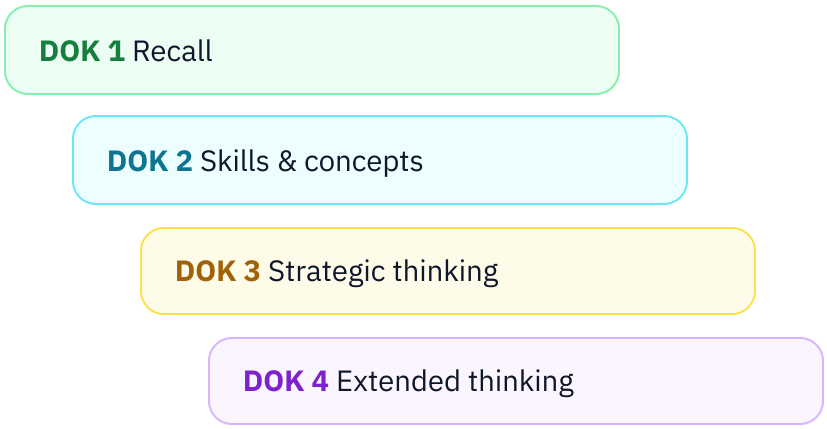
AchieveMetrics Test Bank

SBAC MATHEMATICS · NGSS SCIENCE

DOK Progression Guide

Every SBAC math claim and target (Grade 7, Grade 8, Math 1, Math 2, Math 3) and every NGSS science performance expectation (Grade 8 and High School), with a Test Bank question at each Depth of Knowledge level and the clicks to find more.



For teachers. Each part starts with its own guide to DOK, the Test Bank click paths for that course, and an at-a-glance table.

achievemetricstestbank.com · October 2026 edition

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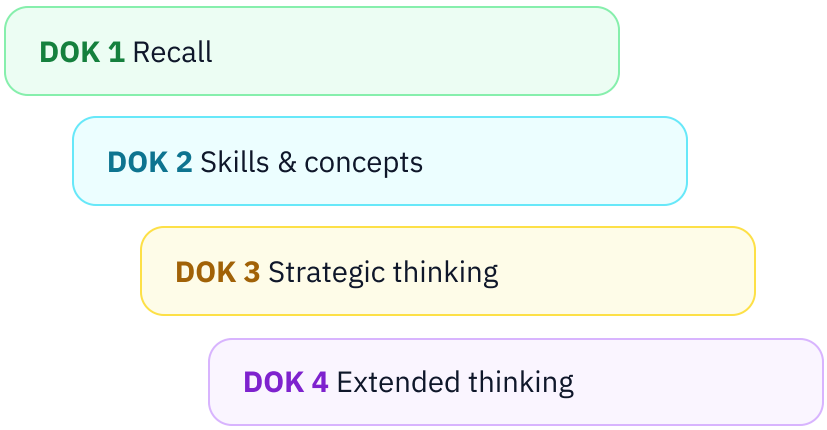
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AchieveMetrics Test Bank

DOK PROGRESSION GUIDE · SBAC MATHEMATICS

Grade 7 Math

Every SBAC claim and target for Grade 7 Math, with a Test Bank question at each Depth of Knowledge (DOK) level the blueprint assesses, and the clicks to find more.



For Grade 7 Math teachers. Claims, targets and DOK levels follow the official Smarter Balanced blueprint.

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How to use this booklet

Depth of Knowledge (DOK) describes the kind of thinking a question asks for, not how hard it is. A long calculation can still be DOK 1, and a short question can be DOK 3. For each target, this booklet shows one question at every DOK level SBAC assesses it at, so you can see the climb and then pick questions at the level your students need next.

The four DOK levels

DOK 1 · Recall — Recall a fact, term or property, or carry out a routine one-step procedure. Read a value straight from a table or graph.

DOK 2 · Skills & concepts — Decide how to approach it and use two or more steps: compare, classify, interpret data, or move between representations.

DOK 3 · Strategic thinking — Reason and plan: justify an answer, critique an argument, use evidence, or solve a problem with no routine path.

DOK 4 · Extended thinking — Carry out an extended investigation that connects several ideas, conditions or sources. On SBAC, DOK 4 is assessed only in the performance task, and only for Claim 3 and Claim 4 targets.

Reading a target page

1. The heading names the claim, the target code and the official target wording, with the standards it draws on.
2. The DOK ladder shows which levels the SBAC blueprint assesses for this target in this grade. Levels in grey with a line through them are not assessed for this target.
3. One example question at each assessed level, lowest first, with the answer shown. Read them top to bottom to see how the thinking climbs.
4. "Why DOK n" explains in one sentence what makes the question that level, so you can spot the same thing in your own questions.
5. "Find more like this" lists the exact Test Bank clicks that generate more questions for the same target at the same level.

Which DOK levels each target is assessed at comes from the official Smarter Balanced test blueprint for this grade (2015–16 Summative Technical Report, Appendix 2.A). Every example was checked by hand against the DOK definitions above, not just its Test Bank tag. A few targets had no Test Bank question that truly fit a level, so we wrote one; those are marked "Written for this guide."

Finding these questions in the Test Bank

Every example page ends with the exact clicks. These are the two routes, starting from Create questions with Grade 7 Math chosen as the grade.

Claim 1 targets (CAT)

Claim 1 questions are filed by target and standard.

Create questions › Grade 7 › CAT › Claim 1 target › Standard › Options: DOK 1 or 2 › Item types (optional) › Generate

The DOK buttons only allow the levels the blueprint assesses for that target, so a level that is greyed out in this booklet is greyed out in the Test Bank too.

Claims 2, 3 and 4 (PT)

These claims are built from performance-task standard groups.

Create questions › Grade 7 › PT › Area 2 (Claims 2 + 4) or Area 3 (Claim 3) › Standard group › Options: DOK › Generate

Each question card shows its claim and target, such as "Claim 3 · Tgt B". Generate at the DOK you want, then keep the cards for your target.

Questions you have saved

Saved questions are filed the same way in your Item Bank.

More › Item Bank › Grade 7 › CAT or PT › Area › Target › DOK

Tip: to move a class up the ladder, generate the same target at the next DOK level. To check that a skill is secure before going further, generate a set at the lowest assessed level.

All targets at a glance

A dot means the SBAC blueprint assesses the target at that DOK level in this grade. Each dot has an example question in this booklet.

Claim 1 · Concepts & Procedures

Target		DOK 1	DOK 2	DOK 3	DOK 4
1A	Analyze proportional relationships and use them to solve real-world and mathematical problems	–	●	–	–
1B	Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers	●	●	–	–
1C	Use properties of operations to generate equivalent expressions	●	●	–	–
1D	Solve real-life and mathematical problems using numerical and algebraic expressions and equations	●	●	–	–
1E	Draw, construct, and describe geometrical figures and describe the relationships between them	●	●	–	–
1F	Solve real-life and mathematical problems involving angle measure, area, surface area, and volume	●	●	–	–
1G	Use random sampling to draw inferences about a population	●	●	–	–
1H	Draw informal comparative inferences about two populations	–	●	–	–
1I	Investigate chance processes and develop, use, and evaluate probability models	●	●	–	–

Claim 2 · Problem Solving

Target		DOK 1	DOK 2	DOK 3	DOK 4
2A	Apply mathematics to solve well-posed problems	–	●	●	–
2B	Select and use appropriate tools strategically	●	●	●	–
2C	Interpret results in the context of a situation	●	●	●	–
2D	Identify important quantities and map their relationships	●	●	●	–

Claim 3 · Communicating Reasoning

Target		DOK 1	DOK 2	DOK 3	DOK 4
3A	Test propositions or conjectures with specific examples	–	●	●	–
3B	Construct chains of reasoning that will justify or refute propositions	–	●	●	●
3C	State logical assumptions being used	–	●	●	–
3D	Use the technique of breaking an argument into cases	–	●	●	–
3E	Distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in the argument—explain what it is	–	●	●	●
3F	Base arguments on concrete referents such as objects, drawings, diagrams, and actions	–	●	●	–
3G	Determine conditions under which an argument does and does not apply	–	●	●	–

Claim 4 · Modeling & Data Analysis

Target		DOK 1	DOK 2	DOK 3	DOK 4
4A	Apply mathematics to solve problems from everyday life (Modeling)	–	●	●	–
4B	Construct chains of reasoning to justify mathematical models	–	●	●	●
4C	State logical assumptions being used	●	●	●	–
4D	Interpret results in the context of a situation	–	●	●	–
4E	Analyze adequacy and make improvements to existing models	–	●	●	●
4F	Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flow charts, or formulas)	●	●	●	–
4G	Identify, analyze, and synthesize relevant external resources to pose or solve problems	–	–	●	●

CLAIM 1

Claim 1 · Concepts & Procedures

Students can explain and apply mathematical concepts and interpret and carry out mathematical procedures with precision and fluency. Claim 1 is tested with individual items on the computer adaptive test (CAT). In the Test Bank, choose CAT, then the target.

Create questions › Grade 7 › CAT › Claim 1 target › Standard › Options: DOK › Generate

GRADE 7 MATH · CLAIM 1 · CONCEPTS & PROCEDURES

1A Analyze proportional relationships and use them to solve real-world and mathematical problems

Standards: 7.RP.A.1; 7.RP.A.2a; 7.RP.A.2c; 7.RP.A.2d; 7.RP.A.3

Assessed at: ~~DOK 1~~ DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students must find the unit rate first, then use it to judge an equation and two scaled costs, so several connected steps are needed.

A volleyball team is ordering sports drinks for their tournament. The team found that 6 bottles cost 15 dollars. Select all the statements that are true about this proportional relationship.

- [x] 18 bottles would cost 45 dollars
- [ ] 12 bottles would cost 25 dollars
- [x] The relationship can be represented by the equation $y = 2.5x$, where x is the number of bottles and y is the cost in dollars
- [ ] The unit rate is 2.40 dollars per bottle
- [ ] The relationship can be represented by the equation $y = 2.4x$, where x is the number of bottles and y is the cost in dollars
- [x] The unit rate is 2.50 dollars per bottle

FIND MORE LIKE THIS

Create questions › Grade 7 › CAT › Target A › Standard › DOK 2 › Generate

Test Bank question

GRADE 7 MATH · CLAIM 1 · CONCEPTS & PROCEDURES

1B Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers

Standards: 7.NS.A.1b; 7.NS.A.1c; 7.NS.1d; 7.NS.A.2b; 7.NS.A.2c; 7.NS.2a; 7.NS.A.2d; 7.NS.A.3

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Each blank is a single routine addition of a positive or negative decimal to the total above it, so students only carry out a known procedure.

Complete the table by adding rational numbers. A basketball team's score changes are recorded below. Find the missing scores after each change.

Quarter	Score Change	Running Total
1	$+12$	12
2	-5.5	**6.5**
3	$+8.25$	**14.75**
4	-3	11.75

FIND MORE LIKE THIS

Create questions › Grade 7 › CAT › Target B › Standard › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must translate a loss and a gain into signed numbers and choose the matching expression before computing, moving between words and symbols.

A football team lost 8 yards on one play and then gained 13 yards on the next play. Which expression correctly represents the total change in yards, and what is the result?

- ○ $8 + 13 = 21$ yards gained
- ○ $-8 - 13 = -21$ yards lost
- ○ $-8 + 13 = 5$ yards gained ✓
- ○ $-8 + (-13) = -21$ yards lost

FIND MORE LIKE THIS

Create questions › Grade 7 › CAT › Target B › Standard › DOK 2 › Generate

Test Bank question

GRADE 7 MATH · CLAIM 1 · CONCEPTS & PROCEDURES

1C Use properties of operations to generate equivalent expressions

Standards: 7.EE.A.1

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students apply the distributive property once to match each factored expression with its expanded form, a routine one-step procedure.

Drag each expression into the correct box to show which expressions are equivalent using the distributive property.

Equivalent to $3(x+5)$	Equivalent to $2(4y+6)$	Equivalent to $5(2x+1)$
$3(x+5)$ ✓	$2(4y+6)$ ✓	$5(2x+1)$ ✓
$3x+15$ ✓	$8y+12$ ✓	$10x+5$ ✓

FIND MORE LIKE THIS

Create questions › Grade 7 › CAT › Target C › Standard › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must turn a 12% increase into 1.12x and then decide to add the first half, combining two ideas to write one simplified expression.

A basketball team's score increased by 12% in the second half compared to the first half. If the team scored x points in the first half, write an equivalent expression that shows the total points scored in both halves combined. (Write your answer as a single simplified expression in terms of x.)

Correct answer: $2.12x$

FIND MORE LIKE THIS

Create questions › Grade 7 › CAT › Target C › Standard › DOK 2 › Generate

Test Bank question

GRADE 7 MATH · CLAIM 1 · CONCEPTS & PROCEDURES

1D Solve real-life and mathematical problems using numerical and algebraic expressions and equations

Standards: 7.EE.B.3; 7.EE.B.4a; 7.EE.B.4b; 7.EE.B.4

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: The equation is given, so students only carry out the routine two-step solving procedure they have practiced.

A gym charges a one-time sign-up fee of 25 dollars plus 15 dollars for each month. Mia paid 100 dollars in all. The equation $15m + 25 = 100$ represents this situation, where m is the number of months. Solve the equation for m.

Correct answer: **5**

FIND MORE LIKE THIS

Create questions › Grade 7 › CAT › Target D › Standard › DOK 1 › Generate

Written for this guide

DOK 2 · Skills & concepts

Why DOK 2: Students must solve the equation, check each claim against their work, and extend the reasoning to an inequality, which takes several steps and judgments.

A track team coach is buying new jerseys for the team. Each jersey costs 9 dollars, and there is a one-time design fee of 14 dollars. The total cost was 149 dollars. This situation can be modeled by the equation $9x + 14 = 149$, where x is the number of jerseys purchased. Decide whether each statement about this situation is true or false.

	True	False
The equation $9x + 14 = 149$ correctly represents the total cost of the jerseys.	☑	☐
Subtracting 14 from both sides gives $9x = 135$.	☑	☐
The number of jerseys purchased is $x = 15$.	☑	☐
The number of jerseys purchased is $x = 12$.	☐	☑
If the total cost had instead been less than 149 dollars, the inequality $9x + 14 < 149$ would give the solution $x < 15$.	☑	☐

FIND MORE LIKE THIS

Create questions › Grade 7 › CAT › Target D › Standard › DOK 2 › Generate

Test Bank question

GRADE 7 MATH · CLAIM 1 · CONCEPTS & PROCEDURES

1E Draw, construct, and describe geometrical figures and describe the relationships between them

Standards: 7.G.A.1; 7.G.A.2; 7.G.A.3

Assessed at: DOK 1 | DOK 2 | ~~DOK 3~~ | ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students find the scale from one pair of lengths and apply it to the other, a direct computation from a scale drawing.

A basketball court is being drawn on a blueprint. The actual court is 94 feet long and 50 feet wide. On the blueprint, the court is drawn 9.4 inches long.

Part A: What is the scale factor used to create this blueprint?

Choose one answer.

- ○ 10 inches : 1 foot
- ○ 1 inch : 9.4 feet
- ○ 1 inch : 94 feet
- ○ 1 inch : 10 feet ✓

Part B: Which measurement supports your answer to Part A?

Choose one answer.

- ○ The blueprint width should be 5 inches because $50 \div 10 = 5$ ✓
- ○ The blueprint width should be 47 inches because $94 - 50 = 44$ plus the 9.4 inches
- ○ The blueprint width should be 5.9 inches because $9.4 \div 50 = 0.188$
- ○ The blueprint width should be 9.4 inches because the scale applies only to length

FIND MORE LIKE THIS

Create questions › Grade 7 › CAT › Target E › Standard › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must picture each slice of the pyramid and classify the resulting cross section, deciding for themselves which shapes are possible.

A trophy for a basketball tournament is shaped like a right rectangular pyramid. Select all the descriptions below that correctly describe a possible two-dimensional cross section formed when the trophy is sliced by a plane.

- A slice parallel to the rectangular base forms a rectangle. ✓
- A slice that passes through the apex and is perpendicular to the base forms a triangle. ✓
- A slice parallel to the base forms a circle.
- A slice parallel to the base forms a pentagon.
- A slice through the apex, cutting through two opposite triangular faces, forms a triangle. ✓

FIND MORE LIKE THIS

Create questions › Grade 7 › CAT › Target E › Standard › DOK 2 › Generate

Test Bank question

GRADE 7 MATH · CLAIM 1 · CONCEPTS & PROCEDURES

1F Solve real-life and mathematical problems involving angle measure, area, surface area, and volume

Standards: 7.G.B.4; 7.G.B.5; 7.G.B.6

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall that vertical angles are equal and adjacent angles on a line are supplementary, then do one subtraction.

On a soccer field, two straight boundary lines, line JL and line KM, intersect at point P. This forms four angles around point P: $\angle 1$, $\angle 2$, $\angle 3$, and $\angle 4$, arranged in order around the point so that $\angle 1$ and $\angle 3$ are vertical angles, and $\angle 2$ and $\angle 4$ are vertical angles. The measure of $\angle 1$ is 124°. Decide whether each statement is True or False.

	True	False
$\angle 1$ and $\angle 2$ are supplementary angles.	☑	☐
$\angle 3$ measures 124°.	☑	☐
$\angle 2$ measures 124°.	☐	☑
$\angle 4$ and $\angle 1$ are vertical angles.	☐	☑
$\angle 2$ and $\angle 4$ each measure 56°.	☑	☐

FIND MORE LIKE THIS

Create questions › Grade 7 › CAT › Target F › Standard › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must decide which five faces get parchment, find each area, and combine them, so they plan a multi-step surface area calculation.

A rectangular baking pan measures 14 inches by 10 inches by 2 inches. Parchment covers its inside bottom and four sides. What area of parchment is needed?

- ○ 308 square inches
- ✓ 236 square inches
- ○ 140 square inches
- ○ 188 square inches

FIND MORE LIKE THIS

Create questions › Grade 7 › CAT › Target F › Standard › DOK 2 › Generate

Test Bank question

GRADE 7 MATH · CLAIM 1 · CONCEPTS & PROCEDURES

1G Use random sampling to draw inferences about a population

Standards: 7.SP.A.1; 7.SP.A.2

Assessed at: DOK 1 | DOK 2 | ~~DOK 3~~ | ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recognize which sampling methods are random and which are biased, recalling what makes a sample representative.

A middle school wants to estimate how many students in the entire school enjoy playing basketball. They plan to survey some students to answer this question. For each statement about their sampling method, decide whether it would help them draw a valid inference about the population.

	Valid for Drawing Inferences	Not Valid for Drawing Inferences
They randomly select 80 students from all students in the school to survey about basketball.	☑	☐
They only survey students who are on the basketball team or attend basketball games.	☐	☑
They survey 60 randomly selected students from each grade level (6th, 7th, and 8th) to get a total sample of 180 students.	☑	☐
They ask the first 50 students they see in the hallway during lunch period.	☐	☑

FIND MORE LIKE THIS

Create questions › Grade 7 › CAT › Target G › Standard › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students turn a sample result into a rate and apply it to several population sizes, using the sample to draw inferences.

A coach randomly surveyed students at a middle school about their favorite sport. She surveyed 50 students and found that 14 preferred basketball. Based on this sample, she estimates how many students in the entire school prefer basketball. Complete the table to show the estimated number of basketball fans for different school sizes.

Total Students in School	Estimated Number Who Prefer Basketball
250	**70**
400	**112**
500	**140**
750	**210**

FIND MORE LIKE THIS

Create questions › Grade 7 › CAT › Target G › Standard › DOK 2 › Generate

Test Bank question

GRADE 7 MATH · CLAIM 1 · CONCEPTS & PROCEDURES

1H Draw informal comparative inferences about two populations

Standards: 7.SP.B

Assessed at: ~~DOK 1~~ DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students compare the difference in means to the MAD and judge each statement, interpreting center and spread together rather than reading a value.

A volleyball coach compared the heights of players from two different teams. Team A had a mean height of 68 inches with a mean absolute deviation (MAD) of 2 inches. Team B had a mean height of 72 inches with a mean absolute deviation of 2 inches. Which statements are correct? Select all that apply.

- [ ] The mean heights are so close together that there is definitely no practical difference between the two teams.
- [ ] Team A has greater variability in heights than Team B because its mean is lower.
- [x] The difference between the mean heights of the two teams is 4 inches. ✓
- [x] Both teams have the same variability in player heights, so their distributions have similar spreads. ✓
- [ ] Team B players are typically 2 times taller than Team A players.
- [x] The difference between the means is equal to 2 times the MAD, which suggests the teams have meaningfully different typical heights. ✓

FIND MORE LIKE THIS

Create questions › Grade 7 › CAT › Target H › Standard › DOK 2 › Generate

Test Bank question

GRADE 7 MATH · CLAIM 1 · CONCEPTS & PROCEDURES

1I Investigate chance processes and develop, use, and evaluate probability models

Standards: 7.SP.C.5; 7.SP.C.7a; 7.SP.C.7b; 7.SP.C.7; 7.SP.C.8; 7.SP.C.6

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students apply the basic definition of probability, favorable outcomes over total outcomes, in one step.

A coach is selecting one player at random from a roster of 24 players to be the team captain. Of these players, 7 play forward positions. What is the probability that a forward will be selected as captain? Express your answer as a fraction in simplest form. Explain your reasoning.

Model response: The probability is $\frac{7}{24}$. Since there are 7 favorable outcomes (forwards) out of 24 total possible outcomes (all players), the probability is the ratio of favorable outcomes to total outcomes: $P(\text{forward}) = \frac{7}{24}$. This fraction is already in simplest form because 7 and 24 share no common factors other than 1.

Rubric: 1 point: Student correctly identifies the probability as $\frac{7}{24}$ and clearly explains that probability equals favorable outcomes divided by total outcomes, with verification that the fraction is in simplest form.

0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 7 › CAT › Target I › Standard › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must build a probability from past data and then use it to predict a new number of successes, two linked steps.

A basketball coach is developing a probability model for free throw success based on past performance. Over 150 attempts, a player made 120 free throws. The coach uses this data to create a probability model where the probability of making a free throw is $\frac{120}{150}$. Based on this model, if the player attempts 50 free throws in an upcoming game, approximately how many free throws should the coach expect the player to make?

- ○ 36 free throws
- ○ 40 free throws ✓
- ○ 30 free throws
- ○ 45 free throws

FIND MORE LIKE THIS

Create questions › Grade 7 › CAT › Target I › Standard › DOK 2 › Generate

Test Bank question

CLAIM 2

Claim 2 · Problem Solving

Students can solve a range of complex well-posed problems in pure and applied mathematics, making productive use of knowledge and problem-solving strategies. In the Test Bank, Claims 2, 3 and 4 are built in the performance task (PT) step: choose PT, then Area 2 · Claims 2 + 4. Each question card is marked with its claim and target (for example "Claim 2 · Tgt A"), so generate a set at the DOK you want and keep the cards for the target you need.

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › Options: DOK › Generate

GRADE 7 MATH · CLAIM 2 · PROBLEM SOLVING

2A Apply mathematics to solve well-posed problems

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students compute and compare two unit prices, then use the constant rate to judge a projection and other claims, a multi-step well-posed problem.

A soccer team is analyzing their concession stand sales. During the first game, they sold 24 bottles of water for 12 dollars total. During the second game, they sold 40 bottles of water for 20 dollars total. The team wants to understand their pricing consistency and project future sales. Which statements correctly interpret the results in the context of this situation? Select all that apply.

- [ ] The team sold 16 more bottles in the second game but earned twice as much money overall.
- [x] The unit price per bottle is 0.50 dollars in both games, so the team is charging a consistent price. ✓
- [ ] The relationship between bottles sold and money earned is not proportional because the numbers are different in each game.
- [x] If the pattern continues, selling 60 bottles of water should bring in 30 dollars. ✓
- [ ] The second game had a lower unit price per bottle, so the team should have charged more to increase profit.
- [x] The constant of proportionality is 0.5, meaning each bottle costs half a dollar. ✓

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: No method is given, so students must plan the steps themselves, deciding how many vans, using round-trip miles, and comparing totals and per-runner costs.

The 24 runners on a track team are traveling to a meet that is 150 miles away. The coach has two choices.

Option 1: Rent vans. Each van holds 8 runners and costs 45 dollars for the day plus 0.30 dollars for every mile driven. The vans must drive to the meet and back.

Option 2: Hire a charter bus that holds all 24 runners for 360 dollars total.

Which option costs less, and how much less per runner? Show your work and explain each decision you made.

Model response: Vans: $24 \div 8 = 3$ vans are needed. Each van drives $150 \times 2 = 300$ miles, so one van costs $45 + 0.30(300) = 45 + 90 = 135$ dollars. Three vans cost $3 \times 135 = 405$ dollars. The bus costs 360 dollars. The bus is cheaper by $405 - 360 = 45$ dollars in total. Per runner: vans cost $405 \div 24 = 16.875 \approx 16.88$ dollars and the bus costs $360 \div 24 = 15$ dollars, so the bus saves about 1.88 dollars per runner.

Rubric: 1 point: Finds that 3 vans are needed, uses the round-trip distance of 300 miles, finds the van total of 405 dollars, concludes the bus is cheaper, and finds the per-runner difference (about 1.88 dollars) with clear work.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

GRADE 7 MATH · CLAIM 2 · PROBLEM SOLVING

2B Select and use appropriate tools strategically

Assessed at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall **Why DOK 1:** Students identify the obvious tool for adding exact decimal distances and the reason it fits, a direct recognition task.

A soccer coach is organizing a tournament and needs to find the total distance traveled by the team's van. The van travels to three different fields: Field A is 12.5 miles away, Field B is 8.75 miles away, and Field C is 15.25 miles away. The coach needs to add these distances together to plan fuel costs.

Part A: Which tool would be most appropriate for the coach to use to calculate the total distance accurately?

Choose one answer.

- ◯ A calculator or spreadsheet program ✓
- ◯ A map with only integer mile markers
- ◯ A ruler or measuring tape
- ◯ Estimation by rounding to the nearest whole number

Part B: Why is the tool you selected in Part A the best choice for this problem?

Choose one answer.

- ◯ It is the quickest way to round distances to the nearest mile
- ◯ It can precisely add decimal numbers like $12.5 + 8.75 + 15.25$ to get an exact total of 36.5 miles ✓
- ◯ It works only with whole numbers and avoids decimals
- ◯ It requires the coach to estimate rather than calculate exact values

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must think about what each task needs mathematically and judge whether the suggested tool or strategy would actually solve it.

A middle school basketball team is analyzing player performance data. Determine whether each strategy for selecting the appropriate tool would help solve the problem described. Select Yes or No for each statement.

	Yes	No
To find which player has the highest shooting percentage, use a graphing calculator to compute $\frac{\text{shots made}}{\text{total shots}}$ for each player.	☑	☐
To determine if a player's free throw improvement is significant over 5 games, arrange the scores in order from smallest to largest without calculating any statistics.	☐	☑
To compare the average points per game for two players across 8 games, use a spreadsheet to calculate the mean for each player's point totals.	☑	☐
To find the team's median rebound count for 12 games, use a protractor to measure angles on a bar graph.	☐	☑
To model the relationship between practice hours and game performance, create a scatter plot using graphing technology.	☑	☐

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students choose their own tool, use it to compare the plans across a range of hours, and justify why that tool fits, with more than one valid approach.

A basketball team can rent a gym using one of two plans.

Plan A: 40 dollars per week plus 15 dollars per hour.
Plan B: 25 dollars per hour with no weekly fee.

The team will rent the gym for 2 to 6 whole hours each week. Choose a tool (a table, a graph, or an equation) to find for which numbers of hours each plan costs less. Use your tool to answer the question, then explain why the tool you chose was a good choice for this problem.

Model response: Sample table: 2 hours: A = 70, B = 50; 3 hours: A = 85, B = 75; 4 hours: A = 100, B = 100; 5 hours: A = 115, B = 125; 6 hours: A = 130, B = 150. Plan B costs less for 2 or 3 hours, the plans cost the same at 4 hours, and Plan A costs less for 5 or 6 hours. (Equation method: $40 + 15h = 25h$ gives $h = 4$.) A table is a good choice because only five whole-number hour values are possible, so every case can be listed and compared directly; an equation is also a good choice because it finds the break-even point quickly.

Rubric: 1 point: Uses a tool correctly to find that Plan B is cheaper for 2 to 3 hours, the plans are equal at 4 hours, Plan A is cheaper for 5 to 6 hours, and gives a reasonable justification for the tool chosen.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

GRADE 7 MATH · CLAIM 2 · PROBLEM SOLVING

2C Interpret results in the context of a situation

Assessed at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students do one division and decide which plain statements correctly describe what the total and the average mean.

A soccer team scored 24 goals in 8 games this season. Based on this information, determine whether each statement correctly interprets this result.

	Correct Interpretation	Incorrect Interpretation
The team averaged 3 goals per game.	☑	☐
The team scored exactly 24 goals in each game.	☐	☑
If the team continues at this rate, they will score 36 goals in 12 games.	☑	☐
The team's scoring rate is 4 goals per game.	☐	☑
The team scored a total of 24 goals across all 8 games played.	☑	☐

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must interpret a decimal quotient in context and decide that it has to be rounded up, not just compute it.

130 students and teachers are going on a field trip. Each bus can carry 48 people. Jordan divides and gets $130 \div 48 \approx 2.71$. How many buses are needed, and why?

- ○ 2 buses, because 2.71 rounds down to 2
- ○ 2.71 buses, because that is the exact answer to the division
- ✓ 3 buses, because 2 buses carry only 96 people and everyone must have a seat
- ○ 4 buses, because there should always be an extra bus

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Written for this guide

DOK 3 · Strategic thinking

Why DOK 3: Students must critique a conclusion drawn from a solution, explain it with evidence from the context, and then reason backward under a new condition.

The 7th grade is raising money for a field trip that costs 1,250 dollars. They already have 380 dollars, and they earn 45 dollars at each car wash. Lena writes $380 + 45w = 1250$ and finds $w \approx 19.33$. She says, "We need 19 car washes."

a) Is Lena correct? Explain using the context.
b) Only 18 car washes can be scheduled before the trip. Will they have enough money? If not, how much would they need to earn at each car wash instead, to the nearest cent?

Model response: a) No. After 19 car washes they would have $380 + 45(19) = 1235$ dollars, which is 15 dollars short. Since 19.33 is more than 19, they need 20 car washes ($380 + 45(20) = 1280$ dollars). b) With 18 car washes they would have $380 + 45(18) = 1190$ dollars, which is 60 dollars short. They need $1250 - 380 = 870$ dollars from 18 car washes, so $870 \div 18 \approx 48.33$ dollars per car wash; since 48.33 dollars falls slightly short, they need at least 48.34 dollars per car wash.

Rubric: 1 point: Explains that 19 washes falls short and 20 are needed, shows that 18 washes give 1,190 dollars (60 dollars short), and finds about 48.34 dollars per wash (48.33 with a note about rounding up is acceptable).
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

GRADE 7 MATH · CLAIM 2 · PROBLEM SOLVING

2D Identify important quantities and map their relationships

Assessed at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students map one simple relationship, equal points in each of 12 games, into a one-step equation and solve it.

A volleyball team scored 156 points total across 12 games this season. If they scored the same number of points in each game, write an equation using p to represent the points scored per game, then solve for p.

Correct answer: **p = 13**

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must identify the rate and the fixed fee, combine them into a two-step equation, and solve it.

A volleyball team is ordering new uniforms. The cost is 12 dollars per uniform plus a one-time design fee of 45 dollars. If the total cost for the order is 189 dollars, write and solve an equation to find the number of uniforms u ordered by the team. Write your answer as a whole number.

Correct answer: **12**

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must sort useful from extra information, link several quantities, and make rounding decisions in context to reach a conclusion.

A 7th grade class is planning a pizza party for 28 students and 2 teachers. The party will last 2 hours. Each person is expected to eat 3 slices of pizza. Each pizza has 8 slices and costs 11.50 dollars. Drinks come in packs of 12 cans for 4.75 dollars, and each person gets 1 can. The class has 175 dollars to spend.

Is 175 dollars enough? Identify the quantities you need, show how they are related, and explain your decisions.

Model response: There are $28 + 2 = 30$ people. Slices needed: $30 \times 3 = 90$. Pizzas: $90 \div 8 = 11.25$, so 12 pizzas must be ordered, costing $12 \times 11.50 = 138$ dollars. Drinks: 30 cans are needed, and $30 \div 12 = 2.5$, so 3 packs are needed, costing $3 \times 4.75 = 14.25$ dollars. Total: $138 + 14.25 = 152.25$ dollars. Yes, 175 dollars is enough, with $175 - 152.25 = 22.75$ dollars left over. The 2-hour length of the party is not needed.

Rubric: 1 point: Counts 30 people, rounds up to 12 pizzas and 3 packs of drinks, finds the total of 152.25 dollars, and concludes that 175 dollars is enough (with 22.75 dollars left).
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

CLAIM 3

Claim 3 · Communicating Reasoning

Students can clearly and precisely construct viable arguments to support their own reasoning and to critique the reasoning of others. In the Test Bank, Claims 2, 3 and 4 are built in the

performance task (PT) step: choose PT, then Area 3 · Claim 3. Each question card is marked with its claim and target (for example "Claim 3 · Tgt A"), so generate a set at the DOK you want and keep the cards for the target you need.

Create questions › Grade 7 › PT › Area 3 · Claim 3 › Standard group › Options: DOK › Generate

GRADE 7 MATH · CLAIM 3 · COMMUNICATING REASONING

3A Test propositions or conjectures with specific examples

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students test a conjecture by checking each table value against the claimed rate and spot the one pair that breaks it.

A sports analyst records the distance a cyclist has traveled at different times during a race, shown in the table below.

Time (minutes): 4, 10, 15, 20
Distance (meters): 800, 2000, 2900, 4000

The analyst makes this conjecture: "This table represents a proportional relationship between time and distance, with a constant rate of 200 meters per minute."

Test the conjecture using specific values from the table. Select all statements that are true.

- [x] Dividing 2000 by 10 gives 200, which is consistent with the conjecture. ✓
- [ ] Since all four ratios equal 200, the conjecture is fully supported by the table.
- [x] Dividing 800 by 4 gives 200, which is consistent with the conjecture. ✓
- [ ] Dividing 2900 by 15 gives exactly 200, which is consistent with the conjecture.
- [x] Since the ratio $\frac{2900}{15}$ does not equal 200, the table does not represent a proportional relationship, so the conjecture is false. ✓

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students choose their own examples, use them to disprove a conjecture, and explain the general pattern, which requires reasoning beyond calculation.

Marcus makes this conjecture: "If a store raises a price by 20% and later lowers the new price by 20%, the price ends up back where it started."

Test Marcus's conjecture using at least two different starting prices. Is the conjecture true? Use your examples to explain why or why not, and describe what always happens to the final price.

Model response: Example 1: 100 dollars raised 20% is $100 \times 1.2 = 120$ dollars; lowered 20% is $120 \times 0.8 = 96$ dollars, not 100. Example 2: 50 dollars becomes $50 \times 1.2 = 60$, then $60 \times 0.8 = 48$ dollars, not 50. The conjecture is false. The 20% decrease is taken from a larger amount than the 20% increase was, so more is taken away than was added. In every case the final price is $1.2 \times 0.8 = 0.96$, or 96%, of the original, which is 4% less.

Rubric: 1 point: Tests at least two prices correctly, concludes the conjecture is false, and explains that the decrease is taken from a larger amount (or that the final price is always 96% of the start).
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 3 · Claim 3 › Standard group › DOK 3 › Generate

Written for this guide

GRADE 7 MATH · CLAIM 3 · COMMUNICATING REASONING

3B Construct chains of reasoning that will justify or refute propositions

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 DOK 4 DOK 4 is assessed only in the performance task.

DOK 2 · Skills & concepts

Why DOK 2: Students compute the average or compare totals and then judge which short arguments correctly support or refute the claim, linking a calculation to a conclusion.

A soccer team's scoring record shows they scored 45 goals in 12 games. A student makes the claim: 'The team averages more than 3.5 goals per game.' Which statements correctly support or refute this claim? Select all that apply.

- [ ] Dividing 45 by 12 gives approximately 3.75, which rounds down to 3, proving the team averages fewer goals per game.
- [x] The team's average is $45 \div 12 = 3.75$ goals per game, which is greater than 3.5, so the claim is correct.
- [x] If the team averaged exactly 3.5 goals per game over 12 games, they would have scored $3.5 \times 12 = 42$ goals, but they scored 45, so the claim is correct.
- [ ] Since 45 is only slightly more than 42, the team averages less than 3.5 goals per game.
- [x] The team scored 45 goals in 12 games, and $45 > 3.5 \times 12$, which means they scored more than 3.5 goals per game on average.
- [ ] The team would need to score at least 42 goals to average 3.5 goals per game, but they only scored 45, so the claim is false.

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must build a connected argument from examples to a general conclusion about when the claim holds, which requires planning and justification.

A store offers two deals on sports socks:

Deal 1: Buy 3 pairs, get a 4th pair free (the free pair is the lowest-priced pair).
Deal 2: 25% off every pair.

Ken says, "These deals always save the same amount of money, because getting 1 of 4 pairs free is the same as 25% off."

Construct a chain of reasoning that justifies or refutes Ken's claim. Use at least one example in which all four pairs cost the same and one example in which the prices are different.

Model response: Same prices: four pairs at 8 dollars each cost 32 dollars. Deal 1: pay for 3 pairs, $3 \times 8 = 24$ dollars. Deal 2: $32 \times 0.75 = 24$ dollars. The deals match. Different prices: pairs cost 10, 10, 10 and 2 dollars, a total of 32 dollars. Deal 1: the 2-dollar pair is free, so pay 30 dollars (save 2). Deal 2: $32 \times 0.75 = 24$ dollars (save 8). The deals are not the same. Ken's claim is only true when all four pairs cost the same. Because Deal 1 gives away the cheapest pair, its savings are less than or equal to one fourth of the total, so Deal 2 always saves at least as much as Deal 1 (and Deal 1 needs a purchase of 4 pairs).

Rubric: 1 point: Shows a correct equal-price example where the deals match and a correct different-price example where they do not, and concludes with reasoning that Ken's claim is only true when the prices are equal (Deal 2 saves at least as much otherwise).
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 3 · Claim 3 › Standard group › DOK 3 › Generate

Written for this guide

DOK 4 · Extended thinking

Why DOK 4: Students investigate the claim across several changing conditions, then synthesize their results into a general argument and a justified recommendation, an extended task.

The 7th grade student council is planning a movie night to raise money. A council member claims: "If we sell twice as many tickets at half the price, we will make the same amount of money, so the ticket price does not matter."

Investigate the claim under each condition below. Show your work for each part.

Part A: There are no costs. Compare selling 200 tickets at 6 dollars each with selling 400 tickets at 3 dollars each.
Part B: Each ticket includes a snack that costs the council 1.50 dollars. Compare the profit for the same two plans.
Part C: The gym holds 350 people. Explain how this changes which plans are possible.
Part D: Write a chain of reasoning that explains when the claim is true and when it is false. Then recommend a ticket price and justify your recommendation using your results.

Model response: Part A: $200 \times 6 = 1200$ dollars and $400 \times 3 = 1200$ dollars, so revenue is the same. Part B: Profit is $200(6 - 1.50) = 900$ dollars versus $400(3 - 1.50) = 600$ dollars, so the higher price earns 300 dollars more. Part C: 400 tickets is not possible because only 350 people fit, so the 3-dollar plan can earn at most $350(3 - 1.50) = 525$ dollars. Part D: Doubling the number of tickets and halving the price keeps the money collected the same, but every extra ticket adds another snack cost (and must fit in the gym). So the claim is true only when there is no cost per ticket and enough space; when each ticket has a cost, the profit drops by the cost of the extra tickets ($200 \times 1.50 = 300$ dollars here). Recommendation: the 6-dollar price, since it earns more profit (900 dollars) and stays well under the 350-person limit. Other recommendations are acceptable if supported by the computed results.

Rubric: 1 point: Parts A to C correct, Part D reasoning partly complete.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 3 · Claim 3 › Standard group › DOK 4 › Generate

Written for this guide

GRADE 7 MATH · CLAIM 3 · COMMUNICATING REASONING

3C State logical assumptions being used

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students must read the coach's conclusion and identify the hidden assumption that practice alone causes the difference, interpreting the reasoning at a basic level.

A coach is analyzing volleyball team statistics. She notices that players who practice 8 hours per week have an average of 15 successful serves out of 20 attempts. Players who practice 5 hours per week have an average of 12 successful serves out of 20 attempts. The coach concludes that practicing more hours per week causes players to have higher serve success rates. Which logical assumption is the coach making in this conclusion?

- ○ All players on the team practice the same amount each week regardless of their skill level.
- ○ The difference in serve success is entirely due to the difference in practice hours, with no other factors affecting the outcome. ✓
- ○ Practicing fewer hours per week will eventually lead to the same success rate as practicing more hours.
- ○ Players who practice more hours are naturally more talented at volleyball than those who practice fewer hours.

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must name hidden assumptions behind a calculation, evaluate them, and explain how the conclusion changes if they fail, which goes beyond picking one.

Jada read the first 30 pages of a 360-page book in 45 minutes. She says, "It will take me 9 hours to read the whole book."

a) Show how Jada got 9 hours.
b) State two assumptions Jada is making.
c) For each assumption, explain whether it is reasonable, and describe how her estimate would change if that assumption were not true.

Model response: a) $360 \div 30 = 12$ groups of 30 pages, and $12 \times 45 = 540$ minutes, which is $540 \div 60 = 9$ hours. b) Sample assumptions: (1) she will read at the same rate for the whole book; (2) the rest of the pages are about as long and as hard as the first 30; (3) the time does not include breaks. c) Sample: Assumption 1 is somewhat reasonable for a short time but she may slow down when tired, which would make it take longer than 9 hours. Assumption 2 may not hold if later chapters have more text or harder ideas, which would increase the time; if later pages have pictures, the time would decrease.

Rubric: 1 point: Shows the 9-hour calculation, states two reasonable assumptions, and explains how the estimate would change if each were false.
0 points: Anything less, including a response that is only partly correct.

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Create questions › Grade 7 › PT › Area 3 · Claim 3 › Standard group › DOK 3 › Generate

Written for this guide

GRADE 7 MATH · CLAIM 3 · COMMUNICATING REASONING

3D Use the technique of breaking an argument into cases

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students test an example in each case and classify where the claim holds, using cases to organize a short argument.

Sasha claims that $|a + b| = |a| + |b|$ for all nonzero integers a and b. She checks three cases:

Case 1: a and b are both positive.
Case 2: a and b are both negative.
Case 3: one of a and b is positive and the other is negative.

In which case or cases is Sasha's claim always true?

- ○ Case 1 only
- ○ Cases 1 and 2 only ✓
- ○ Case 3 only
- ○ Cases 1, 2, and 3

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Written for this guide

DOK 3 · Strategic thinking

Why DOK 3: Students must set up every case themselves, reason about the sign in each, and use the full set of cases to justify a conclusion.

Jon claims: "A product of three nonzero rational numbers is negative only when all three numbers are negative."

Break the problem into cases based on how many of the three numbers are negative (0, 1, 2, or 3). For each case, decide whether the product is positive or negative and give an example. Then use your cases to decide whether Jon's claim is correct.

Model response: 0 negative: positive, e.g. $2 \times 3 \times 4 = 24$. 1 negative: negative, e.g. $-2 \times 3 \times 4 = -24$. 2 negative: positive, e.g. $-2 \times (-3) \times 4 = 24$. 3 negative: negative, e.g. $-2 \times (-3) \times (-4) = -24$. Jon's claim is not correct: the product is also negative when exactly one number is negative. The product is negative whenever an odd number of the factors are negative, because each pair of negative factors multiplies to a positive.

Rubric: 1 point: Correctly analyzes all four cases with examples and concludes that Jon is wrong because the product is also negative with exactly one negative factor (or states the odd-number rule). 0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 3 · Claim 3 › Standard group › DOK 3 › Generate

Written for this guide

GRADE 7 MATH · CLAIM 3 · COMMUNICATING REASONING

3E Distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in the argument—explain what it is

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 DOK 4 DOK 4 is assessed only in the performance task.

DOK 2 · Skills & concepts

Why DOK 2: Students check each coach's conclusion against the numbers given and classify the reasoning as sound or flawed, a basic judgment about each argument.

A basketball team's coach is analyzing player statistics and making conclusions about performance. Determine whether each statement about the coach's reasoning is correct or flawed.

	Correct Reasoning	Flawed Reasoning
Player A made 12 out of 15 free throws, which is 80%. Player B made 16 out of 20 free throws, which is also 80%. The coach concludes both players have equal free throw accuracy.	☑	☐
Player C scored 24 points in the first half and 18 points in the second half. The coach concludes that Player C's performance got worse, so the player must be tired.	☐	☑
Over the season, the team's average points per game increased from 68 to 72 points per game. The coach concludes the team is scoring more points on average, but this doesn't necessarily mean every game had a higher score than every previous game.	☑	☐
Player D had 8 assists in a game where the team won by 15 points. Player E had 6 assists in a game where the team won by 8 points. The coach concludes that Player D is a better playmaker than Player E.	☐	☑

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must find the flaw in each argument and explain it with evidence and correct reasoning, not just compute a probability.

A bag holds 5 red marbles, 3 blue marbles, and 2 green marbles. Kim makes two statements.

Statement 1: "There are three colors, so the probability of drawing a red marble is $\frac{1}{3}$."
Statement 2: "Half of the marbles are red, so if I draw a marble, record its color, and put it back 10 times, I will get exactly 5 red marbles."

For each statement, decide whether Kim's reasoning is correct or flawed. If it is flawed, explain the flaw and give correct reasoning.

Model response: Statement 1 is flawed. The colors are not equally likely because there are different numbers of each color. The probability of red is $\frac{5}{10} = \frac{1}{2}$. Statement 2 is flawed. The probability of red is $\frac{1}{2}$, so 5 red marbles in 10 draws is the expected number, but actual results vary from trial to trial; Kim could get 3, 6, or another number of red marbles. She can say she expects about 5, not exactly 5.

Rubric: 1 point: Identifies both statements as flawed, explains that the colors are not equally likely (P(red) = 1/2), and explains that 5 is the expected number, not a guaranteed result.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 3 · Claim 3 › Standard group › DOK 3 › Generate

Written for this guide

DOK 4 · Extended thinking

Why DOK 4: Students test a claim across several conditions and data sets, find where it breaks down, and synthesize their findings into an improved rule, an extended investigation.

Ravi says, "A bigger box of cereal is always the better buy, so we should always buy the largest box." A store sells the same cereal in four sizes.

Small: 12 ounces for 3.60 dollars
Medium: 18 ounces for 4.95 dollars
Large: 28 ounces for 7.84 dollars
Family: 40 ounces for 10.80 dollars

Part A: Find the price per ounce of each box. Does the data support Ravi's reasoning? Explain any flaw.
Part B: The store gives a coupon for 1.00 dollar off any one box. Find the price per ounce of each box after the coupon. Which box is now the best buy?
Part C: Ravi's family eats about 20 ounces of cereal each week, and an open box goes stale after 2 weeks. Explain how this affects whether the Family box is a good choice.
Part D: Write an improved rule for choosing a box that fixes the flaws in Ravi's reasoning. Use your results from Parts A to C to support your rule.

Model response: Part A: Small 0.30, Medium 0.275, Large 0.28, Family 0.27 dollars per ounce. The Family box is cheapest per ounce, but the Large box costs more per ounce than the Medium box, so a bigger box is not always a better buy; Ravi's reasoning is flawed. Part B: Small $2.60 \div 12 \approx 0.217$, Medium $3.95 \div 18 \approx 0.219$, Large $6.84 \div 28 \approx 0.244$, Family $9.80 \div 40 = 0.245$ dollars per ounce. With the coupon the Small box is the best buy. Part C: The family eats about 40 ounces in 2 weeks, so the Family box would be finished just as it goes stale; any cereal left over would be wasted, which adds to the real cost. Part D: Sample rule: compare unit prices after any coupons, and choose the lowest unit price among boxes the family can finish before the cereal goes stale. Box size alone does not decide the best buy.

Rubric: 1 point: Parts A and B correct with incomplete reasoning in C or D.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 3 · Claim 3 › Standard group › DOK 4 › Generate

Written for this guide

GRADE 7 MATH · CLAIM 3 · COMMUNICATING REASONING

3F Base arguments on concrete referents such as objects, drawings, diagrams, and actions

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: The two radii to test are given, so students compute two areas, compare them, and explain the pattern at a basic level.

A basketball player claims that if you double the radius of a circular shooting area, the area will also double. Test this conjecture using specific examples with radii of 3 meters and 6 meters. Does the conjecture hold true? Explain your reasoning by calculating both areas and comparing them.

Model response: When the radius is 3 meters, the area is $A = \pi r^2 = \pi(3)^2 = 9\pi$ square meters. When the radius is 6 meters, the area is $A = \pi(6)^2 = 36\pi$ square meters. Doubling the radius from 3 to 6 meters quadruples the area from 9π to 36π square meters (since $36\pi \div 9\pi = 4$), not doubles it. The conjecture is false because area depends on the square of the radius, so doubling the radius multiplies the area by $2^2 = 4$.

Rubric: 1 point: Student correctly calculates both areas, compares them accurately, and explains why the conjecture is false by referencing the quadratic relationship between radius and area.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students use a drawing they make to build an argument, refute a claim, and generalize the rule, reasoning from the diagram rather than computing alone.

Tomas says, "$-3 - (-5)$ must be negative because both numbers are negative."

a) Draw a number line and use it to show how to find $-3 - (-5)$.
b) Use your number line to explain whether Tomas is correct.
c) Use the number line to describe, in general, when $a - b$ is positive for any two rational numbers a and b.

Model response: a) Subtracting -5 is the same as adding 5. Start at -3 and move 5 units to the right to land on 2. (Or: $-3 - (-5)$ is the distance and direction from -5 to -3, which is 2 units to the right.) b) Tomas is not correct: $-3 - (-5) = 2$, which is positive. Being negative numbers does not decide the sign; their positions on the number line do. c) $a - b$ is positive whenever a is to the right of b on the number line (that is, $a > b$), no matter what the signs of a and b are.

Rubric: 1 point: Accurate number line showing the result 2, explains that Tomas is wrong using the number line, and states that $a - b$ is positive when a is to the right of b.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 3 · Claim 3 › Standard group › DOK 3 › Generate

Written for this guide

GRADE 7 MATH · CLAIM 3 · COMMUNICATING REASONING

3G Determine conditions under which an argument does and does not apply

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students must test positive, zero, and negative cases to find where the statement holds, which requires choosing examples and comparing results.

Rosa says, "When you multiply a number by $\frac{3}{4}$, the product is always less than the number you started with." For which numbers does Rosa's statement apply?

- ○ All numbers
- ✓ Only positive numbers
- ○ Only negative numbers
- ○ All numbers except 0

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Written for this guide

DOK 3 · Strategic thinking

Why DOK 3: Students must explore several conditions on their own, find every case where the argument fails, and restate it precisely, requiring strategic reasoning.

Jamal claims: "Dividing a number by a fraction always gives a bigger number."

Determine the conditions under which Jamal's claim is true and when it is not. Consider both the number being divided and the fraction you divide by. Give an example for each condition, and write a corrected version of Jamal's claim.

Model response: True example: $6 \div \frac{1}{2} = 12$, and $12 > 6$. Fails when the fraction is greater than 1: $6 \div \frac{3}{2} = 4$, and $4 < 6$. Fails when the fraction equals 1: $6 \div 1 = 6$. Fails when the number is negative: $-6 \div \frac{1}{2} = -12$, and $-12 < -6$. Fails when the number is 0: $0 \div \frac{1}{2} = 0$. Corrected claim: Dividing a positive number by a positive fraction less than 1 gives a bigger number.

Rubric: 1 point: Identifies both conditions (the number must be positive and the divisor must be a positive fraction less than 1), supports each with examples, and writes a correct revised claim.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 3 · Claim 3 › Standard group › DOK 3 › Generate

Written for this guide

CLAIM 4

Claim 4 · Modeling & Data Analysis

Students can analyze complex, real-world scenarios and can construct and use mathematical models to interpret and solve problems. In the Test Bank, Claims 2, 3 and 4 are built in the performance task (PT) step: choose PT, then Area 2 · Claims 2 + 4. Each question card is marked with its claim and target (for example "Claim 4 · Tgt A"), so generate a set at the DOK you want and keep the cards for the target you need.

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › Options: DOK › Generate

GRADE 7 MATH · CLAIM 4 · MODELING & DATA ANALYSIS

4A Apply mathematics to solve problems from everyday life (Modeling)

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students must work through a real-world discount and tax problem step by step and check each computation to locate the first error.

A pair of soccer cleats regularly costs 80 dollars. The store has a 25% markdown, and then 8% sales tax is applied to the discounted price. Kai solved for the final price he pays. Select the step where Kai made his first error.

Step 1: Discount = $0.25 \times 80 = 20$ dollars

Step 2: Sale price = $80 - 20 = 60$ dollars

Step 3: Tax = $0.08 \times 60 = 5.60$ dollars ✓

Step 4: Total price = $60 + 5.60 = 65.60$ dollars

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must model a real situation by planning several dependent steps, including a unit conversion and rounding decisions, with more than one valid approach.

Mr. Ortiz wants to cover a rectangular patio that is 12 feet by 15 feet with square tiles. Each tile is 18 inches on a side. Tiles are sold only in boxes of 10, and each box costs 42 dollars. He plans to buy 10% more tiles than he needs to cover the patio, in case some break.

How much will Mr. Ortiz spend on tiles? Show your work and explain each decision you make.

Model response: Each tile is 18 inches = 1.5 feet on a side. The patio needs $12 \div 1.5 = 8$ tiles across and $15 \div 1.5 = 10$ tiles along, so $8 \times 10 = 80$ tiles. (Or: patio area $12 \times 15 = 180$ square feet; tile area $1.5 \times 1.5 = 2.25$ square feet; $180 \div 2.25 = 80$ tiles.) Ten percent extra: $80 \times 1.10 = 88$ tiles. Boxes: $88 \div 10 = 8.8$, so he must buy 9 boxes. Cost: $9 \times 42 = 378$ dollars.

Rubric: 1 point: Converts 18 inches to 1.5 feet (or the patio to inches), finds 80 tiles, adds 10% to get 88, rounds up to 9 boxes, and finds 378 dollars, with each decision explained.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

GRADE 7 MATH · CLAIM 4 · MODELING & DATA ANALYSIS

4B Construct chains of reasoning to justify mathematical models

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 DOK 4 DOK 4 is assessed only in the performance task.

DOK 2 · Skills & concepts

Why DOK 2: Students must find the rate from the table, reason out the starting fee, and link the reason to the model, rather than reading one value.

A bike rental shop records these costs:

Hours	Cost (dollars)
1	10
2	14
3	18
4	22

Which model fits the data, and which reason correctly justifies it?

- ○ $C = 10h$, because 1 hour costs 10 dollars
- ○ $C = 4h$, because the cost goes up 4 dollars each hour
- ○ $C = 4h + 6$, because the cost goes up 4 dollars each hour and $4(1) + 6 = 10$ matches the cost for 1 hour ✓
- ○ $C = 6h + 4$, because there is a 6-dollar charge each hour plus a 4-dollar fee

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Written for this guide

DOK 3 · Strategic thinking

Why DOK 3: Students must connect data to each part of the model in a logical sequence, explaining why it fits, not only checking that it does.

A pool is being drained at a constant rate. After 2 hours, 9,600 gallons of water remain. After 5 hours, 6,000 gallons remain. Ella says the model $G = 12000 - 1200t$ gives the number of gallons G left after t hours.

a) Construct a chain of reasoning, using the data, to justify or refute Ella's model. Explain what 12,000 and 1,200 mean in the situation.
b) Use the model to find how long it takes to drain the pool completely.

Model response: a) From 2 to 5 hours, the water drops $9600 - 6000 = 3600$ gallons in 3 hours, so the rate is $3600 \div 3 = 1200$ gallons per hour. Going back 2 hours from 9,600 gallons gives $9600 + 2(1200) = 12000$ gallons at the start. Check: $12000 - 1200(2) = 9600$ and $12000 - 1200(5) = 6000$. Ella's model is justified: 12,000 is the starting amount of water in gallons, and 1,200 is the number of gallons drained each hour. b) $12000 - 1200t = 0$ gives $1200t = 12000$, so $t = 10$ hours.

Rubric: 1 point: Finds the rate of 1,200 gallons per hour and the starting amount of 12,000 gallons from the data, verifies both points, explains the meaning of each number, and finds 10 hours.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

DOK 4 · Extended thinking

Why DOK 4: Students build and test several models with data from more than one source and synthesize the results into a justified recommendation, an extended multi-part investigation.

The 7th grade is selling class T-shirts for 15 dollars each. In a random survey of 120 of the school's 600 students, 40 said they would buy a shirt. The class can order from three suppliers.

Supplier A: 75 dollar setup fee plus 6 dollars per shirt.
Supplier B: 9 dollars per shirt, no setup fee.
Supplier C: 7.50 dollars per shirt, but the class must pay for at least 150 shirts.

Part A: Use the survey to estimate how many shirts the class will sell.
Part B: Write a cost model for each supplier, where n is the number of shirts ordered.
Part C: Find the profit with each supplier for your estimate from Part A. Then find the number of shirts at which Supplier A and Supplier B cost the same.
Part D: Recommend a supplier. Write a chain of reasoning that justifies your recommendation, including what would happen if actual sales were much lower than your estimate.

Model response: Part A: $\frac{40}{120} = \frac{1}{3}$, and $\frac{1}{3} \times 600 = 200$ shirts. Part B: A: $C = 75 + 6n$; B: $C = 9n$; C: $C = 7.50n$ for $n \geq 150$, and $C = 1125$ dollars for $n < 150$. Part C: Revenue $200 \times 15 = 3000$ dollars. A costs $75 + 6(200) = 1275$, profit 1,725 dollars. B costs $9(200) = 1800$, profit 1,200 dollars. C costs $7.50(200) = 1500$, profit 1,500 dollars. A and B cost the same when $75 + 6n = 9n$, so $n = 25$ shirts. Part D: Supplier A gives the greatest profit at the estimated 200 shirts and costs less than B for any order over 25 shirts. It also costs less than C for every order (A costs 975 dollars at 150 shirts, and C's minimum is 1,125 dollars). If sales were much lower, Supplier C would be the riskiest because the class pays for 150 shirts no matter what. Supplier A is recommended unless sales fall below 25 shirts.

Rubric: 1 point: All parts attempted with one error, or Part D reasoning incomplete.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 4 › Generate

Written for this guide

GRADE 7 MATH · CLAIM 4 · MODELING & DATA ANALYSIS

4C State logical assumptions being used

Assessed at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recognize the assumption that is directly described in the situation, a recall-level identification with no calculation.

A basketball coach is creating a model to predict the total points a player will score in a season. The coach assumes that the player will play in all 82 games and will score the same number of points in each game based on their average from the first 10 games. Which statement describes a logical assumption the coach is making?

- ✓ The player will maintain a consistent scoring average throughout the entire season.
- The player's scoring average is affected by the weather on game days.
- The player will be injured and miss at least 5 games during the season.
- The player's performance will improve significantly in the second half of the season.

FIND MORE LIKE THIS

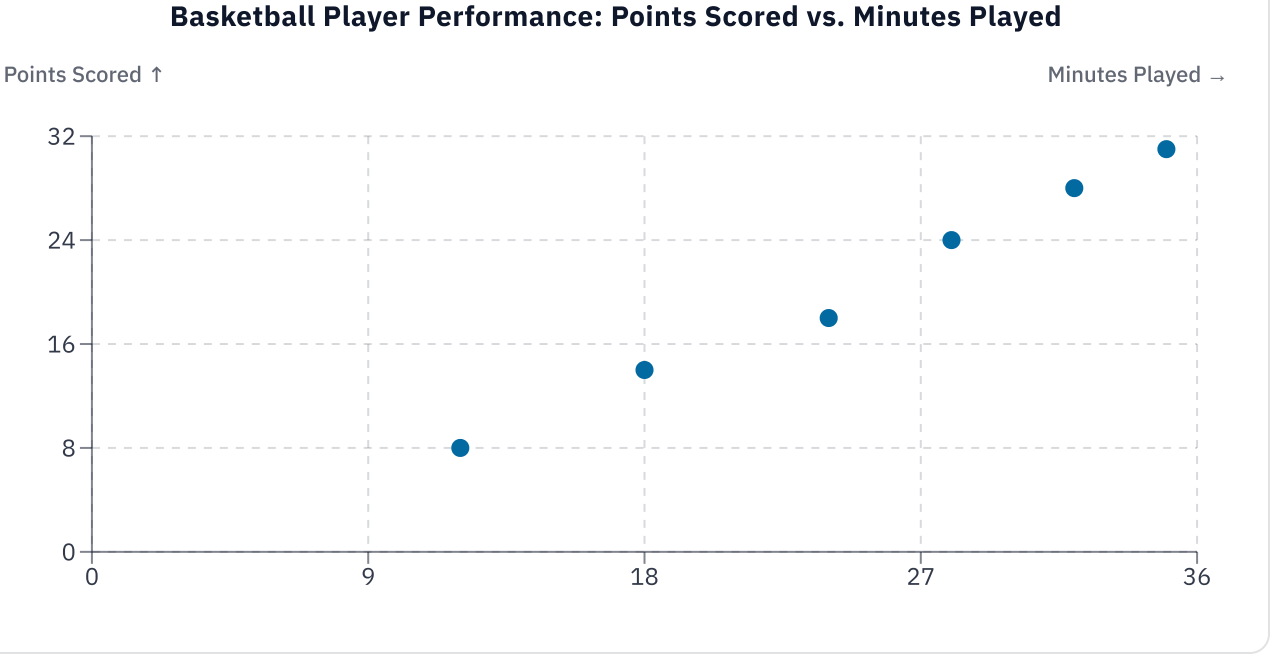
Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must interpret the trend in the scatter plot and decide which assumption is needed to use it for predictions, connecting a graph to a model.

A coach is analyzing a player's scoring pattern shown in the scatter plot. The coach notices that as minutes played increases, points scored increases in a roughly linear pattern. Which assumption would be MOST important for the coach to state when using this relationship to predict future performance?



- ○ The player will score exactly the same number of points in every game regardless of minutes played.
- ○ The player will always play at least 12 minutes in every game.
- ○ The player's scoring rate will remain consistent in future games under similar playing conditions. ✓
- ○ Other players on the team will not affect how many points this player scores.

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must uncover the hidden assumptions behind the prediction, judge whether each is reasonable, and support their judgment with evidence.

A middle school volleyball team is planning a fundraiser. The team sold 45 cupcakes on Friday and 38 cupcakes on Saturday. Based on this data, the team predicts they will sell 300 cupcakes total over a 7-day week. Identify at least two logical assumptions the team made in creating this model. Explain whether each assumption is reasonable and why.

Model response: Two reasonable assumptions are: (1) The team assumes that Friday and Saturday sales are representative of typical days for the week. This is somewhat questionable because weekends may have different sales patterns than weekdays, so averaging these two days may not accurately predict weekday sales. (2) The team assumes that sales will remain constant throughout the week, which may not be realistic because sales could increase as the event becomes more publicized or decrease as fewer cupcakes remain. A more reasonable assumption would be that different days of the week have different sales rates. To create a better model, the team should collect data from all seven days or make separate predictions for weekdays versus weekend days.

Rubric: 1 point: Identifies at least two assumptions clearly, explains the reasoning behind them, and justifies whether they are reasonable with specific evidence.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Test Bank question

GRADE 7 MATH · CLAIM 4 · MODELING & DATA ANALYSIS

4D Interpret results in the context of a situation

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students check each result against the context, noticing impossible values like more makes than attempts or a negative count, which means interpreting results rather than computing.

A middle school basketball team tracked their free throw performance over four practice sessions. The coach recorded the number of successful free throws out of attempts for each session. For each statement about the data, determine whether it makes sense based on the context and reasonableness of the results.

	Makes Sense	Does Not Make Sense
Session 1: 45 successful free throws out of 50 attempts. The team's free throw percentage is 90%, which suggests strong shooting accuracy that could realistically improve over the season with consistent practice.	☑	☐
Session 2: 38 successful free throws out of 35 attempts. This result shows the team made more baskets than shots attempted, indicating exceptional skill development.	☐	☑
Session 3: 22 successful free throws out of 48 attempts. With a success rate of approximately 46%, this represents a significant drop from Session 1, which could reflect player fatigue or decreased focus during practice.	☑	☐
Session 4: The team made −8 successful free throws out of 52 attempts. This negative result demonstrates they need to work on their shooting technique.	☐	☑

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must interpret an inequality's solution in context, critique two claims, and revise their conclusion when new information about the situation appears.

A freight elevator can safely carry at most 1,500 pounds. The elevator operator weighs 180 pounds and must ride with every load. Each box of books weighs about 45 pounds.

a) Write and solve an inequality to find the number of boxes, b, that can go in one trip.
b) Ana says the answer is 30 boxes because 29.33 rounds to 29, "and one more is fine." Ben says the answer is 29 boxes. Who is correct? Explain using the context.
c) The boxes actually weigh between 40 and 50 pounds each. Explain how this information changes the number of boxes you would recommend for one trip, and why.

Model response: a) $180 + 45b \leq 1500$, so $45b \leq 1320$ and $b \leq 29.33$. b) Ben is correct. Thirty boxes would weigh $30 \times 45 = 1350$ pounds, and with the operator the total is 1530 pounds, which is over the limit. Since 29.33 is the maximum, only whole numbers 29 or fewer are safe: $180 + 45(29) = 1485$ pounds. c) If every box could weigh as much as 50 pounds, then $180 + 50b \leq 1500$ gives $b \leq 26.4$, so the safe recommendation is 26 boxes per trip. Using the average of 45 pounds could put a heavy load over the limit, so the safety situation calls for the worst case.

Rubric: 1 point: Correct inequality and solution, explains that Ben is correct because 30 boxes exceed 1,500 pounds, and recommends 26 boxes using the 50-pound worst case with a clear reason.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

GRADE 7 MATH · CLAIM 4 · MODELING & DATA ANALYSIS

4E Analyze adequacy and make improvements to existing models

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 DOK 4 DOK 4 is assessed only in the performance task.

DOK 2 · Skills & concepts

Why DOK 2: Students must see why the original model fails, use two data points to find a better rule, and check each choice, which takes several steps.

Sam is modeling the height of a stack of plastic cups. He knows one cup is 12 centimeters tall, so his model is $H = 12n$, where n is the number of cups. When he stacks 5 cups, the stack is only 20 centimeters tall, because the cups fit inside each other. Which model is the best improvement on Sam's model?

- ○ $H = 12n$, since each cup is still 12 centimeters tall
- ○ $H = 4n$, since $20 \div 5 = 4$
- ○ $H = 2n + 10$, since each added cup adds 2 centimeters to the first cup's 12 ✓
- ○ $H = 12 + 2n$, since each cup adds 2 centimeters to the 12-centimeter cup

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Written for this guide

DOK 3 · Strategic thinking

Why DOK 3: Students must judge a model against evidence, build an improved model from the data, explain its parts, and use it, which requires analysis and planning.

Jen sells lemonade for 1 dollar a cup. Her model for profit is $P = 1.00c$, where c is the number of cups sold. Her records show:

Day 1: 40 cups sold, profit of 18 dollars
Day 2: 60 cups sold, profit of 33 dollars

a) Use the data to explain why Jen's model is not adequate.
b) Write an improved model that fits both days. Explain what each number in your model means.
c) Use your improved model to find how many cups Jen must sell to make a profit of at least 50 dollars in one day.

Model response: a) Jen's model predicts 40 dollars and 60 dollars of profit, but the actual profits were 18 and 33 dollars, so it ignores her costs. b) From Day 1 to Day 2, 20 more cups added $33 - 18 = 15$ dollars, so each cup adds $15 \div 20 = 0.75$ dollars of profit. Then $0.75(40) = 30$, and $30 - 18 = 12$, so $P = 0.75c - 12$. Check: $0.75(60) - 12 = 33$. The 0.75 means each cup earns 75 cents after its 25-cent cost, and the 12 is a fixed daily cost (such as stand rental). c) $0.75c - 12 \geq 50$ gives $0.75c \geq 62$, so $c \geq 82.67$. She must sell at least 83 cups.

Rubric: 1 point: Explains the model's failure using the data, writes $P = 0.75c - 12$ with correct meanings, and finds 83 cups.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

DOK 4 · Extended thinking

Why DOK 4: Students analyze data from several events, judge the model's adequacy, build and test an improved model, and weigh trade-offs, an extended multi-step investigation.

The student council orders pizza for school events using this model: "Order 1 pizza for every 3 people." Each pizza has 8 slices and costs 11 dollars. Here are their records from the last three events.

Event 1: 60 people, 20 pizzas ordered, 6 pizzas left over
Event 2: 90 people, 30 pizzas ordered, 8 pizzas left over
Event 3: 45 people, 15 pizzas ordered, 4 pizzas left over

Part A: For each event, find how many pizzas were eaten and the number of slices eaten per person, rounded to the nearest hundredth.
Part B: Use your results to explain whether the council's model is adequate.
Part C: Write an improved model for the number of pizzas to order for n people. Explain how you decided on it, including how you handle a result that is not a whole number.
Part D: The next event will have 120 people. Compare the number of pizzas and the cost using the old model and your improved model, and explain whether your model should include a few extra pizzas.

Model response: Part A: Event 1: 14 pizzas eaten, $14 \times 8 = 112$ slices, $112 \div 60 \approx 1.87$ slices per person. Event 2: 22 pizzas, 176 slices, $176 \div 90 \approx 1.96$. Event 3: 11 pizzas, 88 slices, $88 \div 45 \approx 1.96$. Part B: People eat about 2 slices each, but the model plans for about $8 \div 3 \approx 2.67$ slices each, so it orders too much every time (18 extra pizzas over three events, about 198 dollars wasted). It is not adequate. Part C: At 2 slices per person, 1 pizza feeds 4 people, so order $\frac{n}{4}$ pizzas, rounded up to a whole pizza. Part D: Old model: $120 \div 3 = 40$ pizzas, 440 dollars. Improved model: $120 \div 4 = 30$ pizzas, 330 dollars, saving 110 dollars. Since one event averaged nearly 2 slices per person and attendance can vary, adding 1 or 2 extra pizzas (31 to 32 pizzas, 341 to 352 dollars) is reasonable and still saves money.

Rubric: 1 point: All parts addressed with one error or one weak explanation.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 4 › Generate

Written for this guide

GRADE 7 MATH · CLAIM 4 · MODELING & DATA ANALYSIS

4F Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flow charts, or formulas)

Assessed at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recognize the one relationship between two quantities, cost and number of tickets, and match it to a simple equation.

Movie tickets cost 8 dollars each. Which equation shows the total cost C, in dollars, for t tickets?

- ○ $C = t + 8$
- ✓ ○ $C = 8t$
- ○ $t = 8C$
- ○ $C = \frac{8}{t}$

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 1 › Generate

Written for this guide

DOK 2 · Skills & concepts

Why DOK 2: Students must organize the given quantities in a two-way table and use the row and column relationships to find each missing count, several connected steps.

A survey asked 80 seventh graders about their activities. 45 students play a sport, 30 students play an instrument, and 12 students do both. Complete the two-way table.

	Plays an instrument	Does not play an instrument	Total
Plays a sport	12	**33**	45
Does not play a sport	**18**	**17**	**35**
Total	30	**50**	80

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Written for this guide

DOK 3 · Strategic thinking

Why DOK 3: Students must sort relevant from irrelevant information and map how volume, a ratio, bag sizes, and prices connect before they can draw a conclusion.

A class is building two raised garden beds. Each bed is 8 feet long and 3 feet wide and will be filled 1.5 feet deep. The beds are 4 feet from the fence. The filling must be 2 parts soil to 1 part compost by volume. Soil comes in 1.5-cubic-foot bags for 7.50 dollars each. Compost comes in 1-cubic-foot bags for 6 dollars each. Seeds cost 3 dollars a packet. The class has 400 dollars to spend on filling the beds.

Identify the quantities you need and the ones you do not. Use a diagram, table, or formulas to show how the quantities are related. Then decide whether the class has enough money to fill both beds.

Model response: Not needed: the 4 feet from the fence and the seed price. Volume of one bed: $8 \times 3 \times 1.5 = 36$ cubic feet, so two beds need 72 cubic feet. Soil is $\frac{2}{3}$ of the mix: $\frac{2}{3} \times 72 = 48$ cubic feet; compost is $\frac{1}{3}$: 24 cubic feet. Soil bags: $48 \div 1.5 = 32$ bags, $32 \times 7.50 = 240$ dollars. Compost bags: 24 bags, $24 \times 6 = 144$ dollars. Total: $240 + 144 = 384$ dollars. Yes, 400 dollars is enough, with 16 dollars left over.

Rubric: 1 point: Identifies the extra information, finds 72 cubic feet, splits it 48 and 24 by the 2 to 1 ratio, finds 32 soil bags and 24 compost bags, totals 384 dollars, and concludes 400 dollars is enough. 0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

GRADE 7 MATH · CLAIM 4 · MODELING & DATA ANALYSIS

4G Identify, analyze, and synthesize relevant external resources to pose or solve problems

Assessed at: ~~DOK 1~~ ~~DOK 2~~ DOK 3 DOK 4 Assessed only in the performance task, at DOK 3 and 4.

DOK 3 · Strategic thinking

Why DOK 3: Students must choose the relevant facts from two separate resources, combine them, and make purchasing decisions to solve the problem, which requires planning.

A class wants to bake 120 cookies for a bake sale and sell them at 3 cookies for 1 dollar. Use the two resources below.

Recipe card (makes 24 cookies): $2\frac{1}{4}$ cups flour, 1 cup butter (2 sticks), $\frac{3}{4}$ cup sugar, 2 eggs, baking time 10 minutes.

Store flyer: Flour, 5-pound bag (about 18 cups) for 3.49 dollars. Butter, package of 4 sticks for 4.29 dollars. Sugar, 4-pound bag (about 9 cups) for 3.19 dollars. Paper plates, 50 for 2.99 dollars.

The class already has the eggs. Decide which information you need, find the cost of the flour, butter, and sugar the class must buy, and find the profit from selling all 120 cookies.

Model response: Scale factor: $120 \div 24 = 5$. Flour: $5 \times 2\frac{1}{4} = 11\frac{1}{4}$ cups, so 1 bag (18 cups) for 3.49 dollars. Butter: $5 \times 2 = 10$ sticks, so $10 \div 4 = 2.5$, round up to 3 packages, $3 \times 4.29 = 12.87$ dollars. Sugar: $5 \times \frac{3}{4} = 3\frac{3}{4}$ cups, so 1 bag for 3.19 dollars. Total cost: $3.49 + 12.87 + 3.19 = 19.55$ dollars. Sales: $120 \div 3 = 40$ groups, so 40 dollars. Profit: $40 - 19.55 = 20.45$ dollars. Not needed: baking time, eggs, and paper plates.

Rubric: 1 point: Scales the recipe by 5, buys 1 bag of flour, 3 packages of butter, and 1 bag of sugar, finds the cost of 19.55 dollars, and finds a profit of 20.45 dollars, ignoring the extra information.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

DOK 4 · Extended thinking

Why DOK 4: Students must gather and combine facts from several resources, carry out an extended multi-part analysis, and design and test their own solution, which is extended thinking.

The 7th grade is choosing a field trip. There are 96 students. One adult chaperone is required for every 10 students or part of 10, so 10 chaperones are needed. Use the three resources below.

Resource 1, Bus company rate sheet: Each bus seats 50 people. Each bus costs 150 dollars for the

driver plus 2.50 dollars per mile, counting the round trip.

Resource 2, Science Museum: 70 miles from school (one way). Student tickets cost 9 dollars. Groups of 20 or more students get 15% off student tickets. Chaperones get in free.

Resource 3, Aquarium: 45 miles from school (one way). Tickets cost 14 dollars for everyone, students and chaperones. No group discount.

Fundraising will cover 25 dollars per student. All costs, including chaperones, are shared by the students.

Part A: How many buses are needed? Explain.
Part B: Find the total cost and the cost per student for each trip, to the nearest cent.
Part C: Which trip fits the budget? By how much is each trip over or under the total budget?
Part D: The students vote for the Aquarium. Using the resources, propose one realistic change that would make the Aquarium trip fit the budget, and show that it works.

Model response: Part A: $96 + 10 = 106$ people; 2 buses seat only 100, so 3 buses are needed. Part B: Museum: round trip 140 miles; one bus $150 + 2.50(140) = 500$ dollars; 3 buses 1,500 dollars; tickets $96 \times 9 \times 0.85 = 734.40$ dollars; total 2,234.40 dollars; per student $2234.40 \div 96 = 23.28$ dollars (rounded from 23.275). Aquarium: round trip 90 miles; one bus $150 + 2.50(90) = 375$ dollars; 3 buses 1,125 dollars; tickets $106 \times 14 = 1484$ dollars; total 2,609 dollars; per student about 27.18 dollars. Part C: The budget is $96 \times 25 = 2400$ dollars. The Museum is 165.60 dollars under budget; the Aquarium is 209 dollars over. Part D: Sample: raise an extra 2.18 dollars per student (about 209 dollars in total), or have the school or parents pay the 140 dollars of chaperone tickets and raise the remaining 69 dollars. Any proposal that uses the resources and shows the new total is at most 2,400 dollars is acceptable.

Rubric: 1 point: All parts addressed with one computational error or an incomplete Part D.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 7 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 4 › Generate

Written for this guide

Sources

- Smarter Balanced Assessment Consortium, 2015–16 Summative Technical Report: claim statements, and the Appendix 2.A test blueprints (pp. 43–48), which list the DOK levels assessed for every claim and target. https://www.cde.ca.gov/ta/tg/ca/documents/sb16sbtechrpt.pdf
- Target wording and standards: Smarter Balanced Mathematics Content Specifications and the CCSS for Mathematics, as stored in the AchieveMetrics Test Bank.
- DOK level definitions: Smarter Balanced Content Specifications (Webb Depth of Knowledge), summarised on the "How to use" page.

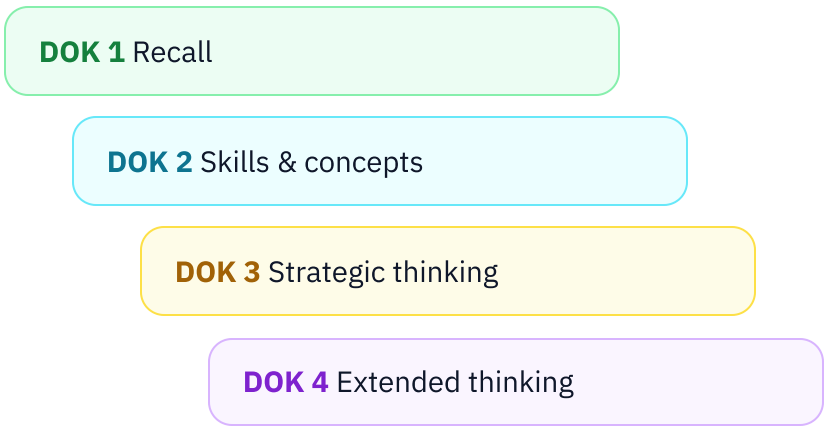
- Example questions: the AchieveMetrics Test Bank, reviewed for this guide.

AchieveMetrics Test Bank · DOK Progression Guide · Grade 7 Math · October 2026 edition.

DOK PROGRESSION GUIDE · SBAC MATHEMATICS

Grade 8 Math

Every SBAC claim and target for Grade 8 Math, with a Test Bank question at each Depth of Knowledge (DOK) level the blueprint assesses, and the clicks to find more.



For Grade 8 Math teachers. Claims, targets and DOK levels follow the official Smarter Balanced blueprint.

achievemetricstestbank.com · October 2026 edition

How to use this booklet

Depth of Knowledge (DOK) describes the kind of thinking a question asks for, not how hard it is. A long calculation can still be DOK 1, and a short question can be DOK 3. For each target, this booklet shows one question at every DOK level SBAC assesses it at, so you can see the climb and then pick questions at the level your students need next.

The four DOK levels

DOK 1 · Recall — Recall a fact, term or property, or carry out a routine one-step procedure. Read a value straight from a table or graph.

DOK 2 · Skills & concepts — Decide how to approach it and use two or more steps: compare, classify, interpret data, or move between representations.

DOK 3 · Strategic thinking — Reason and plan: justify an answer, critique an argument, use evidence, or solve a problem with no routine path.

DOK 4 · Extended thinking — Carry out an extended investigation that connects several ideas, conditions or sources. On SBAC, DOK 4 is assessed only in the performance task, and only for Claim 3 and Claim 4 targets.

Reading a target page

1. The heading names the claim, the target code and the official target wording, with the standards it draws on.
2. The DOK ladder shows which levels the SBAC blueprint assesses for this target in this grade. Levels in grey with a line through them are not assessed for this target.
3. One example question at each assessed level, lowest first, with the answer shown. Read them top to bottom to see how the thinking climbs.
4. "Why DOK n" explains in one sentence what makes the question that level, so you can spot the same thing in your own questions.
5. "Find more like this" lists the exact Test Bank clicks that generate more questions for the same target at the same level.

Which DOK levels each target is assessed at comes from the official Smarter Balanced test blueprint for this grade (2015–16 Summative Technical Report, Appendix 2.A). Every example was checked by hand against the DOK definitions above, not just its Test Bank tag. A few targets had no Test Bank question that truly fit a level, so we wrote one; those are marked "Written for this guide."

Finding these questions in the Test Bank

Every example page ends with the exact clicks. These are the two routes, starting from Create questions with Grade 8 Math chosen as the grade.

Claim 1 targets (CAT)

Claim 1 questions are filed by target and standard.

Create questions › Grade 8 › CAT › Claim 1 target › Standard › Options: DOK 1 or 2 › Item types (optional) › Generate

The DOK buttons only allow the levels the blueprint assesses for that target, so a level that is greyed out in this booklet is greyed out in the Test Bank too.

Claims 2, 3 and 4 (PT)

These claims are built from performance-task standard groups.

Create questions › Grade 8 › PT › Area 2 (Claims 2 + 4) or Area 3 (Claim 3) › Standard group › Options: DOK › Generate

Each question card shows its claim and target, such as "Claim 3 · Tgt B". Generate at the DOK you want, then keep the cards for your target.

Questions you have saved

Saved questions are filed the same way in your Item Bank.

More › Item Bank › Grade 8 › CAT or PT › Area › Target › DOK

Tip: to move a class up the ladder, generate the same target at the next DOK level. To check that a skill is secure before going further, generate a set at the lowest assessed level.

All targets at a glance

A dot means the SBAC blueprint assesses the target at that DOK level in this grade. Each dot has an example question in this booklet.

Claim 1 · Concepts & Procedures

Target		DOK 1	DOK 2	DOK 3	DOK 4
1A	Know that there are numbers that are not rational, and approximate them by rational numbers	●	●	–	–
1B	Work with radicals and integer exponents	●	●	–	–
1C	Understand the connections between proportional relationships, lines, and linear equations	●	●	–	–
1D	Analyze and solve linear equations and pairs of simultaneous linear equations	●	●	–	–
1E	Define, evaluate, and compare functions	●	●	–	–
1F	Use functions to model relationships between quantities	●	●	–	–
1G	Understand congruence and similarity using physical models, transparencies, or geometry software	●	●	–	–
1H	Understand and apply the Pythagorean Theorem	●	●	–	–
1I	Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres	●	●	–	–
1J	Investigate patterns of association in bivariate data	●	●	–	–

Claim 2 · Problem Solving

Target		DOK 1	DOK 2	DOK 3	DOK 4
2A	Apply mathematics to solve well-posed problems	–	●	●	–
2B	Select and use appropriate tools strategically	●	●	●	–
2C	Interpret results in the context of a situation	●	●	●	–
2D	Identify important quantities and map their relationships	●	●	●	–

Claim 3 · Communicating Reasoning

Target		DOK 1	DOK 2	DOK 3	DOK 4
3A	Test propositions or conjectures with specific examples	–	●	●	–
3B	Construct chains of reasoning that will justify or refute propositions	–	●	●	●
3C	State logical assumptions being used	–	●	●	–
3D	Use the technique of breaking an argument into cases	–	●	●	–
3E	Distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in the argument—explain what it is	–	●	●	●
3F	Base arguments on concrete referents such as objects, drawings, diagrams, and actions	–	●	●	–
3G	Determine conditions under which an argument does and does not apply	–	●	●	–

Claim 4 · Modeling & Data Analysis

Target		DOK 1	DOK 2	DOK 3	DOK 4
4A	Apply mathematics to solve problems from everyday life (Modeling)	–	●	●	–
4B	Construct chains of reasoning to justify mathematical models	–	●	●	●
4C	State logical assumptions being used	●	●	●	–
4D	Interpret results in the context of a situation	–	●	●	–
4E	Analyze adequacy and make improvements to existing models	–	●	●	●
4F	Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flow charts, or formulas)	●	●	●	–
4G	Identify, analyze, and synthesize relevant external resources to pose or solve problems	–	–	●	●

CLAIM 1

Claim 1 · Concepts & Procedures

Students can explain and apply mathematical concepts and interpret and carry out mathematical procedures with precision and fluency. Claim 1 is tested with individual items on the computer adaptive test (CAT). In the Test Bank, choose CAT, then the target.

Create questions › Grade 8 › CAT › Claim 1 target › Standard › Options: DOK › Generate

GRADE 8 MATH · CLAIM 1 · CONCEPTS & PROCEDURES

1A Know that there are numbers that are not rational, and approximate them by rational numbers

Standards: 8.NS.A.1; 8.NS.A.2

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students carry out one routine procedure, rewriting a repeating decimal as a fraction, with no decisions about how to approach it.

A basketball player's free throw percentage is $0.8\overline{3}$, which means the decimal $0.8333...$ repeats. Convert this repeating decimal into a fraction in simplest form.

Correct answer: $\frac{5}{6}$

FIND MORE LIKE THIS

Create questions › Grade 8 › CAT › Target A › Standard › DOK 1 › Generate Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must estimate five different irrational values and compare each estimate to an interval, deciding true or false, which takes several steps and judgment.

A sports statistician is estimating distances and times using irrational numbers. Decide whether each statement is true or false.

	True	False
A javelin throw of $\sqrt{50}$ meters is between 7 meters and 7.5 meters.	☑	☐
A long jump distance of $\sqrt{30}$ meters is between 5.5 meters and 6 meters.	☐	☑
A race time of π^2 seconds is between 9 seconds and 10 seconds.	☑	☐
A discus throw of $\sqrt{90}$ meters is between 9 meters and 9.5 meters.	☑	☐
A shot put distance of $\sqrt{2}$ meters is between 1.5 meters and 1.6 meters.	☐	☑

FIND MORE LIKE THIS

Create questions › Grade 8 › CAT › Target A › Standard › DOK 2 › Generate Test Bank question

GRADE 8 MATH · CLAIM 1 · CONCEPTS & PROCEDURES

1B Work with radicals and integer exponents

Standards: 8.EE.A.1; 8.EE.A.2; 8.EE.A.3; 8.EE.A.4

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students apply one exponent property directly and then recall the name of that property, which is recall and a routine procedure.

A basketball player is analyzing her shooting statistics. She notices that her successful free throw attempts can be represented using exponent rules.

Part A: Simplify the expression $2^4 \times 2^{-2}$.

Choose one answer.

- ○ $2^6 = 64$
- ○ $2^8 = 256$
- ◉ $2^2 = 4$ ✓
- ○ $2^{-2} = \frac{1}{4}$

Part B: Which property of integer exponents justifies your answer to Part A?

Choose one answer.

- ○ When dividing powers with the same base, multiply the exponents
- ◉ When multiplying powers with the same base, add the exponents ✓
- ○ When raising a power to a power, divide the exponents
- ○ When multiplying powers with the same base, subtract the exponents

FIND MORE LIKE THIS

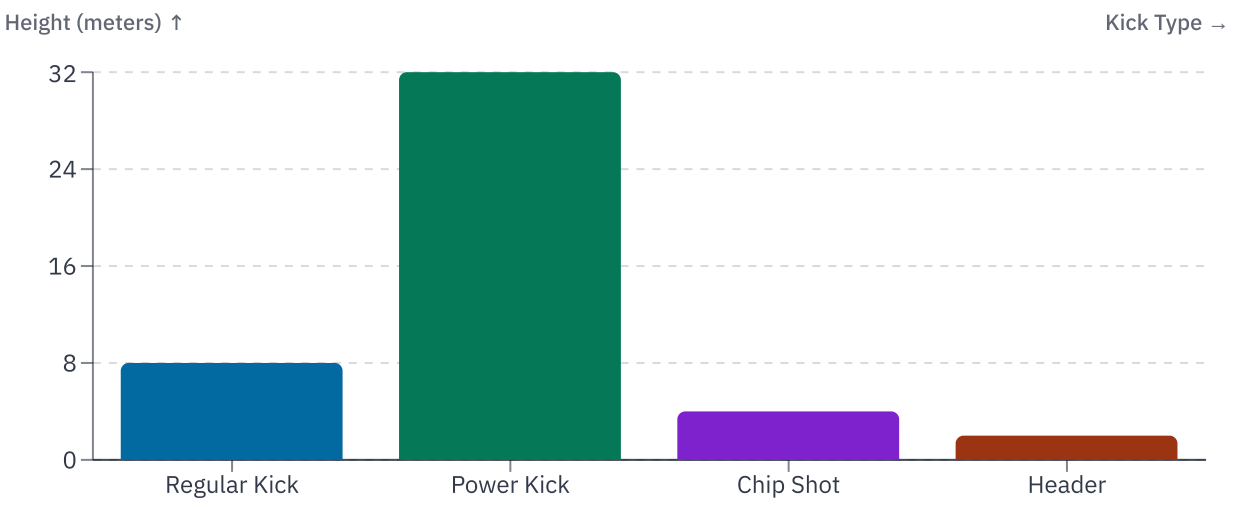
Create questions › Grade 8 › CAT › Target B › Standard › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must decide that comparing heights means dividing, then apply the quotient rule and interpret the result as how many times greater, linking two ideas.

A soccer coach is analyzing the maximum heights reached by different kick types. The graph shows heights in meters for each kick. If the height of a Power Kick is 2^5 meters and the height of a Regular Kick is 2^3 meters, which statement correctly compares these two heights using exponent rules?



- ○ The Power Kick height is 2^{15} times greater than the Regular Kick height because $2^5 \times 2^3 = 2^{15}$
- ○ The Power Kick height is 2^8 times greater than the Regular Kick height because $2^5 + 2^3 = 2^8$
- ○ The Power Kick height is 2^2 times greater than the Regular Kick height because $\frac{2^5}{2^3} = 2^2$ ✓
- ○ The Power Kick height is 2^1 times greater than the Regular Kick height because $2^5 - 2^3 = 2^1$

FIND MORE LIKE THIS

Create questions › Grade 8 › CAT › Target B › Standard › DOK 2 › Generate

Test Bank question

GRADE 8 MATH · CLAIM 1 · CONCEPTS & PROCEDURES

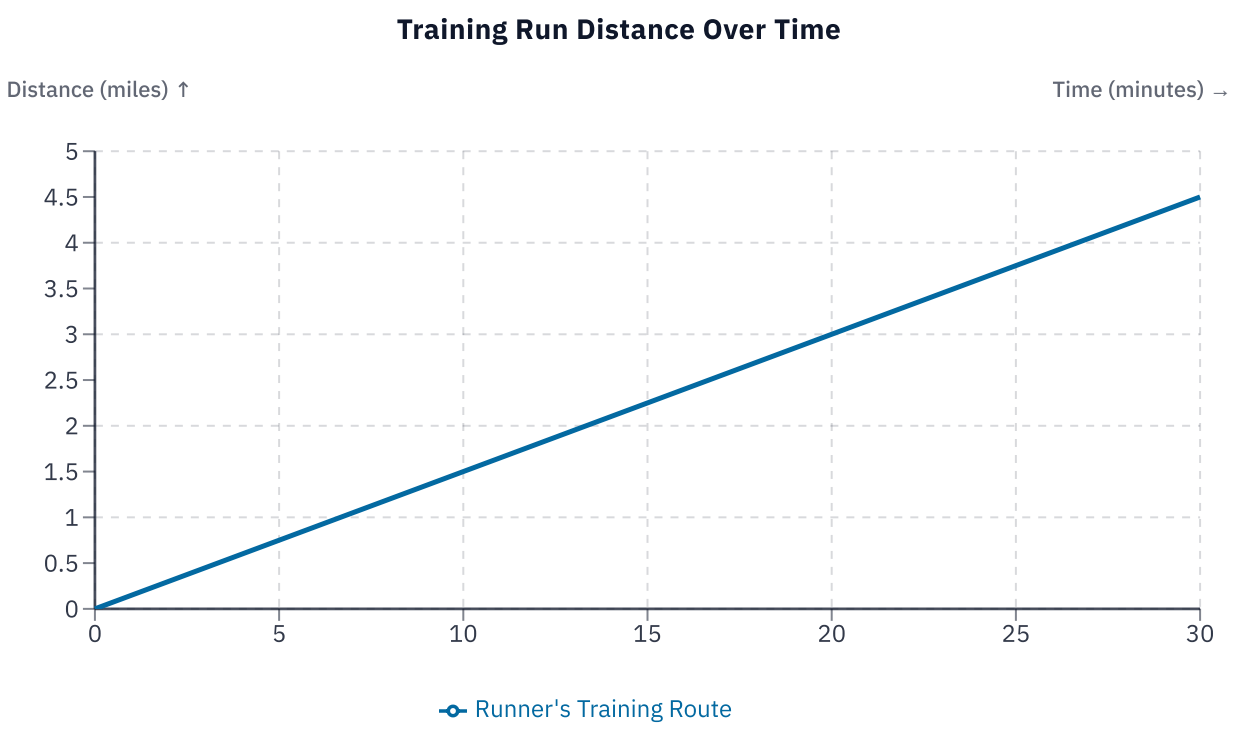
1C Understand the connections between proportional relationships, lines, and linear equations

Standards: 8.EE.B.5; 8.EE.B.6

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall **Why DOK 1:** Students read the unit rate of a proportional relationship straight off a graph, a one-step reading task.

A runner trains at a constant pace. The graph shows the proportional relationship between time and distance. What is the unit rate (slope) that represents the runner's speed in miles per minute?



- ○ 0.25 miles per minute
- ○ 0.20 miles per minute
- ○ 0.15 miles per minute ✓
- ○ 0.10 miles per minute

FIND MORE LIKE THIS

Create questions › Grade 8 › CAT › Target C › Standard › DOK 1 › Generate — Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must find the unit rate from a table, read it from an equation, and compare two different representations, which takes two steps and a translation.

Two pumps are filling a pool at constant rates. The amount of water pumped by Pump A is given by the equation $g = 12m$, where g is gallons and m is minutes. The table shows the amount of water pumped by Pump B.

Minutes	Gallons
5	55
8	88

Which statement correctly compares the two pumps?

- ○ Pump B pumps faster because 88 gallons is greater than 12 gallons.
- ○ Pump A pumps faster because its unit rate is 12 gallons per minute and Pump B's unit rate is 11 gallons per minute. ✓
- ○ Pump B pumps faster because its unit rate is 55 gallons per minute.
- ○ Both pumps pump at the same rate because both relationships are proportional.

FIND MORE LIKE THIS

Create questions › Grade 8 › CAT › Target C › Standard › DOK 2 › Generate — Written for this guide

GRADE 8 MATH · CLAIM 1 · CONCEPTS & PROCEDURES

1D Analyze and solve linear equations and pairs of simultaneous linear equations

Standards: 8.EE.C.7a; 8.EE.C.7b; 8.EE.C.8b; 8.EE.C.8c

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students solve a linear equation with a routine procedure (distribute, combine like terms, isolate x) and do not need to choose a strategy.

A basketball player's total scoring over two games can be described by the equation $3(x - 5) + 2x = 40$, where x represents the average number of points scored per game. Enter the value of x.

Correct answer: 11

FIND MORE LIKE THIS

Create questions › Grade 8 › CAT › Target D › Standard › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students translate a word situation into a system of two equations and then solve it, moving between representations over several steps.

A basketball team is analyzing their scoring performance. In one game, the team scored a total of 84 points. The guards scored 12 more points than the forwards. Let g represent the points scored by guards and f represent the points scored by forwards.

Part A: Which system of equations represents this situation?

Choose one answer.

- ○ $g + f = 12$ and $g = f + 84$
- ✓ $g + f = 84$ and $g = f + 12$
- ○ $g + f = 84$ and $f = g + 12$
- ○ $g - f = 84$ and $g = f - 12$

Part B: How many points did the guards score?

Choose one answer.

- ○ 60 points
- ○ 36 points
- ✓ 48 points
- ○ 72 points

FIND MORE LIKE THIS

Create questions › Grade 8 › CAT › Target D › Standard › DOK 2 › Generate

Test Bank question

GRADE 8 MATH · CLAIM 1 · CONCEPTS & PROCEDURES

1E Define, evaluate, and compare functions

Standards: 8.F.A.1; 8.F.A.2; 8.F.A.3

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall the definition of a function (each input has exactly one output) and recognize it in a simple table.

A basketball player tracks the number of free throws made based on practice time. The table below shows the relationship between hours of practice and free throws made.

Hours of Practice	Free Throws Made
1	8
2	16
3	24
4	32

Which statement correctly describes this function?

- ○ This is not a function because the outputs do not increase by the same amount each time.
- ○ For each input (hours of practice), there is exactly one output (free throws made). ✓
- ○ For each input (hours of practice), there are two different outputs (free throws made).
- ○ The input is the number of free throws made and the output is the hours of practice.

FIND MORE LIKE THIS

Create questions › Grade 8 › CAT › Target E › Standard › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students compare two functions given in different forms, an equation and a table, finding rates and evaluating, then judge several statements.

A basketball team is comparing two players' scoring patterns. Player A's points per game follows the rule $y = 3x + 5$, where x is the number of games played and y is total points scored. Player B's total points are shown in the table below.

Games Played	Total Points
1	8
2	16
3	24
4	32

Select all statements that are true.

- [x] Player B's scoring pattern is a linear function with a rate of change of 8 points per game.
- [ ] Both players' scoring patterns can be represented by the equation $y = 8x$.
- [ ] Player A scores more points per game than Player B.
- [x] Player B's total points after 5 games would be 40 points.
- [x] Player A's scoring pattern is a linear function.

FIND MORE LIKE THIS

Create questions › Grade 8 › CAT › Target E › Standard › DOK 2 › Generate

Test Bank question

GRADE 8 MATH · CLAIM 1 · CONCEPTS & PROCEDURES

1F Use functions to model relationships between quantities

Standards: 8.F.B.4; 8.F.B.5

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students identify the slope and a point directly from a function written in slope-intercept form, which is recall of a known form.

Use the drop-down menus to complete the statement.

A basketball player's total points over several games is shown by the function $f(x) = 4x + 5$, where x is the number of games played. The slope of this function is [4 ▾], and the function [passes through ▾] the point $(0, 5)$.

Drop-down 1 choices: -4 | 4 ✓ | 5

Drop-down 2 choices: does not pass through | **passes through** ✓

FIND MORE LIKE THIS

Create questions › Grade 8 › CAT › Target F › Standard › DOK 1 › Generate — Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students use two data points to find the rate of change and then the initial value, building a function model in more than one step.

A rock climbing gym charges a membership fee plus an hourly rate. Marcus pays \$35 for 2 hours of climbing and \$59 for 5 hours of climbing. Which function best represents the total cost C in dollars as a function of h, the number of hours climbed?

- ○ $C = 7h + 21$
- ○ $C = 15h + 5$
- ○ $C = 12h + 11$
- ○ $C = 8h + 19$ ✓

FIND MORE LIKE THIS

Create questions › Grade 8 › CAT › Target F › Standard › DOK 2 › Generate — Test Bank question

GRADE 8 MATH · CLAIM 1 · CONCEPTS & PROCEDURES

1G Understand congruence and similarity using physical models, transparencies, or geometry software

Standards: 8.G.A.1; 8.G.A.3; 8.G.A.2

Assessed at: DOK 1 | DOK 2 | ~~DOK 3~~ | ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students apply the definition of similar figures by checking that matching side ratios are equal, a direct routine check.

A basketball coach is using transparencies to compare two triangular court markings. Triangle A has side lengths of 6 meters, 8 meters, and 10 meters. Triangle B has side lengths of 9 meters, 12 meters, and 15 meters. Which statement correctly describes the relationship between these two triangles?

- ○ The triangles are similar because they both have a side length of 6 meters.
- ✓ ○ The triangles are similar because corresponding sides are proportional with a scale factor of 1.5.
- ○ The triangles are congruent because they have different side lengths.
- ○ The triangles are congruent because the side lengths of Triangle B are all larger than Triangle A.

FIND MORE LIKE THIS

Create questions › Grade 8 › CAT › Target G › Standard › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must classify each transformation as preserving or changing size and decide which produce congruent figures, which is classification across several cases.

A basketball court design is being created using transformations. Triangle A with vertices at $(0, 0)$, $(4, 0)$, and $(2, 3)$ represents a player formation. The design team applies the following transformations to create new formations. Select all the transformations that would result in a triangle congruent to Triangle A.

- [ ] Dilate Triangle A by a scale factor of 2 centered at the origin
- [ ] Dilate Triangle A by a scale factor of 0.5 centered at the origin
- [x] Rotate Triangle A 90 degrees counterclockwise about the origin
- [x] Reflect Triangle A across the x-axis
- [x] Translate Triangle A 5 units right and 2 units up

FIND MORE LIKE THIS

Create questions › Grade 8 › CAT › Target G › Standard › DOK 2 › Generate

Test Bank question

GRADE 8 MATH · CLAIM 1 · CONCEPTS & PROCEDURES

1H Understand and apply the Pythagorean Theorem

Standards: 8.G.B.7; 8.G.B.8

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: The right triangle and its legs are given directly, so students simply apply the Pythagorean Theorem formula once.

A right triangle is formed on a soccer field: one leg runs 6 meters along the goal line, and the other leg runs 8 meters straight out from the goal line to a cone. What is the straight-line distance from the corner of the goal line to the cone? Explain your reasoning.

Model response: Using the Pythagorean Theorem, $a^2 + b^2 = c^2$, with legs 6 and 8: $6^2 + 8^2 = 36 + 64 = 100$. So $c = \sqrt{100} = 10$ meters.

Rubric: 1 point: complete and correct with clear reasoning.

0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 8 › CAT › Target H › Standard › DOK 1 › Generate Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must recognize that the diagonal of a rectangle forms a right triangle with the sides before applying the theorem and rounding, which adds a modeling step.

A soccer field has a rectangular goal area. A player kicks the ball from one corner of the goal area diagonally across to the opposite corner. The goal area is 18 meters long and 8 meters wide. What is the straight-line distance the ball travels, in meters? Round to the nearest tenth.

Correct answer: **19.7**

FIND MORE LIKE THIS

Create questions › Grade 8 › CAT › Target H › Standard › DOK 2 › Generate Test Bank question

GRADE 8 MATH · CLAIM 1 · CONCEPTS & PROCEDURES

1I Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres

Standards: 8.G.C.9

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students substitute given values into the cylinder volume formula, a single routine procedure.

A cylindrical water tank at a sports facility has a radius of 4 meters and a height of 10 meters. What is the volume of the tank? (Use $\pi \approx 3.14$)

- ○ 125.6 cubic meters
- ○ 251.2 cubic meters
- ✓ 502.4 cubic meters
- ○ 1,256 cubic meters

FIND MORE LIKE THIS

Create questions › Grade 8 › CAT › Target I › Standard › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students choose the right formula for each solid, compute volumes, and compare them to stated values, handling several shapes and comparisons.

A sports equipment company is designing new water bottles shaped like cylinders and cones for different teams. Decide whether each statement about the volumes is true or false.

	True	False
A cylindrical water bottle with radius 3 cm and height 20 cm has a volume of approximately 565.5 cubic cm.	☑	☐
A conical sports drink cup with radius 4 cm and height 15 cm has a volume greater than 800 cubic cm.	☐	☑
If a cylindrical bottle has radius 2 cm and height 25 cm, its volume is less than 300 cubic cm.	☐	☑
Two cone-shaped cups, each with radius 5 cm and height 12 cm, have a combined volume of approximately 628 cubic cm.	☑	☐

FIND MORE LIKE THIS

Create questions › Grade 8 › CAT › Target I › Standard › DOK 2 › Generate

Test Bank question

GRADE 8 MATH · CLAIM 1 · CONCEPTS & PROCEDURES

1J Investigate patterns of association in bivariate data

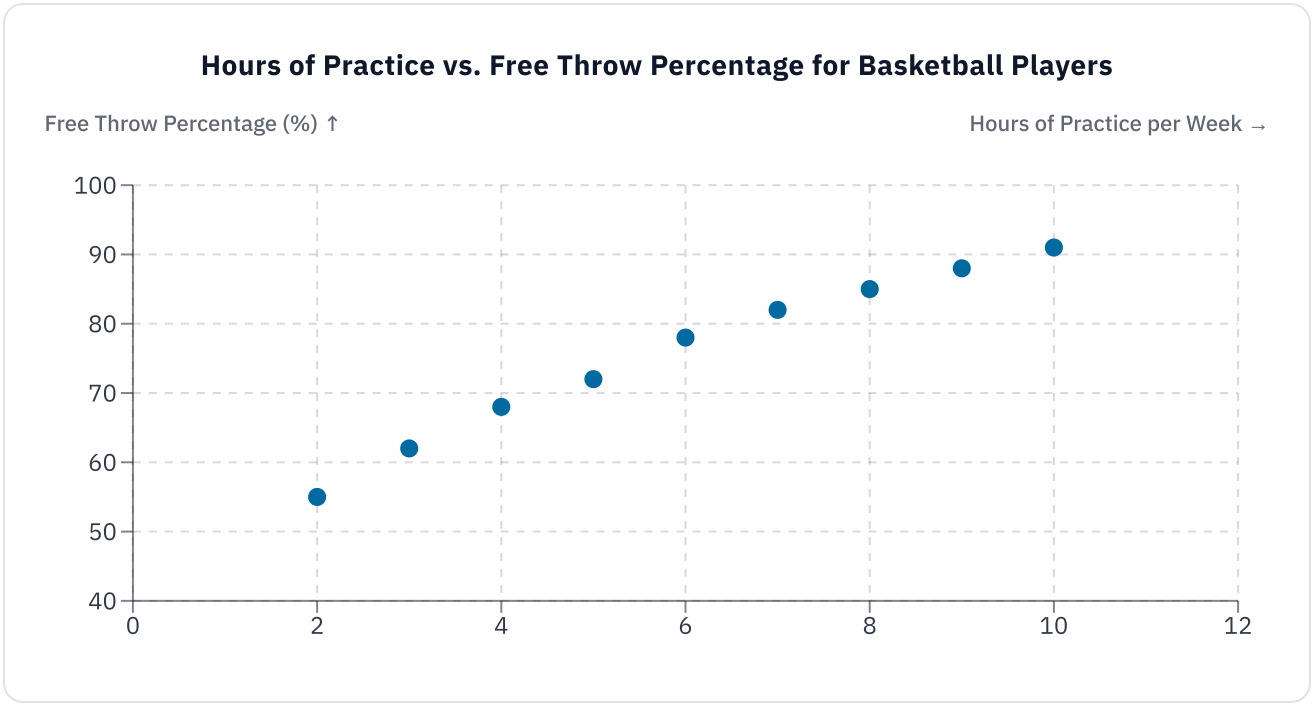
Standards: 8.SP.A.1-2; 8.SP.A.1-3; 8.SP.3; 8.SP.4

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students read the direction of an obvious trend straight off a scatter plot and name the association.

Based on the scatter plot, which statement best describes the relationship between hours of practice per week and free throw percentage?



- ◯ As the hours of practice per week increase, the free throw percentage tends to decrease.
- ◯ Players who practice 5 hours per week always shoot above 80% from the free throw line.
- ◯ There is no association between practice hours and free throw percentage.
- ◯ As the hours of practice per week increase, the free throw percentage tends to increase. ✓

FIND MORE LIKE THIS

Create questions › Grade 8 › CAT › Target J › Standard › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret the slope of a linear model in the context of bivariate data and must tell it apart from the intercept, which is interpretation, not recall.

A coach collected data on the number of hours players practiced each week and the number of points they scored in the next game. She found the linear model $y = 4x + 6$, where x is hours practiced per week and y is predicted points scored. Select the statement that correctly interprets the slope of this model.

- For every additional hour practiced, predicted points scored increases by 6.
- For every additional hour practiced, predicted points scored increases by 4. ✓
- A player who practices 0 hours is predicted to score 4 points.
- Points scored increases by 4 points for every 6 hours practiced.

FIND MORE LIKE THIS

Create questions › Grade 8 › CAT › Target J › 8.SP.3 › DOK 2 › Generate

Test Bank question

CLAIM 2

Claim 2 · Problem Solving

Students can solve a range of complex well-posed problems in pure and applied mathematics, making productive use of knowledge and problem-solving strategies. In the Test Bank, Claims 2, 3 and 4 are built in the performance task (PT) step: choose PT, then Area 2 · Claims 2 + 4. Each question card is marked with its claim and target (for example "Claim 2 · Tgt A"), so generate a set at the DOK you want and keep the cards for the target you need.

Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › Options: DOK › Generate

GRADE 8 MATH · CLAIM 2 · PROBLEM SOLVING

2A Apply mathematics to solve well-posed problems

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students must decide to simplify the fraction and estimate the square root before comparing three values in different forms, a multi-step problem.

A coach is comparing the distances that three athletes can jump. Athlete A jumped $\sqrt{15}$ meters, Athlete B jumped 3.9 meters, and Athlete C jumped $\frac{16}{4}$ meters. The coach knows that $\sqrt{16} = 4$ and $\sqrt{9} = 3$. Which statement correctly orders the athletes from shortest to longest jump?

- ○ Athlete A and Athlete B jumped the same distance, both shorter than Athlete C
- ○ Athlete B jumped the shortest distance, followed by Athlete A, then Athlete C
- ○ Athlete C jumped the shortest distance, followed by Athlete B, then Athlete A
- ○ Athlete A jumped the shortest distance, followed by Athlete B, then Athlete C ✓

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must plan a path through several linked steps (two volume formulas, a division, and a total demand) and draw a conclusion, with no routine to follow.

A soccer team brings a cylindrical water cooler to a tournament. The inside of the cooler has a radius of 6 inches and a height of 20 inches, and it is completely full. Players drink from cone-shaped paper cups. Each cup has a radius of 1.5 inches and a height of 4 inches.

The team plays 3 games. There are 20 players, and each player drinks 4 full cups of water during each game.

Is one full cooler enough water for the whole tournament? Show your work and explain how you know.

Model response: Cooler volume: $V = \pi r^2 h = \pi(6^2)(20) = 720\pi$ cubic inches. Cup volume: $V = \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi(1.5^2)(4) = 3\pi$ cubic inches. Number of full cups in the cooler: $720\pi \div 3\pi = 240$ cups. Cups needed: $3 \times 20 \times 4 = 240$ cups. Yes, one full cooler is exactly enough, with no water left over.

Rubric: 1 point: Correct volumes of the cooler (720π) and cup (3π), correct number of cups (240) and cups needed (240), and a conclusion that one cooler is exactly enough.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

GRADE 8 MATH · CLAIM 2 · PROBLEM SOLVING

2B Select and use appropriate tools strategically

Assessed at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recognize which familiar tools fit a data task, which is recall of what each tool is used for.

A middle school basketball team is analyzing player statistics. The coach wants to determine which tools would be most appropriate to use when organizing and comparing the team's scoring data from 15 games. Select all the tools that would be appropriate for this task.

- [ ] A ruler to measure the distance between players on the court
- [ ] A protractor to measure the angles of each player's shooting form
- [ ] A compass to determine the direction players are facing when they shoot
- [x] A spreadsheet application to create columns for each game and calculate total points
- [x] A calculator or computer program to find the average points per game
- [x] A data table or chart to display the points scored in each game

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must choose a common form (decimals) to compare a repeating decimal with a square root, then evaluate both and compare.

A basketball coach is analyzing player performance. Player A's free throw percentage is $0.8\overline{3}$ (where the 3 repeats), and Player B's free throw percentage is $\sqrt{0.64}$. The coach wants to compare their percentages to determine which player is more accurate. Which statement correctly compares the two players' free throw percentages?

- Player A's percentage of $0.8\overline{3}$ equals approximately 0.833, while Player B's percentage is 0.64, so Player B is more accurate.
- ✓ Player A's percentage of $0.8\overline{3}$ equals approximately 0.833, while Player B's percentage is 0.8, so Player A is more accurate.
- Player A's percentage of $0.8\overline{3}$ equals approximately 0.833, while Player B's percentage is 0.9, so Player B is more accurate.
- Player A's percentage of $0.8\overline{3}$ equals approximately 0.888, while Player B's percentage is 0.8, so both players are equally accurate.

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students choose a tool, justify the choice, use it to build a model and predict, and judge how reliable the result is, which requires planning and reasoning.

A coach records the number of free throw attempts and points scored per game for nine players.

Free Throw Attempts	2	3	4	5	6	7	8	9	10
Points Scored	8	12	15	18	22	24	28	31	33

The coach wants to predict how many points a player who attempts 11 free throws per game will score.

(a) Choose a mathematical tool or method to make the prediction (for example, a scatter plot with a line of fit, an equation, or a table pattern). Explain why it is a good choice for this data.
(b) Use your tool to make the prediction. Show your work.
(c) Explain how confident you are in the prediction and why.

Model response: (a) A scatter plot with a line of fit (and its equation) is a good choice because the points show a roughly linear, increasing pattern, and a line lets us extend the pattern past the data. (b) Using the points (2, 8) and (10, 33), the slope is $\frac{33-8}{10-2} = \frac{25}{8} \approx 3.1$. Then $8 = 3.1(2) + b$, so $b \approx 1.8$ and $y \approx 3.1x + 1.8$. At $x = 11$, $y \approx 3.1(11) + 1.8 \approx 36$ points. (c) Fairly confident, because 11 is just outside the data and the pattern is close to linear; the prediction would be less reliable much farther from the data. Any prediction from about 34 to 38 with a sound line is acceptable.

Rubric: 1 point: Chooses an appropriate tool with a valid reason, makes a prediction between 34 and 38 supported by work, and gives a reasonable comment on confidence.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

GRADE 8 MATH · CLAIM 2 · PROBLEM SOLVING

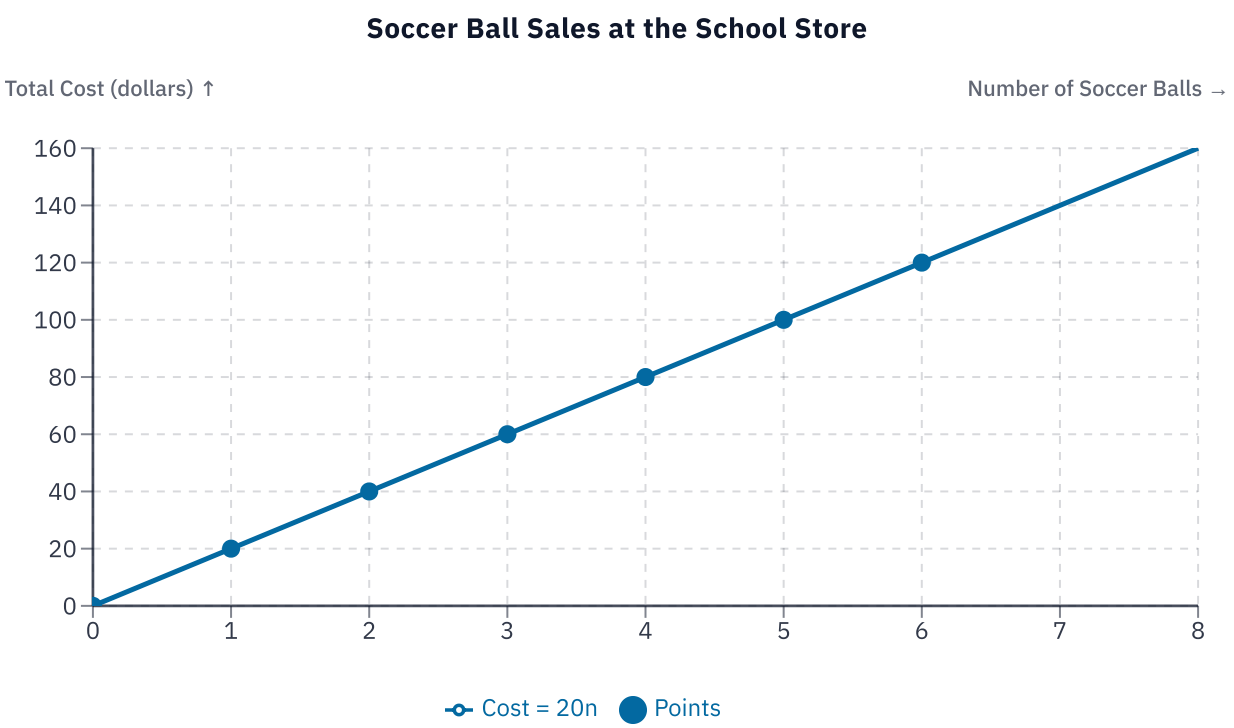
2C Interpret results in the context of a situation

Assessed at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students extend a proportional pattern shown on a graph by one step to get a cost, a direct one-step result in context.

The graph shows the proportional relationship between the number of soccer balls purchased and the total cost. Coach Martinez needs to buy 7 soccer balls for the team. Based on the proportional relationship shown in the graph, what will be the total cost?



- ○ 100 dollars
- ○ 160 dollars
- ○ 120 dollars
- ○ 140 dollars ✓

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 1 › Generate

DOK 2 · Skills & concepts

Why DOK 2: Students must interpret a decimal solution in a context where only whole numbers make sense and test values on each side to decide what it means.

Gym A charges a $20 monthly fee plus $5 per visit. Gym B charges $8 per visit with no monthly fee. Kenji solves $20 + 5v = 8v$ and gets $v \approx 6.67$. Which statement correctly interprets Kenji's result for one month?

- The gyms cost the same when a person makes exactly 6.67 visits, so a person who visits 6 times should choose Gym A.
- Gym B costs less for 6 or fewer visits, and Gym A costs less for 7 or more visits. ✓
- Gym A costs less for 6 or fewer visits, and Gym B costs less for 7 or more visits.
- The result is not useful because a person cannot make 6.67 visits.

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Written for this guide

DOK 3 · Strategic thinking

Why DOK 3: Students combine several pieces of information, interpret a decimal answer in context, judge whether a goal is met, and justify a change, which requires reasoning, not one procedure.

The garden club is selling potted plants for $4 each. The club spent $55 on pots and soil. Their goal is to make a profit of at least $250 after paying for supplies. The sale lasts 5 hours. In the first 2 hours, they sold 24 plants, and they expect to keep selling at the same rate.

(a) How many plants must the club sell to reach its goal?
(b) Will the club reach its goal by the end of the sale? Use the selling rate to explain your answer.
(c) If the club does not reach its goal, describe one change the club could make and show that it would work.

Model response: (a) Profit is $4p - 55$. Solve $4p - 55 \geq 250$: $4p \geq 305$, so $p \geq 76.25$. Since plants are whole, the club must sell at least 77 plants. (b) The rate is $24 \div 2 = 12$ plants per hour, so in 5 hours the club sells about $12 \times 5 = 60$ plants. Profit $= 4(60) - 55 = 185$ dollars, which is less than 250, so the club will not reach its goal. (c) Example: extend the sale. At 12 plants per hour, 77 plants take $77 \div 12 \approx 6.4$ hours, so a 7-hour sale works: $12 \times 7 = 84$ plants and $4(84) - 55 = 281$ dollars. (Other valid changes, such as raising the price to $5.25 or more, are acceptable if supported: $5.25(60) - 55 = 260$.)

Rubric: 1 point: Finds 77 plants (rounding up correctly), uses the rate to conclude the goal is not met with supporting numbers, and gives a change that is shown to work.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

GRADE 8 MATH · CLAIM 2 · PROBLEM SOLVING

2D Identify important quantities and map their relationships

Assessed at: DOK 1 | DOK 2 | DOK 3 | ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students pick out the relevant quantities and apply a direct multiply-and-add relationship, a short routine calculation.

A basketball team is planning a trip to a tournament. The team has 12 players and 3 coaches. Each player needs 2 uniforms, and each coach needs 1 uniform. The team also needs to rent a bus that costs 480 dollars total, and this cost will be split equally among all people going on the trip.

Part A: How many uniforms does the team need in total?

Choose one answer.

- ○ 15
- ○ 39
- ○ 36
- ○ 27 ✓

Part B: Which calculation correctly shows how you found the total number of uniforms?

Choose one answer.

- ○ $12 \times 3 = 36$ uniforms
- ○ $12 + 3 = 15$ uniforms
- ○ $(12 \times 2) + (3 \times 1) = 24 + 3 = 27$ uniforms ✓
- ○ $15 \times 2 = 30$ uniforms

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must define variables and translate two relationships in words into a system of equations, moving from a situation to a mathematical representation.

A volleyball team is planning a fundraiser. They will sell t-shirts for $12 each and hoodies for $28 each. The team needs to raise 840 dollars total. They predict they will sell twice as many t-shirts as hoodies. Write an equation or system of equations that represents this situation, identify what each variable represents, and explain how the relationships between quantities help you set up your model.

Model response: Let h = number of hoodies sold and t = number of t-shirts sold. The two equations are: $t = 2h$ (t-shirts sold is twice hoodies) and $12t + 28h = 840$ (total revenue). The relationship shows that the number of t-shirts depends on the number of hoodies, and the total revenue depends on both quantities multiplied by their respective prices. By mapping these relationships, we can substitute $t = 2h$ into the revenue equation to solve for h.

Rubric: 1 point: Student correctly identifies both variables with clear definitions, writes both equations accurately, and explains how the relationships connect the quantities to model the situation.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students set up an equation with two unknowns and a constraint, then must plan a search strategy and verify the combination, a non-routine problem.

A skateboard shop sells two types of boards: standard decks that cost $45 each and premium decks that cost $72 each. The shop owner wants to order boards for a total of exactly $630. If the owner must order at least 5 of each type, find one combination of standard and premium decks that totals exactly $630. Show your work and explain why your answer makes sense.

Model response: Let s = number of standard decks and p = number of premium decks. We need $45s + 72p = 630$ with $s \geq 5$ and $p \geq 5$. Testing $p = 5$: $45s + 72(5) = 630$, so $45s + 360 = 630$, which gives $45s = 270$ and $s = 6$. Check: $45(6) + 72(5) = 270 + 360 = 630$ ✓. The solution is 6 standard decks and 5 premium decks. This works because both values meet the minimum requirement of at least 5 of each type, and the total cost equals exactly $630.

Rubric: 1 point: Identifies correct combination(s) with valid algebraic work, verifies the solution, and explains the reasoning.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Test Bank question

CLAIM 3

Claim 3 · Communicating Reasoning

Students can clearly and precisely construct viable arguments to support their own reasoning and to critique the reasoning of others. In the Test Bank, Claims 2, 3 and 4 are built in the performance task (PT) step: choose PT, then Area 3 · Claim 3. Each question card is marked with its claim and target (for example "Claim 3 · Tgt A"), so generate a set at the DOK you want and keep the cards for the target you need.

Create questions › Grade 8 › PT › Area 3 · Claim 3 › Standard group › Options: DOK › Generate

GRADE 8 MATH · CLAIM 3 · COMMUNICATING REASONING

3A Test propositions or conjectures with specific examples

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students test a conjecture by finding and estimating several square roots, using specific examples to see whether the pattern holds.

A student is testing the conjecture: 'The square root of any number between 1 and 100 is between 1 and 10.' Complete the table by finding the square root of each number. Round to the nearest tenth if needed.

Number	Square Root
4	2
25	**5**
50	**7.1**
81	9
99	**9.9**

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must decide how precise their approximations need to be, test the claim, and justify their conclusion, since tenths alone cannot settle it.

A basketball player's vertical jump height is $\sqrt{3}$ feet. Another player's vertical jump is $\sqrt{5}$ feet. The coach claims that the difference between their jump heights is less than 0.5 feet. Test this conjecture by using rational approximations of $\sqrt{3}$ and $\sqrt{5}$. Show your work and explain whether the coach's claim is correct.

Model response: Using rational approximations: $\sqrt{3} \approx 1.7$ and $\sqrt{5} \approx 2.2$ (or more precise values like $\sqrt{3} \approx 1.73$ and $\sqrt{5} \approx 2.24$). The difference is approximately $2.2 - 1.7 = 0.5$ feet (or $2.24 - 1.73 = 0.51$ feet). Since the difference equals or slightly exceeds 0.5 feet, the coach's claim that the difference is *less than* 0.5 feet is **incorrect**. The actual difference is approximately 0.5 feet or slightly more.

Rubric: 1 point: Student correctly approximates both irrational numbers, calculates the difference accurately, and clearly states whether the conjecture is true or false with sound reasoning.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 3 · Claim 3 › Standard group › DOK 3 › Generate

Test Bank question

GRADE 8 MATH · CLAIM 3 · COMMUNICATING REASONING

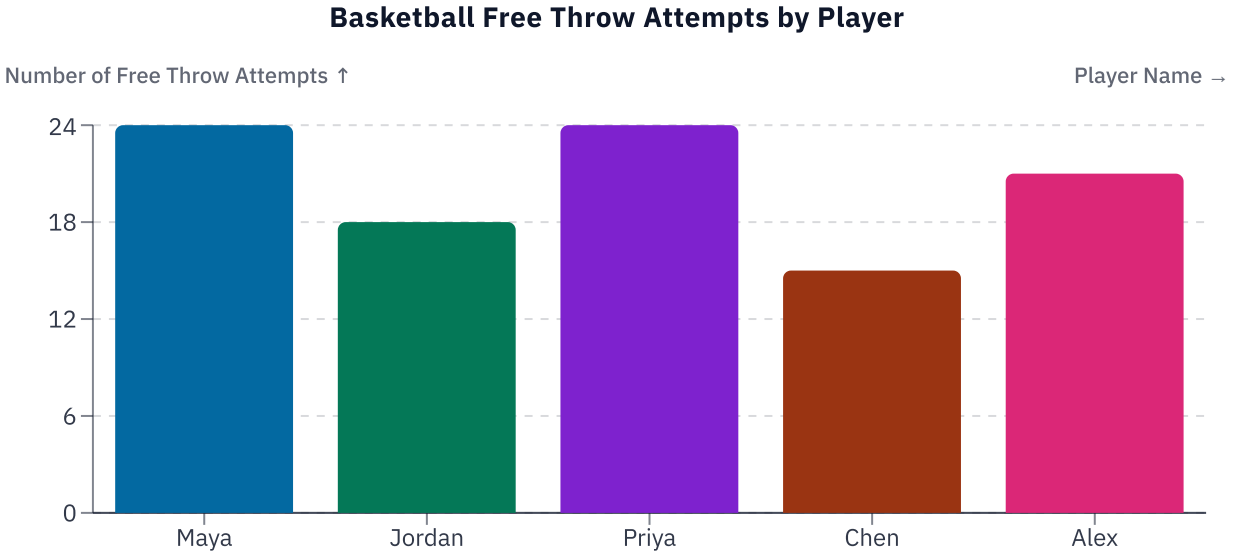
3B Construct chains of reasoning that will justify or refute propositions

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 DOK 4 DOK 4 is assessed only in the performance task.

DOK 2 · Skills & concepts

Why DOK 2: Students read values from a bar chart, compute two sums, and use them to decide whether a claim is justified, a short chain of reasoning.

A coach claims that 'The total number of free throw attempts made by Maya and Chen combined is greater than the total made by Jordan and Alex combined.' Based on the bar chart, is this claim justified?



- ○ Yes, the claim is justified because Maya and Chen each attempted more free throws individually than Jordan.
- ○ No, the claim is not justified because $24 + 15 = 39$ and $18 + 21 = 39$, so the totals are equal, not greater. ✓
- ○ Yes, the claim is justified because $24 + 15 = 39$ and $18 + 21 = 39$, so they are equal.
- ○ No, the claim is not justified because Jordan attempted fewer free throws than both Maya and Priya.

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must build a logical argument from several connected facts (rewrite, compare slopes and intercepts, connect to intersections) and justify a conclusion.

Ava says that the system of equations below has no solution.

$$y = 2x + 3$$
$$4x - 2y = 8$$

Construct a chain of reasoning to show whether Ava is correct. Your argument should use the equations, not only a graph.

Model response: Ava is correct. Rewrite the second equation in slope-intercept form: $4x - 2y = 8$ gives $-2y = -4x + 8$, so $y = 2x - 4$. Both lines have slope 2, so they are parallel, and their y-intercepts (3 and -4) are different, so they are not the same line. Parallel lines that are not the same line never intersect, so there is no point that satisfies both equations. Substitution confirms this: $4x - 2(2x + 3) = 8$ gives $4x - 4x - 6 = 8$, or $-6 = 8$, which is false for every x.

Rubric: 1 point: A complete, logical argument that the lines have the same slope and different intercepts (or that substitution leads to a false statement), with a clear conclusion that Ava is correct.
0 points: Anything less, including a response that is only partly correct.

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Create questions › Grade 8 › PT › Area 3 · Claim 3 › Standard group › DOK 3 › Generate

Written for this guide

DOK 4 · Extended thinking

Why DOK 4: Students carry out an extended investigation across several conditions, gather evidence, build a general argument, and extend it to new solids, which is the extended thinking of a performance task.

Investigation: Doubling the Radius

A container company says, "If you double the radius of a cylinder, you double its volume."

(a) Test the claim on three different cylinders. For each one, choose a radius and height, find the volume, then double only the radius and find the new volume. Record your results in a table and leave your answers in terms of π.
(b) Use your results to decide whether the claim is true. Then write a general argument, using $V = \pi r^2 h$, that explains what really happens to the volume of any cylinder when the radius is doubled.
(c) Extend your investigation: What happens to the volume of a cylinder when only the height is doubled? What happens to the volume of a cone when its radius is doubled? What happens to the volume of a sphere when its radius is doubled? Justify each answer with the volume formula.
(d) Write a corrected statement the company could use.

Model response: (a) Example: $r = 1, h = 5$: $V = 5\pi$; doubled radius $r = 2$: $V = 20\pi$. $r = 3, h = 2$: $V = 18\pi$; $r = 6$: $V = 72\pi$. $r = 2, h = 10$: $V = 40\pi$; $r = 4$: $V = 160\pi$. Each new volume is 4 times the original. (b) The claim is false. In general, $V = \pi(2r)^2 h = \pi \cdot 4r^2 \cdot h = 4(\pi r^2 h)$, so doubling the radius multiplies the volume by 4, because the radius is squared. (c) Doubling only the height: $\pi r^2(2h) = 2(\pi r^2 h)$, so the volume doubles. Cone: $\frac{1}{3}\pi(2r)^2 h = 4 \cdot \frac{1}{3}\pi r^2 h$, so the volume is multiplied by 4. Sphere: $\frac{4}{3}\pi(2r)^3 = 8 \cdot \frac{4}{3}\pi r^3$, so the volume is multiplied by 8. (d) "Doubling the radius of a cylinder makes its volume 4 times as large. Doubling the height doubles the volume."

Rubric: 1 point: All parts addressed with one error or one weak justification.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 3 · Claim 3 › Standard group › DOK 4 › Generate

Written for this guide

GRADE 8 MATH · CLAIM 3 · COMMUNICATING REASONING

3C State logical assumptions being used

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students check a claim with two squared values and must state the assumption behind the comparison, a basic explanation of a relationship.

A basketball player's vertical jump height is $\sqrt{5}$ feet. The coach claims this is greater than 2 feet but less than 2.5 feet. Is the coach's claim correct? Explain the logical assumptions you are making to determine whether $\sqrt{5}$ falls in this range.

Model response: Yes, the coach's claim is correct. I assumed that to compare $\sqrt{5}$ to other numbers, I need to square all values to compare them. Since $2^2 = 4$ and $2.5^2 = 6.25$, and $4 < 5 < 6.25$, it follows that $2 < \sqrt{5} < 2.5$. The logical assumption is that if $a^2 < b < c^2$ where a, b, c are positive numbers, then $a < \sqrt{b} < c$.

Rubric: 1 point: Student correctly determines the coach's claim is correct and explicitly states the logical assumption about squaring to compare irrational numbers with rational numbers.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must build an argument, name the facts it depends on, and explain why the same reasoning fails when an assumption is missing, which is strategic reasoning.

Triangle ABC has angles that measure $40°$ and $65°$. Triangle DEF also has angles that measure $40°$ and $65°$. The side lengths of the triangles are different.

Ana says, "The two triangles are similar."

(a) Write an argument that supports Ana's claim.
(b) State each fact or assumption your argument depends on.
(c) Ben says, "Two triangles that each have one $40°$ angle must be similar too." Explain why Ana's argument does not work for Ben's triangles.

Model response: (a) The angles of a triangle add to $180°$, so the third angle of each triangle is $180° - 40° - 65° = 75°$. All three pairs of corresponding angles are equal ($40°$, $65°$, $75°$), so the triangles have the same shape, and one can be mapped onto the other by a dilation followed by rigid motions. They are similar. (b) The argument depends on: the angle sum of every triangle is $180°$; triangles whose corresponding angles are all equal are similar (angle-angle similarity); and the given angles are corresponding angles in the two triangles. (c) Knowing only one pair of equal angles does not fix the other two angles. For example, one triangle could have angles $40°$, $70°$, $70°$ and the other $40°$, $100°$, $40°$; they have different shapes, so they are not similar. Ana's argument needs two pairs of equal angles.

Rubric: 1 point: A correct argument using the angle sum and angle-angle similarity, clearly stated facts or assumptions, and a correct explanation (ideally with a counterexample) of why one angle is not enough.
0 points: Anything less, including a response that is only partly correct.

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Create questions › Grade 8 › PT › Area 3 · Claim 3 › Standard group › DOK 3 › Generate

Written for this guide

GRADE 8 MATH · CLAIM 3 · COMMUNICATING REASONING

3D Use the technique of breaking an argument into cases

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students must simplify the equation and then reason about two separate cases for the value of a, rather than solving one equation.

Consider the equation $2(x + 3) = ax + 6$, where a is a number. Which statement correctly describes the solutions of the equation for every possible value of a?

- For every value of a, the equation has exactly one solution, $x = 0$.
- If $a = 2$, the equation has infinitely many solutions. If $a \neq 2$, the equation has exactly one solution, $x = 0$. ✓
- If $a = 2$, the equation has no solution. If $a \neq 2$, the equation has exactly one solution.
- If $a = 6$, the equation has infinitely many solutions. If $a \neq 6$, the equation has no solution.

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Written for this guide

DOK 3 · Strategic thinking

Why DOK 3: Students must recognize that the answer depends on the exponent, organize all integers into cases, and justify a conclusion for each, which requires planning and reasoning.

Jamal claims: "For every integer n, $(-3)^n$ is less than 3^n."

Break the problem into cases to decide whether Jamal's claim is always true, sometimes true, or never true. Include positive, negative, and zero exponents in your reasoning, and give an example for each case.

Model response: The claim is sometimes true. Case 1: n is even (including $n = 0$ and negative even numbers). Then $(-3)^n = 3^n$, because an even number of negative factors makes a positive result. Examples: $(-3)^2 = 9 = 3^2$; $(-3)^0 = 1 = 3^0$; $(-3)^{-2} = \frac{1}{9} = 3^{-2}$. The values are equal, so the claim is false. Case 2: n is odd (positive or negative). Then $(-3)^n = -(3^n)$, which is negative, while 3^n is positive. Examples: $(-3)^3 = -27 < 27$; $(-3)^{-1} = -\frac{1}{3} < \frac{1}{3}$. The claim is true. So the claim is true only when n is odd.

Rubric: 1 point: Correctly separates even and odd exponents (including zero and negative exponents), gives a correct example for each case, and concludes the claim is sometimes true (true only for odd n). 0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 3 · Claim 3 › Standard group › DOK 3 › Generate

Written for this guide

GRADE 8 MATH · CLAIM 3 · COMMUNICATING REASONING

3E Distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in the argument—explain what it is

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 DOK 4 DOK 4 is assessed only in the performance task.

DOK 2 · Skills & concepts

Why DOK 2: Students check each step of a worked solution and identify where the reasoning first goes wrong, which takes more than recall.

A basketball team's ticket revenue equation is $3(x + 4) = 2x + 18$, where x is the ticket price in dollars. Kai solved the equation below. Select the step where Kai made his first error.

- Step 1: $3(x + 4) = 2x + 18$
- Step 2: $3x + 4 = 2x + 18$ ✓
- Step 3: $x + 4 = 18$
- Step 4: $x = 14$

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate two competing arguments using evidence from data and then choose the chain of reasoning that justifies the correct one.

A basketball team's scoring pattern over five games shows: Game 1: 68 points, Game 2: 74 points, Game 3: 71 points, Game 4: 77 points, Game 5: 85 points. A player claims that the team's scoring has increased by a constant rate each game. Another player argues that while the team is scoring more overall, the rate of increase is not constant.

Part A: Which player's reasoning is correct?

Choose one answer.

- ◯ The first player is correct because the average score increases when you compare the first two games to the last two games.
- ◯ The first player is correct because the team scored more points in Game 5 than Game 1.

- ○ The second player is correct because the team did not score an even number of points in every game.
- ○ The second player is correct because the increases between consecutive games are not all equal. ✓

Part B: Which chain of reasoning best supports your answer to Part A?

Choose one answer.

- ○ The team scored more than 70 points in four out of five games, which demonstrates a constant pattern of improvement.
- ○ The team's average score across all five games is 75 points, which is higher than the score in Games 1, 2, and 3, proving the team improved consistently.
- ○ Game 4 shows a 6-point increase over Game 3, and Game 5 shows an 8-point increase over Game 4, so the increases are getting larger and therefore must be constant.
- ○ The differences between consecutive games are: $74 - 68 = 6$, $71 - 74 = -3$, $77 - 71 = 6$, and $85 - 77 = 8$. Since these differences are not all the same value, the increase is not constant. ✓

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 3 · Claim 3 › Standard group › DOK 3 › Generate

Test Bank question

DOK 4 · Extended thinking

Why DOK 4: Students analyze several arguments, explain each flaw with equations, apply the result to different people, and reason about changing conditions, an extended multi-part investigation.

Investigation: Choosing a Phone Plan

A family is comparing two monthly phone plans for each of their three children.
- Plan A: $30 per month plus $0.10 per text message
- Plan B: $45 per month with unlimited text messages

Three students made these claims:
- Ari: "Plan B is always the better deal because it is unlimited."
- Bea: "Plan A is cheaper for anyone who sends fewer than 150 texts a month."
- Cal: "Plan A is cheaper for anyone who sends fewer than 450 texts a month, because $45 \div 0.10 = 450$."

The children's monthly texts last month were: Maya 90 texts, Leo 210 texts, Sam 140 texts.

(a) Decide whether each student's reasoning is correct or flawed. For each flawed claim, explain exactly what the flaw is.
(b) Use equations to support your decisions.
(c) Recommend a plan for each child and show the cost of each plan for that child.
(d) Sam's texting varies a lot: some months he sends 100 texts, and some months he sends 200. Explain how this should affect the recommendation for Sam.

Model response: (a) Ari is flawed: "unlimited" does not mean cheaper; for low use, Plan A costs less (for example, 90 texts cost $39 on Plan A). Bea is correct. Cal is flawed: he divided $45 by $0.10 but ignored Plan A's $30 base fee; only $15 of the $45 is available for texts. (b) Plan A: $C = 30 + 0.10t$; Plan B: $C = 45$. Set equal: $30 + 0.10t = 45$, so $t = 150$. Plan A is cheaper when $t < 150$, and Plan B is cheaper when $t > 150$. (c) Maya (90): Plan A $39, Plan B $45, choose Plan A. Leo (210): Plan A $51, Plan B $45, choose Plan B. Sam (140): Plan A $44, Plan B $45, choose Plan A (saves $1). (d) At 100 texts Plan A costs $40 (saves $5), and at 200 texts it costs $50 (costs $5 more). If his months are split evenly, the costs balance out to about the same; because the savings for Sam are so small, Plan B may be the safer choice to avoid high bills, or the family could track a few more months before deciding. Any reasoned recommendation using these costs is acceptable.

Rubric: 1 point: All parts addressed with one error or one weak explanation.
0 points: Anything less, including a response that is only partly correct.

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Written for this guide

GRADE 8 MATH · CLAIM 3 · COMMUNICATING REASONING

3F Base arguments on concrete referents such as objects, drawings, diagrams, and actions

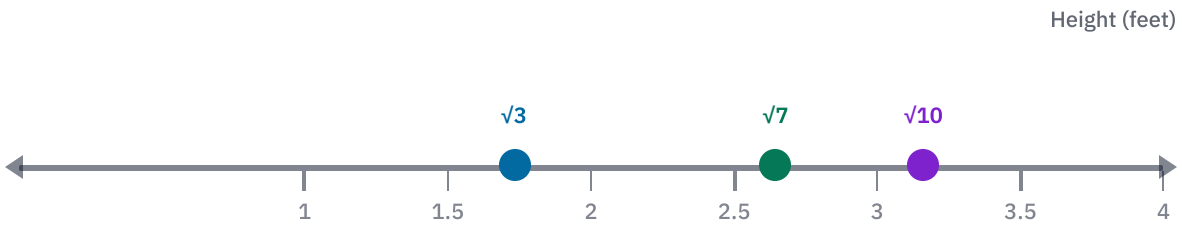
Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students use a number line diagram as concrete evidence to locate and compare irrational values and pick the argument the diagram supports.

A coach measured three basketball players' vertical jumps. Player A jumped $\sqrt{3}$ feet, Player B jumped $\sqrt{7}$ feet, and Player C jumped $\sqrt{10}$ feet. Based on the number line showing irrational and rational number approximations, which statement uses a logical assumption about comparing these jump heights?

Estimating Player Jump Heights



- ○ Since $\sqrt{7}$ appears on the number line, it must be a rational number, making it easier to measure than $\sqrt{3}$ and $\sqrt{10}$.
- ○ Since $\sqrt{3}$ is between 1 and 2, and $\sqrt{7}$ is between 2 and 3, Player B jumped higher than Player A because we can approximate and compare the irrational numbers using rational numbers. ✓
- ○ Player C's jump of $\sqrt{10}$ feet is exactly 3.162 feet, so it is a rational number and can be compared directly without approximation.
- ○ All three irrational numbers are equal because they all contain square root symbols, so the jump heights must be the same.

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must use a diagram as the basis of a proof, finding one area in two ways and connecting them, which requires planning and justification.

Picture this diagram: A large square has side length $a + b$. Inside it, four identical right triangles are placed, one in each corner. Each triangle has legs of length a and b and a hypotenuse of length c. The four hypotenuses form a smaller square, tilted inside the large square, with side length c.

Use the diagram to explain why $a^2 + b^2 = c^2$ for the right triangles. Your explanation should find the area of the large square in two different ways.

Model response: Way 1: The large square has side $a + b$, so its area is $(a + b)^2 = (a + b)(a + b) = a^2 + 2ab + b^2$. Way 2: The large square is made of four right triangles and the tilted square. Each triangle has area $\frac{1}{2}ab$, so the four triangles have area $4 \cdot \frac{1}{2}ab = 2ab$. The tilted square has area c^2. So the total area is $2ab + c^2$. Both ways give the same area: $a^2 + 2ab + b^2 = 2ab + c^2$. Subtracting $2ab$ from both sides gives $a^2 + b^2 = c^2$.

Rubric: 1 point: Finds the area of the large square both ways correctly and uses the equal areas to conclude $a^2 + b^2 = c^2$, with clear reference to the parts of the diagram.
0 points: Anything less, including a response that is only partly correct.

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Written for this guide

GRADE 8 MATH · CLAIM 3 · COMMUNICATING REASONING

3G Determine conditions under which an argument does and does not apply

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students test the claim on several kinds of numbers and sort out where it holds and where it fails, which goes beyond one routine step.

Lia claims, "When you square a number, the result is always greater than the number you started with." That is, $a^2 > a$. Select ALL the values of a for which Lia's claim does NOT apply.

- [ ] $a = -2$
- [x] $a = 0$ ✓
- [x] $a = \frac{1}{2}$ ✓
- [x] $a = 1$ ✓
- [ ] $a = 3$

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Written for this guide

DOK 3 · Strategic thinking

Why DOK 3: Students must state when a theorem applies, test two cases against that condition, and explain why an argument fails outside it, which requires strategic reasoning.

Ty says, "The equation $a^2 + b^2 = c^2$ works for every triangle, so a triangle with sides 7, 24, and 25 is a right triangle, and a triangle with sides 6, 7, and 9 is also a right triangle."

(a) Explain the conditions under which the Pythagorean Theorem and its converse apply.
(b) Use those conditions to decide which of Ty's triangles is a right triangle. Show your work.
(c) Explain what is wrong with Ty's argument.

Model response: (a) The Pythagorean Theorem applies only to right triangles: if a triangle is a right triangle with legs a and b and hypotenuse c, then $a^2 + b^2 = c^2$. The converse says that if the side lengths satisfy $a^2 + b^2 = c^2$ (with c the longest side), then the triangle is a right triangle. (b) Sides 7, 24, 25: $7^2 + 24^2 = 49 + 576 = 625 = 25^2$, so it is a right triangle. Sides 6, 7, 9: $6^2 + 7^2 = 36 + 49 = 85$, but $9^2 = 81$. Since $85 \neq 81$, it is not a right triangle. (c) Ty assumes the equation is true for every triangle. It is true only for right triangles, so he must check the side lengths with the converse instead of assuming the equation holds.

Rubric: 1 point: States that the theorem applies only to right triangles and describes the converse, correctly checks both triangles, and explains Ty's error.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 3 · Claim 3 › Standard group › DOK 3 › Generate

Written for this guide

CLAIM 4

Claim 4 · Modeling & Data Analysis

Students can analyze complex, real-world scenarios and can construct and use mathematical models to interpret and solve problems. In the Test Bank, Claims 2, 3 and 4 are built in the performance task (PT) step: choose PT, then Area 2 · Claims 2 + 4. Each question card is marked with its claim and target (for example "Claim 4 · Tgt A"), so generate a set at the DOK you want and keep the cards for the target you need.

Create questions › **Grade 8** › **PT** › **Area 2 · Claims 2 + 4** › **Standard group** › **Options: DOK** › **Generate**

GRADE 8 MATH · CLAIM 4 · MODELING & DATA ANALYSIS

4A Apply mathematics to solve problems from everyday life (Modeling)

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students apply squaring to check two estimates in a real setting and decide which is correct, which takes more than one step and a decision.

A track coach uses the expression $\sqrt{50}$ to model the distance, in meters, a runner must cover to cut diagonally across a square section of the practice field. Two athletes estimate this value: Maria says $\sqrt{50}$ is between 7 and 7.5, while Jake says it is between 7.5 and 8. Determine who is correct, and justify your reasoning by comparing $\sqrt{50}$ to the squares of the boundary numbers.

Model response: Maria is correct. Since $7^2 = 49$ and $7.5^2 = 56.25$, and $49 < 50 < 56.25$, it follows that $7 < \sqrt{50} < 7.5$. Jake's range is incorrect because $7.5^2 = 56.25$, which is already greater than 50, so $\sqrt{50}$ cannot be as large as 7.5. Therefore the diagonal distance is a little more than 7 meters, closer to 7.1 meters.

Rubric: 1 point: Correctly identifies Maria as correct with valid reasoning comparing squares (49<50<56.25) to justify the bound.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must model a real situation, decide which information to use, chain several conversions, and interpret the result against a deadline, which is strategic thinking.

The Lopez family is filling a cylindrical backyard pool for a party. The pool has a diameter of 12 feet and is 3 feet deep. They want to fill it to a depth of 2.5 feet. Their hose delivers 8 gallons of water per minute. One cubic foot of water is about 7.5 gallons.

They start filling the pool at 9:00 a.m. The party starts at 3:00 p.m. Will the pool be filled to 2.5 feet before the party starts? If so, about what time will it be ready? Show your work and explain your reasoning.

Model response: Radius $= 12 \div 2 = 6$ ft. Volume of water needed: $V = \pi r^2 h = \pi(6^2)(2.5) = 90\pi \approx 282.7$ cubic feet. Gallons: $282.7 \times 7.5 \approx 2{,}120$ gallons. Time: $2{,}120 \div 8 \approx 265$ minutes, which is about 4 hours 25 minutes. Starting at 9:00 a.m., the pool will be ready at about 1:25 p.m., which is before the 3:00 p.m. party. Yes, it will be ready in time, with about an hour and a half to spare.

Rubric: 1 point: Uses the radius (6 ft) and the fill depth (2.5 ft), correctly finds the volume, converts to gallons, finds the time (about 265 minutes), and concludes the pool will be ready at about 1:25 p.m., before the party.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

GRADE 8 MATH · CLAIM 4 · MODELING & DATA ANALYSIS

4B Construct chains of reasoning to justify mathematical models

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 DOK 4 DOK 4 is assessed only in the performance task.

DOK 2 · Skills & concepts

Why DOK 2: Students must check the data against the model and connect constant ratios to a proportional model, explaining a relationship rather than recalling a fact.

Lena earns money babysitting. The table shows her earnings for four jobs.

Hours	2	3	5	6
Earnings (dollars)	30	45	75	90

Lena uses the model $E = 15h$ to predict her earnings E for h hours. Which reasoning best justifies her model?

- ○ The earnings increase each time, so any equation with h in it will work.
- ○ For every job, earnings divided by hours equals 15, and 0 hours of work would earn $0, so the relationship is proportional with a unit rate of $15 per hour. ✓
- ○ The largest earnings, $90, divided by the smallest number of hours, 2, gives the rate in the model.
- ○ The model works because 15 is the difference between the first two earnings in the table, so the model only needs to fit those two jobs.

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Written for this guide

DOK 3 · Strategic thinking

Why DOK 3: Students must justify why a linear model fits, build it, explain its parts in context, and use it to make and defend a decision, a chain of reasoning.

A plumber charges a fixed amount for each service call plus an hourly rate. The table shows the total charge for four jobs.

Hours of Work	1	2	3	4
Total Charge (dollars)	95	140	185	230

(a) Explain why a linear model is appropriate for this data.
(b) Write a linear model for the total charge C for h hours, and explain what each number in your model means.
(c) A customer has a budget of $400 for a job expected to take 7 hours. Use your model to decide whether the budget is enough, and justify your answer.

Model response: (a) Each additional hour adds the same amount: $140 - 95 = 45$, $185 - 140 = 45$, $230 - 185 = 45$. A constant rate of change means the data are linear. (b) The slope is 45 dollars per hour. Working back one hour from $h = 1$: $95 - 45 = 50$, so the fixed charge is 50 dollars. $C = 45h + 50$. The 45 is the hourly rate, and the 50 is the service-call fee charged even before any work is done. (c) $C = 45(7) + 50 = 315 + 50 = 365$ dollars. Since $365 < 400$, the budget is enough, with $35 left over.

Rubric: 1 point: Justifies linearity with a constant rate of change, writes $C = 45h + 50$ with correct meanings, and correctly decides that $365 fits within the budget.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

DOK 4 · Extended thinking

Why DOK 4: Students justify, build, apply, and critique a model over several conditions and design a way to test it, the extended reasoning typical of a performance task.

Investigation: Modeling Plant Growth

A science class measured the height of a bean plant once a week.

Week	0	1	2	3	4	5
Height (cm)	2.0	4.5	7.1	9.4	12.0	14.6

(a) Describe the pattern in the data. Explain whether a linear model is reasonable, using the changes from week to week as evidence.
(b) Write a linear model for the height h after w weeks. Explain how you chose the slope and the starting value, and what each means for the plant.
(c) Use your model to predict the height at week 8 and at week 52. Explain which prediction is more believable and why.
(d) Describe what additional data the class could collect to test whether the model still works later in the plant's life, and how the model might need to change.

Model response: (a) The height increases by about 2.5 cm each week (changes: 2.5, 2.6, 2.3, 2.6, 2.6), so the growth rate is nearly constant and a linear model is reasonable for these weeks. (b) Using the average weekly change, about 2.5 cm per week, and the starting height of 2 cm: $h = 2.5w + 2$. The slope 2.5 means the plant grows about 2.5 cm per week; 2 is the height in centimeters at week 0. (Using (0, 2.0) and (5, 14.6) gives a slope of about 2.52, which is also acceptable.) (c) Week 8: $h = 2.5(8) + 2 = 22$ cm. Week 52: $h = 2.5(52) + 2 = 132$ cm. The week 8 prediction is more believable because it is close to the data. Week 52 is far outside the data, and real plants slow down, stop growing, or die, so the linear pattern probably will not hold. (d) Keep measuring each week for many more weeks and compare the measurements to the model's predictions. If the weekly change gets smaller, the model would need a smaller rate for later weeks, or a different kind of model that levels off.

Rubric: 1 point: All parts addressed with one error or one weak justification.
0 points: Anything less, including a response that is only partly correct.

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Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 4 › Generate

Written for this guide

GRADE 8 MATH · CLAIM 4 · MODELING & DATA ANALYSIS

4C State logical assumptions being used

Assessed at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall **Why DOK 1:** Students recall the basic assumption behind a linear model, a constant rate, and fill it into a statement.

Use the drop-down menus to complete the statement about the linear model.

When modeling a basketball player's total points scored over a season, we assume that the player scores [the same number of ▾] points per game and that [the scoring rate ▾] remains constant throughout the season.

Drop-down 1 choices: a different number of | zero | **the same number of ✓**

Drop-down 2 choices: **the scoring rate ✓** | the team's defense | the number of games played

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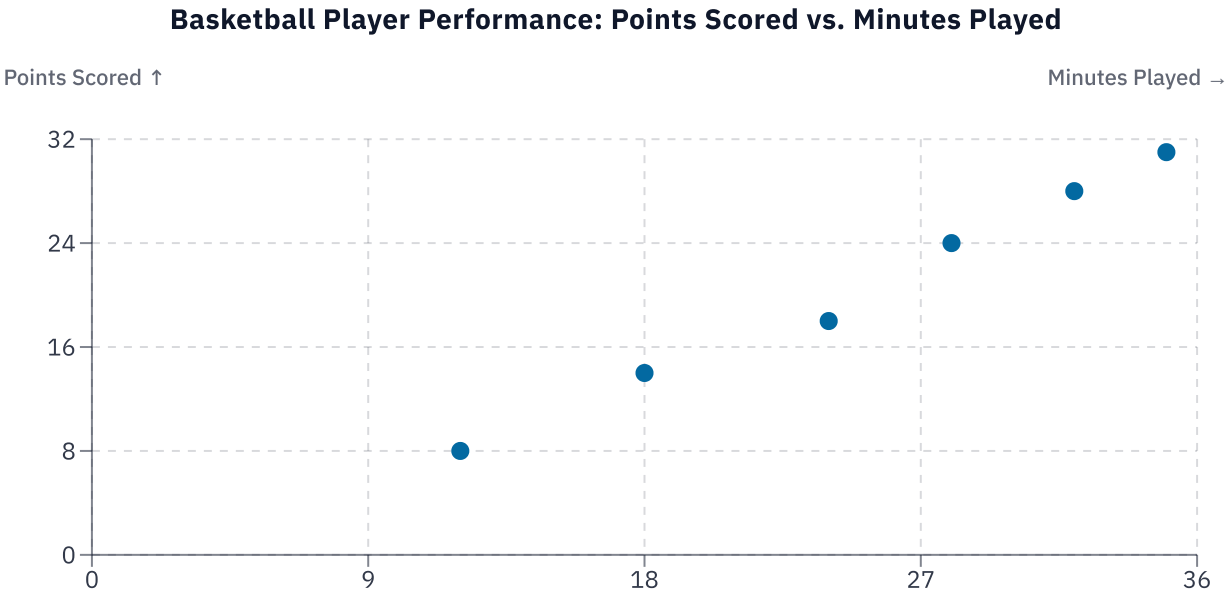
Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret a scatter plot and decide which assumption is needed to use the pattern for predictions, comparing several possible assumptions.

A coach is analyzing a player's scoring pattern shown in the scatter plot. The coach notices that as minutes played increases, points scored increases in a roughly linear pattern. Which assumption would be MOST important for the coach to state when using this relationship to predict future performance?



- ○ The player will score exactly the same number of points in every game regardless of minutes played.
- ○ The player will always play at least 12 minutes in every game.
- ○ The player's scoring rate will remain consistent in future games under similar playing conditions. ✓
- ○ Other players on the team will not affect how many points this player scores.

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must name the assumption behind the coach's prediction and argue both why it could hold and why it might not, using reasoning about the situation.

A middle school basketball team is analyzing player performance data. The coach assumes that a player's free throw percentage will remain the same for the next 10 games as it was during the last 5 games. If a player made 18 out of 25 free throw attempts in the last 5 games, what logical assumption is the coach making? Explain why this assumption might or might not be reasonable.

Model response: The coach is assuming that the player's free throw percentage will stay constant and that past performance predicts future performance. This assumption might be reasonable if the player has consistent skill and practice habits, but it might not be reasonable if the player is injured, tired, or facing stronger defensive pressure in upcoming games.

Rubric: 1 point: Student clearly identifies the assumption (constant performance) and provides at least one valid reason why it could be reasonable AND one reason why it might not be reasonable.
0 points: Anything less, including a response that is only partly correct.

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Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Test Bank question

GRADE 8 MATH · CLAIM 4 · MODELING & DATA ANALYSIS

4D Interpret results in the context of a situation

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students interpret the slope and intercept of a model in context and judge whether the starting value is reasonable.

Use the drop-down menus to complete the statement.

A basketball player tracks her free throw percentage over several weeks. The line modeling her improvement has equation $y = 1.5x + 65$, where x is the number of weeks and y is her free throw percentage. The slope of the line is [1.5 ▾], which means her free throw percentage [increases by 1.5% ▾] each week. When $x = 0$, this model predicts she should have a [65% ▾] free throw percentage, which [is ▾] reasonable for a starting point.

Drop-down 1 choices: 0.65 | 1.5 ✓ | 65

Drop-down 2 choices: increases by 65% | decreases by 1.5% | **increases by 1.5%** ✓

Drop-down 3 choices: 1.5% | 66.5% | 65% ✓

Drop-down 4 choices: **is** ✓ | is not

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must interpret a model's parts, use it to decide, recognize an impossible result, and determine where the model makes sense, which requires evaluating results in context.

Maria's phone battery is fully charged at 100%. She models the battery level B (in percent) after h hours of use with the equation $B = 100 - 8h$.

(a) Explain what the numbers 100 and -8 mean in this situation.
(b) Maria has a 9-hour school day and wants at least 20% battery left at the end. Use the model to decide whether she will, and explain.
(c) Maria uses the model to predict the battery level after 15 hours and gets -20%. Explain what this result means and whether it makes sense.
(d) For what values of h does the model make sense? Explain.

Model response: (a) 100 is the starting battery level (100% at 0 hours). -8 means the battery level goes down 8 percentage points for each hour of use. (b) $B = 100 - 8(9) = 100 - 72 = 28$. Since $28\% \geq 20\%$, she will have enough battery. (c) A battery level of -20% is impossible, so the result does not make sense. It shows the model only works until the battery runs out. (d) Setting $B = 0$: $100 - 8h = 0$, so $h = 12.5$. The model makes sense for $0 \leq h \leq 12.5$ hours.

Rubric: 1 point: Correct meanings of 100 and -8, correct conclusion for 9 hours (28%), a clear explanation that -20% is impossible, and a reasonable domain ($0 \leq h \leq 12.5$).
0 points: Anything less, including a response that is only partly correct.

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Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

GRADE 8 MATH · CLAIM 4 · MODELING & DATA ANALYSIS

4E Analyze adequacy and make improvements to existing models

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 DOK 4 DOK 4 is assessed only in the performance task.

DOK 2 · Skills & concepts

Why DOK 2: Students compare model predictions with real data, notice the pattern in the errors, and decide which part of the model to change, which is interpreting and comparing.

A ride-share company uses the model $C = 2.5m + 15$ to estimate the cost C, in dollars, of a ride of m miles. The table shows the actual costs of three rides.

Miles	4	8	12
Actual Cost (dollars)	23	31	39

Which statement best describes how well the model fits the actual costs and how it could be improved?

- ○ The model fits well because every predicted cost is within $1 of the actual cost.
- ✓ ○ The model gives costs that are too high for every ride, and the gap grows with distance; changing the rate to $2 per mile would make it match the data.
- ○ The model gives costs that are too low; changing the starting fee to $20 would make it match the data.
- ○ The model gives costs that are too high; changing the starting fee to $10 would make it match the data.

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Written for this guide

DOK 3 · Strategic thinking

Why DOK 3: Students analyze where and why a model fails, use evidence to build a better one, and justify which prediction to trust, which is strategic reasoning about a model.

Devon models the height of a burning candle with the equation $h = 20 - 1.5t$, where h is the height in centimeters and t is the time in hours. He then measures the candle.

Time (hours)	0	2	4	6
Height (cm)	20	16	12	8

(a) Compare Devon's model to the measurements. Describe how well the model fits.
(b) Write an improved model and explain why it is better.
(c) Use both models to predict when the candle will burn out. Explain which prediction Devon should trust and why.

Model response: (a) Devon's model predicts 20, 17, 14, and 11 cm, but the measured heights are 20, 16, 12, and 8 cm. The starting height is right, but the model is too high, and the error grows over time (1, 2, then 3 cm), so the burning rate in the model is too slow. (b) The measured height drops 4 cm every 2 hours, which is 2 cm per hour. The improved model is $h = 20 - 2t$, which matches all four measurements. (c) Devon's model: $20 - 1.5t = 0$ gives $t \approx 13.3$ hours. Improved model: $20 - 2t = 0$ gives $t = 10$ hours. Devon should trust 10 hours, because the improved model matches the actual data, while his original model overestimates how long the candle lasts.

Rubric: 1 point: Accurately describes the misfit (correct start, rate too slow, growing error), writes $h = 20 - 2t$ with a data-based reason, and correctly predicts 10 hours (and about 13.3 hours for the original) with a justified choice.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

DOK 4 · Extended thinking

Why DOK 4: Students test a model against several data sets, diagnose its weaknesses, rebuild and retest it, apply it, and consider new conditions, an extended investigation.

Investigation: Improving a Car Wash Model

The student council plans its car wash fundraisers using the model $E = 10c$, where E is the money they keep and c is the number of cars washed. They charge $10 per car. Here are the results from four past car washes.

Event	Cars Washed	Money Kept After Supplies (dollars)
1	20	180
2	30	290
3	15	125
4	40	400

At every event they spent $40 on supplies, and drivers often gave tips.

(a) Use the model to predict the money kept for each event. Compare the predictions to the actual results and describe any pattern in the errors.
(b) Build an improved linear model using the data. Explain what each part of your model represents in the situation.
(c) Test your new model on all four events and explain how well it fits.
(d) The council wants to keep at least $300 at the next car wash. Use your model to find how many cars they need to wash.
(e) Describe one situation in which even your improved model might not give good predictions, and explain how you would adjust for it.

Model response: (a) Predictions: 200, 300, 150, 400. Actual: 180, 290, 125, 400. The model is too high for small events and gets closer for larger ones, so it is missing a fixed cost and slightly underestimating the amount per car. (b) From Event 1 to Event 2, 10 more cars added $110, so the money kept increases by $11 per car ($10 price plus about $1 in tips per car). Using $(20, 180)$: $180 = 11(20) + b$, so $b = -40$. Model: $E = 11c - 40$. The 11 is money per car including tips, and -40 is the supply cost. (c) $11(20) - 40 = 180$, $11(30) - 40 = 290$, $11(15) - 40 = 125$, $11(40) - 40 = 400$. The model matches all four events exactly. (d) $11c - 40 \geq 300$, so $11c \geq 340$ and $c \geq 30.9$. They need to wash at least 31 cars. (e) Example: on a rainy day fewer drivers come and may tip less, or if the price per car changes, the rate of 11 would change. They could collect data from more events, including rainy days, and adjust the rate or plan a lower estimate.

Rubric: 1 point: All parts addressed with one error or one weak explanation.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 4 › Generate

Written for this guide

GRADE 8 MATH · CLAIM 4 · MODELING & DATA ANALYSIS

4F Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flow charts, or formulas)

Assessed at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students extend a simple linear pattern in a table by a constant step, a routine procedure.

A basketball team tracks the relationship between practice hours and free throws made. The table shows a linear pattern. Complete the table by finding the missing values.

Practice Hours	Free Throws Made
0	8
2	**14**
4	**20**
6	26

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students identify the fixed fee and per-item cost, write an equation relating them, and evaluate it to compare with a budget, a two-step mapping of quantities.

A middle school basketball team is ordering custom jerseys for the season. The company charges a base fee of 50 dollars plus 12 dollars per jersey. The team needs to order jerseys for 15 players. (a) Write an equation that shows the relationship between the total cost c and the number of jerseys n. (b) Use your equation to find the total cost for 15 jerseys. (c) If the team has a budget of 250 dollars, explain whether they can afford to order jerseys for all 15 players and justify your answer.

Model response: (a) The equation is $c = 50 + 12n$ (or $c = 12n + 50$). (b) Substituting $n = 15$: $c = 50 + 12(15) = 50 + 180 = 230$ dollars. (c) Yes, the team can afford the jerseys because the total cost of 230 dollars is less than their budget of 250 dollars.

Rubric: 1 point: Student writes a correct equation, correctly calculates the total cost as 230 dollars, and provides a complete justification comparing 230 dollars to the 250-dollar budget.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must organize information from words into a two-way table, choose to compare relative frequencies, and draw a conclusion from several pieces of information.

A school surveyed 100 eighth graders about whether they have a rule to turn off their phones at night and whether they usually get at least 8 hours of sleep.
- 60 students have a phone rule.
- Of the students with a phone rule, 42 usually get at least 8 hours of sleep.
- Of the students without a phone rule, 16 usually get at least 8 hours of sleep.

(a) Organize the information in a two-way table, including all row and column totals.
(b) For each group (phone rule and no phone rule), find the relative frequency of students who get at least 8 hours of sleep.
(c) Is there evidence of an association between having a phone rule and getting at least 8 hours of sleep? Use your results to explain.

Model response: (a)

	8+ hours	Less than 8 hours	Total
Phone rule	42	18	60
No phone rule	16	24	40
Total	58	42	100

(b) Phone rule: $42 \div 60 = 0.70$, or 70%. No phone rule: $16 \div 40 = 0.40$, or 40%. (c) Yes. 70% of students with a phone rule get at least 8 hours of sleep compared with only 40% of students without one. Because these percentages are very different, there is evidence of an association: students with a phone rule are more likely to get enough sleep. (The survey does not prove that the rule causes more sleep.)

Rubric: 1 point: A complete, correct two-way table, correct relative frequencies (70% and 40%), and a conclusion about association based on comparing them.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

GRADE 8 MATH · CLAIM 4 · MODELING & DATA ANALYSIS

4G Identify, analyze, and synthesize relevant external resources to pose or solve problems

Assessed at: ~~DOK 1~~ ~~DOK 2~~ DOK 3 DOK 4 Assessed only in the performance task, at DOK 3 and 4.

DOK 3 · Strategic thinking

Why DOK 3: Students must sort useful from irrelevant information across several resources, combine it to plan an order, and justify a decision, which is strategic thinking.

The art club is ordering T-shirts to sell at the school fair. Use the resources below to answer the questions.

Resource 1: Price sheets
- Vendor A: $6 per shirt plus a $40 setup fee. Shipping is free.
- Vendor B: $8 per shirt with no setup fee. Shipping is free for orders of 30 or more shirts; otherwise shipping is $15.

Resource 2: Club notes
- Last year the club sold 45 shirts.
- The club expects to sell 10% more shirts this year.
- The club meets on Tuesdays in Room 204.
- Shirts will sell for $12 each.

(a) Identify which information in the resources you need and which you do not need.
(b) Decide how many shirts the club should order and which vendor to use. Show your work.
(c) Find the club's expected profit if it sells all the shirts it orders.

Model response: (a) Needed: both vendors' prices, fees, and shipping rules; last year's sales; the expected 10% increase; and the selling price. Not needed: the meeting day and room. (b) Expected sales: $45 \times 1.10 = 49.5$, so about 50 shirts. Vendor A: $6(50) + 40 = 340$ dollars. Vendor B: $8(50) = 400$ dollars (free shipping because the order is over 30). Vendor A is cheaper by $60, so order 50 shirts from Vendor A. (c) Revenue: $12 \times 50 = 600$ dollars. Profit: $600 - 340 = 260$ dollars.

Rubric: 1 point: Correctly separates needed and unneeded information, finds about 50 shirts, compares both vendors correctly to choose Vendor A, and finds a profit of $260 (or a correct profit for a reasonable order of 49 or 50 shirts).
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

DOK 4 · Extended thinking

Why DOK 4: Students must locate and combine information from several resources, design and compare plans, and test their plan under a changed condition, an extended performance-task investigation.

Investigation: Rain Barrels for the School Garden

The school garden club wants to collect rainwater from the roof of the garden shed. Use the resources to plan a purchase.

Resource 1: Rain facts
- One inch of rain falling on 1 square foot of roof produces about 0.62 gallon of water.
- One cubic foot holds about 7.48 gallons.
- In a typical week in June, about 1.5 inches of rain falls.

Resource 2: The shed
- The shed roof covers 400 square feet and drains into one downspout.

Resource 3: Barrel options (all barrels are cylinders)
- Barrel A: radius 1 foot, height 3 feet, $60 each
- Barrel B: radius 1.5 feet, height 4 feet, $150 each

Resource 4: Club needs
- The garden needs about 250 gallons of water per week.
- The club has a budget of $350.

(a) Find how many gallons of water the roof collects in a typical June week.
(b) Find the capacity of each barrel in gallons.
(c) Design a purchase plan that stays within the budget, meets the garden's weekly need, and captures as much of the week's rain as possible. Compare at least two possible plans and justify your choice.
(d) Identify one assumption you made and explain how your plan would change in a dry week with only 0.5 inch of rain.

Model response: (a) $400 \times 1.5 \times 0.62 = 372$ gallons. (b) Barrel A: $V = \pi(1^2)(3) = 3\pi \approx 9.42$ cubic feet, and $9.42 \times 7.48 \approx 70.5$ gallons. Barrel B: $V = \pi(1.5^2)(4) = 9\pi \approx 28.27$ cubic feet, and $28.27 \times 7.48 \approx 211.5$ gallons. (c) Example plans: Two Barrel B: cost $300, capacity about 423 gallons, captures all 372 gallons. Five Barrel A: cost $300, capacity about 352.5 gallons, captures 352.5 gallons. One B and three A: cost $330, capacity about 423 gallons. Best choice: two Barrel B, because it captures all 372 gallons, meets the 250-gallon need, and costs the least ($300), leaving $50. (d) Assumption: every week has about 1.5 inches of rain and none is lost. In a dry week: $400 \times 0.5 \times 0.62 = 124$ gallons, which is less than the 250 gallons needed. Extra barrel space would not help that week; the club would need water from another source or to save extra water from rainy weeks.

Rubric: 1 point: All parts addressed with one error or one weak justification.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Grade 8 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 4 › Generate

Written for this guide

Sources

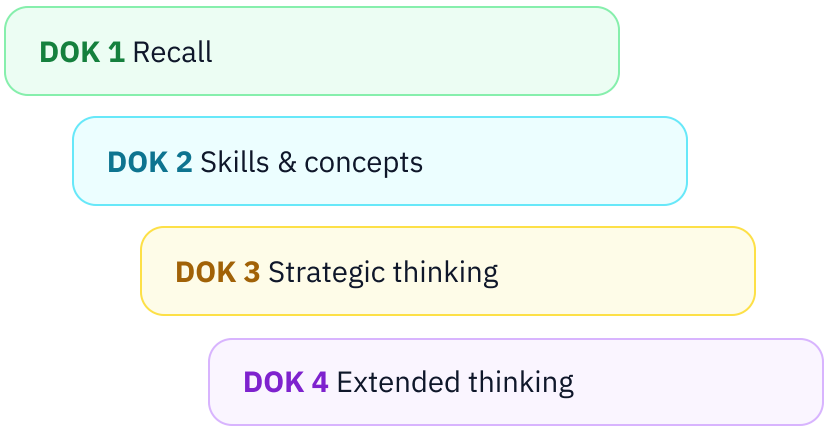
- Smarter Balanced Assessment Consortium, 2015–16 Summative Technical Report: claim statements, and the Appendix 2.A test blueprints (pp. 43–48), which list the DOK levels assessed for every claim and target. https://www.cde.ca.gov/ta/tg/ca/documents/sb16sbtechrpt.pdf
- Target wording and standards: Smarter Balanced Mathematics Content Specifications and the CCSS for Mathematics, as stored in the AchieveMetrics Test Bank.
- DOK level definitions: Smarter Balanced Content Specifications (Webb Depth of Knowledge), summarised on the "How to use" page.
- Example questions: the AchieveMetrics Test Bank, reviewed for this guide.

AchieveMetrics Test Bank · DOK Progression Guide · Grade 8 Math · October 2026 edition.

DOK PROGRESSION GUIDE · SBAC MATHEMATICS

Math 1

Every SBAC claim and target for Math 1, with a Test Bank question at each Depth of Knowledge (DOK) level the blueprint assesses, and the clicks to find more.



For Math 1 teachers. Claims, targets and DOK levels follow the official Smarter Balanced blueprint.

achievemetricstestbank.com · October 2026 edition

How to use this booklet

Depth of Knowledge (DOK) describes the kind of thinking a question asks for, not how hard it is. A long calculation can still be DOK 1, and a short question can be DOK 3. For each target, this booklet shows one question at every DOK level SBAC assesses it at, so you can see the climb and then pick questions at the level your students need next.

The four DOK levels

DOK 1 · Recall — Recall a fact, term or property, or carry out a routine one-step procedure. Read a value straight from a table or graph.

DOK 2 · Skills & concepts — Decide how to approach it and use two or more steps: compare, classify, interpret data, or move between representations.

DOK 3 · Strategic thinking — Reason and plan: justify an answer, critique an argument, use evidence, or solve a problem with no routine path.

DOK 4 · Extended thinking — Carry out an extended investigation that connects several ideas, conditions or sources. On SBAC, DOK 4 is assessed only in the performance task, and only for Claim 3 and Claim 4 targets.

Reading a target page

1. The heading names the claim, the target code and the official target wording, with the standards it draws on.
2. The DOK ladder shows which levels the SBAC blueprint assesses for this target in this grade. Levels in grey with a line through them are not assessed for this target.
3. One example question at each assessed level, lowest first, with the answer shown. Read them top to bottom to see how the thinking climbs.
4. "Why DOK n" explains in one sentence what makes the question that level, so you can spot the same thing in your own questions.
5. "Find more like this" lists the exact Test Bank clicks that generate more questions for the same target at the same level.

Which DOK levels each target is assessed at comes from the official Smarter Balanced test blueprint for this grade (2015–16 Summative Technical Report, Appendix 2.A). Every example was checked by hand against the DOK definitions above, not just its Test Bank tag. A few targets had no Test Bank question that truly fit a level, so we wrote one; those are marked "Written for this guide."

Finding these questions in the Test Bank

Every example page ends with the exact clicks. These are the two routes, starting from Create questions with Math 1 chosen as the course.

Claim 1 targets (CAT)

Claim 1 questions are filed by target and standard.

Create questions › Math 1 › CAT › Claim 1 target › Standard › Options: DOK 1 or 2 › Item types (optional) › Generate

The DOK buttons only allow the levels the blueprint assesses for that target, so a level that is greyed out in this booklet is greyed out in the Test Bank too.

Claims 2, 3 and 4 (PT)

These claims are built from performance-task standard groups.

Create questions › Math 1 › PT › Area 2 (Claims 2 + 4) or Area 3 (Claim 3) › Standard group › Options: DOK › Generate

Each question card shows its claim and target, such as "Claim 3 · Tgt B". Generate at the DOK you want, then keep the cards for your target.

Questions you have saved

Saved questions are filed the same way in your Item Bank.

More › Item Bank › Math 1 › CAT or PT › Area › Target › DOK

Tip: to move a class up the ladder, generate the same target at the next DOK level. To check that a skill is secure before going further, generate a set at the lowest assessed level.

All targets at a glance

A dot means the SBAC blueprint assesses the target at that DOK level in this grade. Each dot has an example question in this booklet.

Claim 1 · Concepts & Procedures

Target		DOK 1	DOK 2	DOK 3	DOK 4
1A	Extend the properties of exponents to rational exponents	●	●	–	–
1B	Use properties of rational and irrational numbers	●	●	–	–
1C	Reason quantitatively and use units to solve problems	●	●	–	–
1D	Interpret the structure of expressions	●	●	–	–
1F	Perform arithmetic operations on polynomials	–	●	–	–
1G	Create equations that describe numbers or relationships	●	●	–	–
1H	Understand solving equations as a process of reasoning and explain the reasoning	●	●	–	–
1I	Solve equations and inequalities in one variable	●	●	–	–
1J	Represent and solve equations and inequalities graphically	●	●	–	–
1K	Understand the concept of a function and use function notation	●	●	–	–
1L	Interpret functions that arise in applications in terms of a context	●	●	–	–
1M	Analyze functions using different representations	●	●	●	–
1N	Build a function that models a relationship between two quantities	–	●	–	–
1P	Summarize, represent, and interpret data on a single measurement variable	–	●	–	–

Claim 2 · Problem Solving

Target		DOK 1	DOK 2	DOK 3	DOK 4
2A	Apply mathematics to solve well-posed problems from everyday life	–	●	●	–
2B	Select and use appropriate tools strategically	●	●	●	–
2C	Interpret results in the context of a situation	●	●	●	–
2D	Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flow charts, or formulas)	●	●	●	–

Claim 3 · Communicating Reasoning

Target		DOK 1	DOK 2	DOK 3	DOK 4
3A	Test propositions or conjectures with specific examples	–	●	●	–
3B	Construct chains of reasoning that will justify or refute propositions	–	●	●	●
3C	State logical assumptions being used	–	●	●	–
3D	Use the technique of breaking an argument into cases	–	●	●	–
3E	Distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in the argument—explain what it is	–	●	●	●
3F	Base arguments on concrete referents such as objects, drawings, diagrams, and actions	–	●	●	–
3G	Determine conditions under which an argument does and does not apply	–	●	●	–

Claim 4 · Modeling & Data Analysis

Target		DOK 1	DOK 2	DOK 3	DOK 4
4A	Apply mathematics to solve problems from everyday life (Modeling)	–	●	●	–
4B	Construct chains of reasoning to justify mathematical models	–	●	●	●
4C	State logical assumptions being used	●	●	●	–
4D	Interpret results in the context of a situation	–	●	●	–
4E	Analyze adequacy and make improvements to existing models	–	●	●	●
4F	Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flow charts, or formulas)	●	●	●	–
4G	Identify, analyze, and synthesize relevant external resources to pose or solve problems	–	–	●	●

CLAIM 1

Claim 1 · Concepts & Procedures

Students can explain and apply mathematical concepts and interpret and carry out mathematical procedures with precision and fluency. Claim 1 is tested with individual items on the computer adaptive test (CAT). In the Test Bank, choose CAT, then the target.

Create questions › Math 1 › CAT › Claim 1 target › Standard › Options: DOK › Generate

MATH 1 · CLAIM 1 · CONCEPTS & PROCEDURES

1A Extend the properties of exponents to rational exponents

Standards: N-RN.1; N-RN.2

Assessed at: DOK 1 | DOK 2 | ~~DOK 3~~ | ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall one definition, that a cube root equals an exponent of one third, and apply it directly with no planning or extra steps.

A basketball player's vertical jump height can be modeled using the expression $\sqrt[3]{512}$. Which of the following expressions is equivalent to $\sqrt[3]{512}$ using rational exponents?

- ◯ $512^{1/3}$ ✓
- ◯ $512^{1/2}$
- ◯ 512^{3}
- ◯ 3^{512}

FIND MORE LIKE THIS

Create questions › Math 1 › CAT › Target A › N-RN.2 › DOK 1 › Generate — Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Each entry takes two linked steps: find the root named by the denominator then apply the power in the numerator, so students interpret the exponent rather than recall a fact.

A basketball player's vertical jump height (in inches) can be modeled using rational exponents. Complete the table by rewriting each expression involving radicals or rational exponents in simplified form.

Original Expression	Simplified Form
$16^{1/2}$	4
$27^{2/3}$	9
$32^{3/5}$	8
$\sqrt[4]{81}$ or $81^{1/4}$	3

FIND MORE LIKE THIS

Create questions › Math 1 › CAT › Target A › N-RN.2 › DOK 2 › Generate — Test Bank question

MATH 1 · CLAIM 1 · CONCEPTS & PROCEDURES

1B Use properties of rational and irrational numbers

Standards: N-RN.3

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students apply one known property, rational plus irrational is irrational, to a single sum; the explanation simply names that property.

A basketball player's vertical jump height can be expressed as $3 + \sqrt{5}$ feet. Explain whether this height is a rational or irrational number. Use properties of rational and irrational numbers to justify your answer.

Model response: The height $3 + \sqrt{5}$ feet is irrational. Since 3 is a rational number and $\sqrt{5}$ is an irrational number, their sum must be irrational. According to the properties of rational and irrational numbers, the sum of a rational number and an irrational number is always irrational.

Rubric: 1 point: Correctly identifies the number as irrational and provides clear reasoning that the sum of a rational number (3) and an irrational number ($\sqrt{5}$) is irrational.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 1 › CAT › Target B › N-RN.3 › DOK 1 › Generate Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must first simplify the expression and then classify the result by reasoning about a rational times an irrational number, which takes two connected steps.

Use the drop-down menus to complete the statement about a runner's training data.

A coach records that a runner's average speed is $\frac{12}{\sqrt{3}}$ miles per hour. When rationalized, this speed equals [$4\sqrt{3}$ ▾] miles per hour. Since $4\sqrt{3}$ is [irrational ▾], the runner's speed is a(n) [irrational ▾] number.

Drop-down 1 choices: $\frac{4}{\sqrt{3}}$ | $12\sqrt{3}$ | $4\sqrt{3}$ ✓

Drop-down 2 choices: irrational ✓ | rational

Drop-down 3 choices: irrational ✓ | rational

FIND MORE LIKE THIS

Create questions › Math 1 › CAT › Target B › N-RN.3 › DOK 2 › Generate Test Bank question

MATH 1 · CLAIM 1 · CONCEPTS & PROCEDURES

1C Reason quantitatively and use units to solve problems

Standards: N-Q.1; N-Q.2; N-Q.3

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: This is a single routine unit conversion with the conversion factor given; Part B only asks students to recognize why the units cancel.

A basketball player's vertical jump is measured at 28 inches. The coach wants to track the player's progress and record all measurements in centimeters for the team database. (Use the conversion: 1 inch = 2.54 centimeters)

Part A: What is the player's vertical jump in centimeters?

Choose one answer.

- ○ 11.02 centimeters
- ○ 71.12 centimeters ✓
- ○ 30.54 centimeters
- ○ 25.46 centimeters

Part B: Which statement best explains why the conversion $28 \text{ inches} \times 2.54 \frac{\text{centimeters}}{\text{inch}}$ is the correct method?

Choose one answer.

- ○ The conversion factor 2.54 is larger than 1, so it always gives a bigger number in centimeters.
- ○ Centimeters are always used in sports, so we must multiply by 2.54 regardless of the starting unit.
- ○ The number 28 must be multiplied by any conversion factor to ensure the answer is correct.
- ○ Multiplying by the conversion factor changes inches to centimeters because the units of 'inches' cancel and leave 'centimeters' in the answer. ✓

FIND MORE LIKE THIS

Create questions › Math 1 › CAT › Target C › N-Q.1 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must find the hourly rate from the table, use it to fill a missing distance, and convert kilometers to miles, coordinating several steps and units.

A runner is training for a marathon. The table below shows the relationship between time in hours and distance covered in kilometers. Use unit conversion and dimensional analysis to complete the table. (Use the conversion: 1 kilometer ≈ 0.621 miles)

Time (hours)	Distance (km)	Distance (miles)
0.5	6	**3.73**
1	12	**7.45**
1.5	**18**	11.18
2	24	**14.90**

FIND MORE LIKE THIS

Create questions › Math 1 › CAT › Target C › N-Q.1 › DOK 2 › Generate

Test Bank question

MATH 1 · CLAIM 1 · CONCEPTS & PROCEDURES

1D Interpret the structure of expressions

Standards: A-SSE.1

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students only need to recall vocabulary (coefficient, constant, variable) and point to each part of a simple expression.

A basketball player's total points scored this season can be represented by the expression $12g + 8$, where g is the number of games played. Select all the statements that correctly identify parts of this expression.

- [x] The coefficient is 12
- [x] The constant term is 8
- [x] The variable is g
- [ ] The coefficient is 8
- [ ] The variable is 12

FIND MORE LIKE THIS

Create questions › Math 1 › CAT › Target D › A-SSE.1 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret what each part of a linear and an exponential expression means in context, including treating a factor as a single quantity, rather than just naming parts.

A basketball player's total season points are modeled by $P(g) = 18g + 250$, where g is the number of games played. A booster club's fundraising account grows according to $F(t) = 1200(1.08)^t$, where t is the number of years. Decide whether each statement about the structure of these expressions is True or False.

	True	False
In $P(g) = 18g + 250$, the 18 represents the number of points the player scores per game played.	☑	☐
In $P(g) = 18g + 250$, the 250 represents the number of points scored per game.	☐	☑
The expression $18g + 250$ is linear because the variable g appears raised only to the first power.	☑	☐
In $F(t) = 1200(1.08)^t$, the 1200 represents the yearly growth rate of the fund.	☐	☑
In $F(t) = 1200(1.08)^t$, the factor $(1.08)^t$ can be treated as a single entity representing the total growth multiplier after t years.	☑	☐

FIND MORE LIKE THIS

Create questions › Math 1 › CAT › Target D › A-SSE.1 › DOK 2 › Generate

Test Bank question

MATH 1 · CLAIM 1 · CONCEPTS & PROCEDURES

1F Perform arithmetic operations on polynomials

Standards: A-APR.1

Assessed at: ~~DOK 1~~ DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students multiply two binomials, which requires distributing each term and then combining like terms, a multi-step procedure that ends in a single polynomial.

A soccer field's dimensions can be expressed using polynomials. The length of the field is represented by $(3x + 8)$ meters, and the width is represented by $(2x - 3)$ meters. Find the area of the field by multiplying these two expressions. Write your answer as a polynomial in standard form.

Correct answer: $6x^2 + 7x - 24$

FIND MORE LIKE THIS

Create questions › Math 1 › CAT › Target F › A-APR.1 › DOK 2 › Generate

Test Bank question

MATH 1 · CLAIM 1 · CONCEPTS & PROCEDURES

1G Create equations that describe numbers or relationships

Standards: A-CED.1; A-CED.2; A-CED.3; A-CED.4

Assessed at: DOK 1 | DOK 2 | ~~DOK 3~~ | ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: The situation translates directly into one multiplication equation; students recognize that equation and its simple rearrangements.

A soccer player scores 3 goals in each game. After playing several games, the player has scored a total of 24 goals. Which equations correctly represent this situation? Select all that apply.

- [ ] $g + 3 = 24$, where g is the number of games played
- [ ] $3 + g = 24$, where g is the number of games played
- [x] $24 \div 3 = g$, where g is the number of games played
- [x] $3g = 24$, where g is the number of games played
- [x] $g = \frac{24}{3}$, where g is the number of games played
- [ ] $24 - 3 = g$, where g is the number of games played

FIND MORE LIKE THIS

Create questions › Math 1 › CAT › Target G › A-CED.1 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must decide which inequality matches "at least," recognize the hidden nonnegative and whole-number constraints, and reject equations that do not fit the context.

A high school basketball team is planning a fundraiser selling custom team apparel. The team sells hoodies for $35 each and t-shirts for $12 each. They need to raise at least $840 to fund their spring tournament. Let h represent the number of hoodies sold and t represent the number of t-shirts sold. Which of the following correctly represent constraints or relationships for this fundraiser scenario? Select all that apply.

- [ ] $t = 35h - 12$
- [x] $h \geq 0$ and $t \geq 0$
- [x] $35h + 12t \geq 840$
- [x] h and t must be non-negative integers because you cannot sell a partial item
- [ ] $h + t = 840$
- [ ] $35h + 12t = 840$

FIND MORE LIKE THIS

Create questions › Math 1 › CAT › Target G › A-CED.2 › DOK 2 › Generate

Test Bank question

MATH 1 · CLAIM 1 · CONCEPTS & PROCEDURES

1H Understand solving equations as a process of reasoning and explain the reasoning

Standards: A-REI.1

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students carry out a routine two-step solve and match each step to the familiar reason for it, such as adding to both sides.

A basketball player is solving the equation $2x - 5 = 11$ to find how many points she needs to score. Complete the table showing each step of solving and the reasoning that justifies moving from one step to the next.

Step	Equation or Value	Reasoning
Start	$2x - 5 = 11$	Original equation
Step 1	$2x = 16$	Add 5 to both sides of the equation
Step 2	$x = 8$	Divide both sides by 2 ▾
Solution	$x = 8$	The player needs to score 8 points

FIND MORE LIKE THIS

Create questions › Math 1 › CAT › Target H › A-REI.1 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must explain why a step is valid and also judge whether a different first step would work, which requires reasoning about equivalent equations, not just following a procedure.

Maya solved the equation $3(x - 4) = 2x + 5$ as shown.

Step 1: $3x - 12 = 2x + 5$
Step 2: $x - 12 = 5$
Step 3: $x = 17$

Part A: Which reason justifies going from Step 1 to Step 2?

Choose one answer.

- ✓ Subtract $2x$ from both sides; subtracting the same quantity from both sides keeps the two sides equal.
- Use the distributive property on the left side.
- Add 12 to both sides to undo the subtraction.
- Divide both sides by x so that only one x term remains.

Part B: Devon says Maya could have started by dividing both sides of the original equation by 3 instead. Which statement is correct?

Choose one answer.

- ✓ Devon is right. Dividing both sides by 3 gives $x - 4 = \frac{2x+5}{3}$, an equation with the same solution, so it also leads to $x = 17$.
- Devon is wrong, because the distributive property must always be used first.
- Devon is right, and dividing both sides by 3 gives $x - 4 = 2x + 5$.
- Devon is wrong, because dividing both sides by a number changes the solution of an equation.

FIND MORE LIKE THIS

Create questions › Math 1 › CAT › Target H › A-REI.1 › DOK 2 › Generate

Written for this guide

MATH 1 · CLAIM 1 · CONCEPTS & PROCEDURES

1I Solve equations and inequalities in one variable

Standards: A-REI.3; A-REI.3.1

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Solving requires one routine step, multiplying both sides by 12, with the value of the other variable given.

A basketball player's scoring average over the season is found using the equation $\frac{s}{g} = 18.5$, where s is total points scored and g is games played. If the player played $g = 12$ games, solve for s, the total points scored.

Write your answer as a whole number.

Correct answer: 222

FIND MORE LIKE THIS

Create questions › Math 1 › CAT › Target I › A-REI.3 › DOK 1 › Generate Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students translate a verbal description into an absolute value inequality, solve it as a compound inequality, and match it to equivalent forms and a context statement.

A basketball player is analyzing her shooting performance. Her actual number of successful free throws differs from her target of 12 makes by at most 3. Which of the following correctly represent this situation? Select all that apply.

- [ ] $|x - 3| \leq 12$
- [ ] The player made fewer than 9 or more than 15 successful free throws
- [x] $|x - 12| \leq 3$ ✓
- [ ] $x - 12 \leq 3$ only
- [x] $9 \leq x \leq 15$ ✓
- [x] The player made between 9 and 15 successful free throws, inclusive ✓

FIND MORE LIKE THIS

Create questions › Math 1 › CAT › Target I › A-REI.3.1 › DOK 2 › Generate Test Bank question

MATH 1 · CLAIM 1 · CONCEPTS & PROCEDURES

1J Represent and solve equations and inequalities graphically

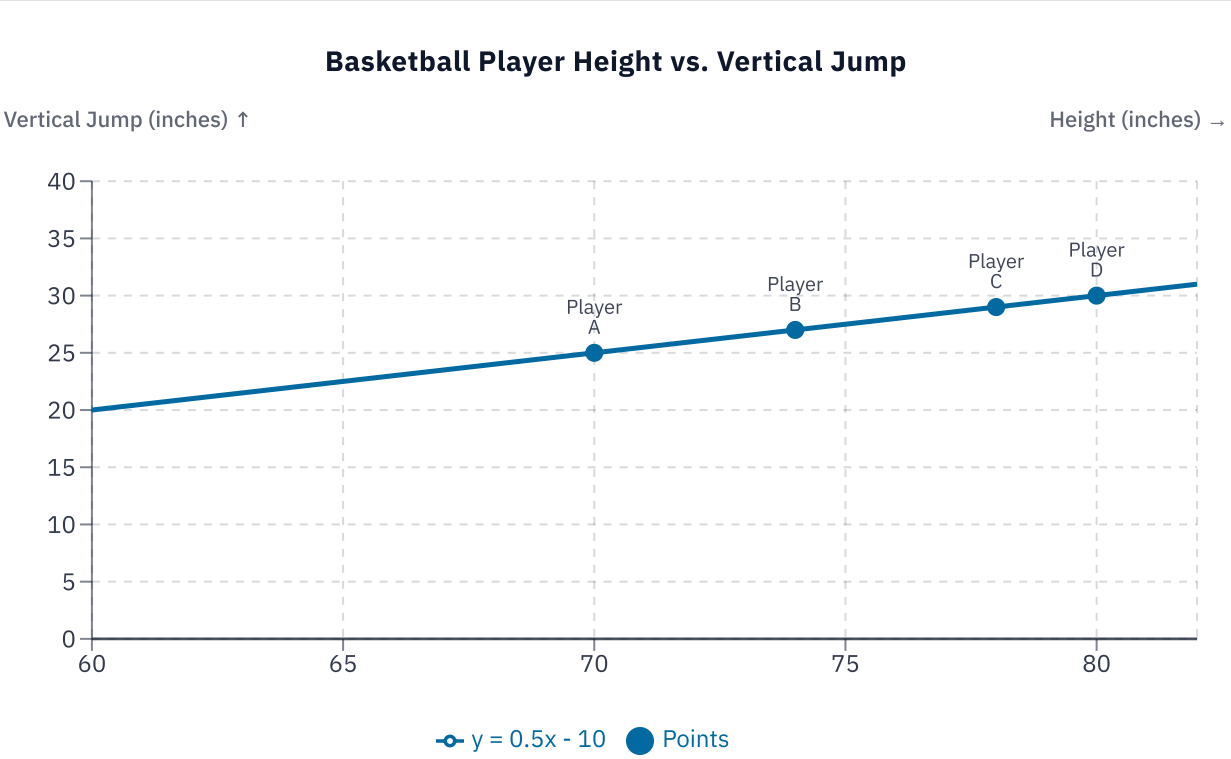
Standards: A-REI.5; A-REI.6; A-REI.10; A-REI.11; A-REI.12

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students find the input that gives an output of 20 by reading the graph or doing one substitution, which is a direct read-off.

The line shown models the relationship between a player's height and vertical jump. According to the graph, at what height would a player have a vertical jump of exactly 20 inches?



- ○ $x = 70$ inches
- ○ $x = 50$ inches
- ○ $x = 75$ inches
- ○ $x = 60$ inches ✓

FIND MORE LIKE THIS

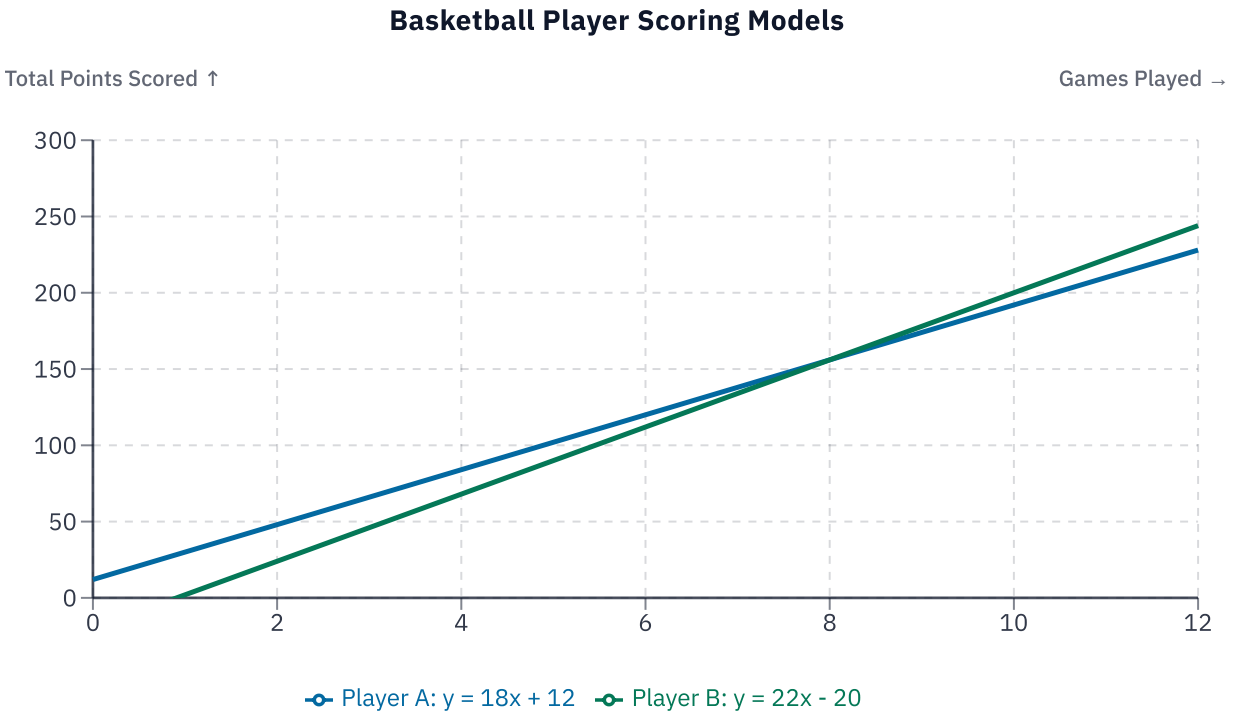
Create questions › Math 1 › CAT › Target J › A-REI.11 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must recognize that equal totals mean the intersection of two lines and then find it by setting the equations equal and solving.

Two basketball players have scoring patterns modeled by linear equations. Player A scores according to $y = 18x + 12$, and Player B scores according to $y = 22x - 20$, where x represents games played and y represents total points scored. Based on the graphs shown, after how many games will both players have scored the same total number of points?



- ○ After 10 games
- ○ After 16 games
- ○ After 4 games
- ○ After 8 games ✓

FIND MORE LIKE THIS

Create questions › Math 1 › CAT › Target J › A-REI.11 › DOK 2 › Generate

Test Bank question

MATH 1 · CLAIM 1 · CONCEPTS & PROCEDURES

1K Understand the concept of a function and use function notation

Standards: F-IF.1; F-IF.2; F-IF.3

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students identify which number is the input and which is the output in a given function statement, a direct use of function notation.

Use the drop-down menus to complete the statement.

A basketball player's total points scored in a season is given by the function $P(g) = 18g + 5$, where g is the number of games played. In this context, $P(10) = 185$ means the player scored [185 ▾] points after playing [10 ▾] games.

Drop-down 1 choices: 5 | 18 | **185** ✓

Drop-down 2 choices: 5 | **10** ✓ | 185

FIND MORE LIKE THIS

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DOK 2 · Skills & concepts

Why DOK 2: Students must apply a recursive rule repeatedly to reach the fourth term and then interpret that value in context, which takes several connected steps.

A volleyball player's point totals form a sequence, where $f(n)$ is the number of points she scores in game n. The sequence is defined by $f(1) = 9$ and $f(n) = f(n-1) + 5$ for $n \geq 2$. Select the statement that correctly interprets $f(4)$ for this situation.

- **$f(4) = 24$, meaning the player scores 24 points in her 4th game.** ✓
- $f(4) = 4$, meaning the player scores 4 points in her 9th game.
- $f(4) = 9$, meaning the player scores 9 points in her 4th game.
- $f(4) = 14$, meaning the player scores 14 points in her 2nd game.

FIND MORE LIKE THIS

Create questions › Math 1 › CAT › Target K › F-IF.3 › DOK 2 › Generate — Test Bank question

MATH 1 · CLAIM 1 · CONCEPTS & PROCEDURES

1L Interpret functions that arise in applications in terms of a context

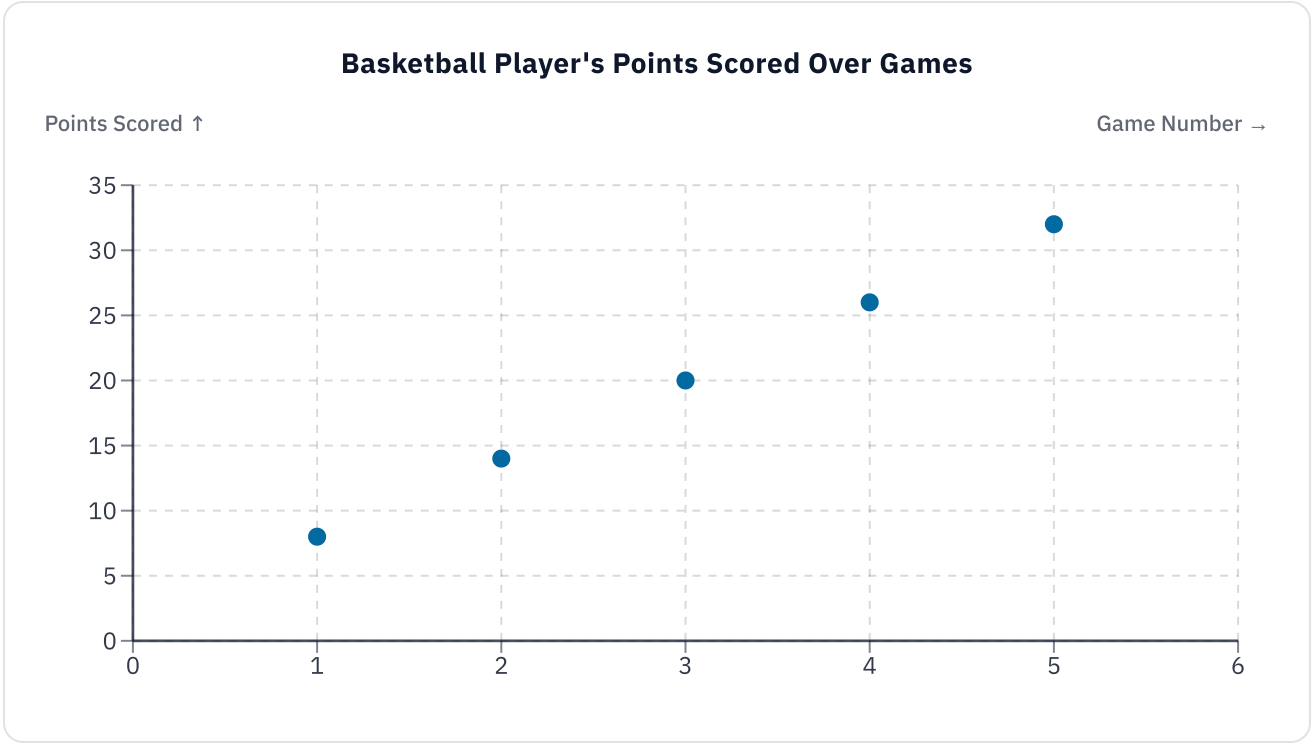
Standards: F-IF.4; F-IF.5; F-IF.6

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students read one labeled point from a graph and state what its coordinates mean, which is a direct read-off.

The graph shows how many points a basketball player scored in each of the first 5 games of the season. What does the point $(3, 20)$ represent in this context?



- ○ The player's average score per game is 20 points in 3 games.
- ✓ In game 3, the player scored 20 points.
- ○ After 20 games, the player had scored 3 points total.
- ○ The player scored 3 points in game 20.

FIND MORE LIKE THIS

Create questions › Math 1 › CAT › Target L › F-IF.4 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret slope, intercept, increasing behavior, and a computed value in context, judging several statements rather than recalling one fact.

A basketball player's vertical jump height over time during a training session is modeled by the function $h(t) = 24 + 0.5t$, where $h(t)$ is the height in inches and t is the number of weeks of training. Select all statements that correctly interpret key features of this function in terms of the context.

- [x] After 10 weeks of training, the vertical jump height will be 29 inches.
- [x] The vertical jump height increases by 0.5 inches each week.
- [ ] The function is decreasing, meaning the player's vertical jump gets worse over time.
- [x] The initial vertical jump height before training begins is 24 inches.
- [ ] The y-intercept of 24 represents the number of weeks needed to improve the jump.
- [ ] The vertical jump height reaches its maximum value at $t = 24$ weeks.

FIND MORE LIKE THIS

Create questions › Math 1 › CAT › Target L › F-IF.4 › DOK 2 › Generate

Test Bank question

MATH 1 · CLAIM 1 · CONCEPTS & PROCEDURES

1M Analyze functions using different representations

Standards: F-IF.7a; F-IF.7e; F-IF.9; F-BF.3

Assessed at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students find each intercept with one routine step (set the input to zero, or set the output to zero) for a given linear function.

The balance on a gift card is modeled by $B(w) = 60 - 5w$, where $B(w)$ is the balance in dollars after w weeks. What are the intercepts of the graph of B?

- ◯ Vertical intercept $(0, 60)$ and horizontal intercept $(12, 0)$ ✓
- ◯ Vertical intercept $(0, -5)$ and horizontal intercept $(60, 0)$
- ◯ Vertical intercept $(0, 60)$ and horizontal intercept $(-12, 0)$
- ◯ Vertical intercept $(0, 12)$ and horizontal intercept $(60, 0)$

FIND MORE LIKE THIS

Create questions › Math 1 › CAT › Target M › F-IF.7a › DOK 1 › Generate

Written for this guide

DOK 2 · Skills & concepts

Why DOK 2: Students compare a function given as an equation with one given as a table, evaluating both at the same input before drawing a conclusion.

A high school basketball team is analyzing two players' scoring performance over the season. Player A's total points scored after each game is represented by the linear function $p(g) = 18g + 5$, where g is the number of games played. Player B's total points scored is shown in the table below:

Games Played	1	2	3	4	5
Total Points	12	24	36	48	60

Use these two different representations to answer the following questions.

Part A: Which statement correctly compares the initial scoring advantage of these two players?

Choose one answer.

- ◯ Player A starts with more total points after game 1, scoring 18 points compared to Player B's 12 points.

- ○ Player A starts with more total points after game 1, scoring 23 points compared to Player B's 12 points. ✓
- ○ Player B starts with more total points after game 1, scoring 24 points compared to Player A's 18 points.
- ○ Both players have the same total points after game 1.

Part B: Which mathematical evidence from the two representations supports your answer to Part A?

Choose one answer.

- ○ From the table, Player B's points increase by 12 each game. From the function, Player A's points increase by 18 each game.
- ○ From the table, Player B scores 12 points total after game 1. From the linear function, $p(1) = 18(1) + 5 = 23$ points for Player A. ✓
- ○ The y-intercept of Player A's function is 5, which is less than Player B's starting value of 12.
- ○ Player B's function has a steeper slope of 12 points per game compared to Player A's slope of 18.

FIND MORE LIKE THIS

Create questions › Math 1 › CAT › Target M › F-IF.9 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students compare a linear table with an exponential equation across several properties, including average rate of change and long-run behavior, and must reason about what happens beyond the data.

Two youth sports leagues are tracking participant growth. League A's number of participants is given by the table below, where x is years since 2015. League B's number of participants is modeled by the exponential function $B(x) = 200(1.15)^x$.

x: 0, 1, 2, 3
League A participants: 200, 240, 280, 320

Decide whether each statement is True or False.

	True	False
Both League A and League B start with 200 participants when $x = 0$.	☑	☐
League A grows by a constant number of participants each year, while League B grows by a constant percentage each year.	☑	☐
At $x = 3$, League B has fewer participants than League A.	☑	☐
As x increases without bound, League A will always have more participants than League B.	☐	☑
The rate of change of League A from $x = 1$ to $x = 2$ (40 participants/year) is greater than the average rate of change of League B over the same interval.	☑	☐

FIND MORE LIKE THIS

Create questions › Math 1 › CAT › Target M › F-IF.9 › DOK 3 › Generate

Test Bank question

MATH 1 · CLAIM 1 · CONCEPTS & PROCEDURES

1N Build a function that models a relationship between two quantities

Standards: F-BF.1; F-BF.2; F-LE.1; F-LE.2; F-LE.3; F-LE.5

Assessed at: ~~DOK 1~~ DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students build an explicit function from a verbal description, using the given first term and constant change to work out the starting value, not just copying numbers.

A lacrosse team's equipment budget increases by 150 dollars each season. If the team spent 800 dollars on equipment in season 1, write an explicit function $f(n)$ that models the total equipment budget in dollars for season n, where n is a positive integer. Write your answer in the form $f(n) =$ your expression.

Correct answer: **f(n) = 150 n + 650**

FIND MORE LIKE THIS

Create questions › Math 1 › CAT › Target N › F-BF.1 › DOK 2 › Generate

Test Bank question

MATH 1 · CLAIM 1 · CONCEPTS & PROCEDURES

1P Summarize, represent, and interpret data on a single measurement variable

Standards: S-ID.1; S-ID.2; S-ID.3; S-ID.5; S-ID.6; S-ID.7; S-ID.8; S-ID.9

Assessed at: ~~DOK 1~~ DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students must check each step of a comparison of two data sets (medians, quartiles, IQR, outlier fence) and find where the work goes wrong.

A coach compared the points scored by two basketball teams over 7 games.
Team A: $12, 14, 15, 16, 18, 20, 45$
Team B: $30, 32, 34, 35, 36, 38, 40$

A student analyzed the two data sets. Select the step where the student made the first error.

Step 1: List the data in order — Team A: $12, 14, 15, 16, 18, 20, 45$; Team B: $30, 32, 34, 35, 36, 38, 40$.

Step 2: The median of Team A is 16 and the median of Team B is 35.

Step 3: For Team A, $Q1 = 14$ and $Q3 = 20$, so $IQR = 20 - 14 = 6$.

Step 4: The upper outlier boundary for Team A is $Q3 + 1.5(IQR) = 20 + 1.5(6) = 29$. Since $45 > 29$, the value 45 is an outlier for Team A.

Step 5: For Team B, $Q1 = 32$ and $Q3 = 38$, so $IQR = 38 - 32 = 16$. ✓

Step 6: Team B has a smaller spread and no outliers, so Team B's scores are more consistent than Team A's.

FIND MORE LIKE THIS

Create questions › Math 1 › CAT › Target P › S-ID.2 › DOK 2 › Generate

Test Bank question

CLAIM 2

Claim 2 · Problem Solving

Students can solve a range of complex well-posed problems in pure and applied mathematics, making productive use of knowledge and problem-solving strategies. In the Test Bank, Claims 2, 3 and 4 are built in the performance task (PT) step: choose PT, then Area 2 · Claims 2 + 4. Each question card is marked with its claim and target (for example "Claim 2 · Tgt A"), so generate a set at the DOK you want and keep the cards for the target you need.

Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › Options: DOK › Generate

MATH 1 · CLAIM 2 · PROBLEM SOLVING

2A Apply mathematics to solve well-posed problems from everyday life

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students write a cost expression for each gym and set them equal, choosing the approach themselves in a familiar two-step problem.

Gym A charges a one-time joining fee of 50 dollars plus 30 dollars per month. Gym B has no joining fee and charges 40 dollars per month. After how many months will the total amount paid be the same at both gyms?

Write your answer as a whole number.

Correct answer: **5**

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Written for this guide

DOK 3 · Strategic thinking

Why DOK 3: Students must plan a multi-step solution, model profit for two companies, compare them, and explain how the best choice changes with the number of shirts.

The art club will sell T-shirts for 15 dollars each and wants a profit of at least 600 dollars. It can order the shirts from one of two companies.

Company A: 120 dollar setup fee plus 7 dollars per shirt
Company B: no setup fee, 9 dollars per shirt

(a) For each company, find the least number of shirts the club must sell to make a profit of at least 600 dollars. Assume the club sells every shirt it orders.
(b) The club expects to sell about 120 shirts. Which company should it use? Justify your choice with calculations.
(c) Explain how your recommendation would change if the club expected to sell only 50 shirts.

Model response: (a) Company A: profit $= 15x - (120 + 7x) = 8x - 120$. $8x - 120 \geq 600$ gives $x \geq 90$ shirts. Company B: profit $= 15x - 9x = 6x$. $6x \geq 600$ gives $x \geq 100$ shirts.
(b) At 120 shirts, Company A gives $8(120) - 120 = 840$ dollars and Company B gives $6(120) = 720$ dollars. Company A is better. The costs are equal when $120 + 7x = 9x$, or $x = 60$, so Company A is cheaper for any order above 60 shirts.
(c) At 50 shirts, Company A gives $8(50) - 120 = 280$ dollars and Company B gives $6(50) = 300$ dollars, so Company B is better, but neither company lets the club reach its 600 dollar goal.

Rubric: 1 point: Correct minimum numbers of shirts for both companies (90 and 100), a correct comparison at 120 shirts with a recommendation of Company A, and a correct explanation that Company B is better at 50 shirts (noting the goal is not reached).
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

MATH 1 · CLAIM 2 · PROBLEM SOLVING

2B Select and use appropriate tools strategically

Assessed at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: The equation is given and students only carry out a routine two-step solve, using a calculator as a tool for the arithmetic.

A school band is renting a sound system for a concert. The rental company charges a flat fee of 45 dollars plus 15 dollars for each hour of use. The band pays a total of 165 dollars. Write and solve the equation $45 + 15h = 165$ using a calculator to find the number of hours, h, the band rented the sound system.

Correct answer: 8

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must recognize that the equation cannot be solved with algebra steps and choose graphing technology, then interpret the intersection correctly.

Account A starts with 500 dollars and grows by 35 dollars each year. Account B starts with 200 dollars and grows by 8% each year. Jordan wants to know after about how many years the two accounts will have the same balance. Which strategy and result are correct?

- ✓ Graph $y = 500 + 35t$ and $y = 200(1.08)^t$ with graphing technology and find where the graphs intersect; the balances are equal after about 25 years.
- Set $500 + 35t = 200(1.08)^t$ and subtract 500 from both sides to solve exactly; the balances are equal after about 9 years.
- Make a table of both balances for $t = 0$ to $t = 10$; since Account A is larger in every row, the balances are never equal.
- Graph both functions with graphing technology and find where the graphs intersect; the balances are equal after about 15 years.

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Written for this guide

DOK 3 · Strategic thinking

Why DOK 3: Students choose a model from the data, select and justify a technology tool for an equation they cannot solve algebraically, and verify with a second method.

A town planner recorded the town's population:

Year 0: 12,000
Year 1: 12,600
Year 2: 13,230
Year 3: 13,892
Year 4: 14,586

The town must open a new school in the first year the population is greater than 20,000.

(a) Decide whether a linear model or an exponential model fits the data better. Use the data as evidence, and write your model.
(b) Choose a tool (for example, a spreadsheet, the table feature of a graphing calculator, or a graph) to find the first whole year in which the population is greater than 20,000. Explain why the tool you chose is a good choice for this problem, and give the year.
(c) Describe how you could check your answer using a different tool or method.

Model response: (a) The differences (600, 630, 662, 694) are not constant, but the ratios are all about 1.05 (for example, $12{,}600 \div 12{,}000 = 1.05$ and $13{,}230 \div 12{,}600 = 1.05$). The population grows by 5% each year, so an exponential model fits: $P(t) = 12{,}000(1.05)^t$.
(b) A table in a spreadsheet or graphing calculator is a good tool, because the equation $12{,}000(1.05)^t = 20{,}000$ cannot be solved with algebra steps from this course, and a table quickly lists the population year by year. The table shows $P(10) \approx 19{,}547$ and $P(11) \approx 20{,}524$, so the first year is year 11.
(c) Graph $y = 12{,}000(1.05)^x$ and $y = 20{,}000$ and find the intersection, which is at about $x = 10.5$, so the first whole year above 20,000 is year 11. Or substitute $t = 10$ and $t = 11$ into the model with a calculator.

Rubric: 1 point: Justifies an exponential model using constant ratios and writes $P(t) = 12{,}000(1.05)^t$; uses an appropriate tool with a reason for choosing it and finds year 11; describes a valid second method to check.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

MATH 1 · CLAIM 2 · PROBLEM SOLVING

2C Interpret results in the context of a situation

Assessed at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: The solution is already given; students only restate what it means in context with the correct units.

Use the drop-down menus to complete the statement.

A runner's distance from the starting line is modeled by the equation $d = 8t + 15$, where d is distance in meters and t is time in seconds. After solving for when the runner reaches 79 meters, you find $t = 8$ seconds. This result means the runner [is 79 meters from ▾] the starting line after [8 seconds ▾].

Drop-down 1 choices: has passed | **is 79 meters from ✓** | started at

Drop-down 2 choices: **8 seconds ✓** | 15 seconds | 64 seconds

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students compute two unit rates and then interpret the comparison to decide which sprinter is faster, combining calculation with interpretation.

A high school track coach is analyzing her sprinters' performance. During practice, one sprinter runs 100 meters in 12.5 seconds. The coach wants to express this sprinter's average speed in meters per second to compare it with a teammate who ran 200 meters in 24 seconds. What is the first sprinter's average speed, and what does this value tell you about how her performance compares to her teammate?

- ✓ The first sprinter's average speed is 8 m/s, which is slower than her teammate's speed of $\frac{200}{24} \approx 8.3$ m/s, so the teammate is the faster sprinter.
- The first sprinter's average speed is 12.5 m/s, which is faster than her teammate's speed of 8 m/s, so the first sprinter is the faster sprinter.
- The first sprinter's average speed is 1,250 m/s, which makes her much faster than her teammate.
- The first sprinter's average speed is 8 m/s, which is the same as her teammate's speed of $\frac{200}{24} \approx 8.3$ m/s, so they have similar performance levels.

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students compute two results and then judge each against the data range used to build the model, explaining which prediction can be trusted.

A track coach studies how standing vertical jump height relates to body mass using the rational-exponent model $H(m) = 120\,m^{-1/3}$, where $H(m)$ is predicted jump height in centimeters and m is body mass in kilograms. The coach built this model using data from adult sprinters with masses between 50 kg and 100 kg. Use the properties of rational exponents to find the exact values of $H(64)$ and $H(8)$. Then explain whether each result is a meaningful prediction in the context of the coach's athletes, discussing the model's range of validity and your confidence in each prediction. Explain your reasoning.

Model response: Since $64^{1/3} = 4$, $H(64) = 120/4 = 30$ cm. Since $8^{1/3} = 2$, $H(8) = 120/2 = 60$ cm. The value $H(64) = 30$ cm is a reasonable, trustworthy prediction because 64 kg falls within the 50–100 kg range of the sprinters whose data built the model. However, $H(8) = 60$ cm is not a meaningful prediction: no adult sprinter has a mass of 8 kg, so this input lies far outside the data used to create the model. Using the formula there is an extrapolation beyond the model's valid domain, so the result, while mathematically correct, has no real-world confidence and should not be interpreted as an actual jump height.

Rubric: 1 point: Correctly computes $H(64) = 30$ cm and $H(8) = 60$ cm using rational exponent properties, and clearly explains that the first is a valid prediction within the model's data range while the second is an invalid extrapolation outside the realistic mass domain, discussing prediction confidence and model limitations.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Test Bank question

MATH 1 · CLAIM 2 · PROBLEM SOLVING

2D Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flow charts, or formulas)

Assessed at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recognize which quantities matter for the stated goal, a direct identification with no calculation or relationship building.

A coach is planning a training program for a basketball team. The team needs to track player performance over 12 weeks. The coach wants to measure improvement and set goals. Which of the following represent important quantities and their relationships that should be mapped out for this problem? Select all that apply.

- [ ] The color of each player's jersey and its effect on shooting accuracy
- [ ] The total cost of basketballs divided by the number of players on the team
- [x] The number of free throws made per player per week and how this changes over the 12-week period
- [x] The number of minutes played per player per game as it relates to total points scored over 12 weeks
- [x] Each player's average points scored per game and the relationship between practice hours and points scored
- [ ] The alphabetical order of players' last names

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Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must pick out the relevant quantities and the correct relationship (time equals distance divided by speed, plus the stop) and convert minutes to hours.

A high school soccer team is planning a trip to a tournament 180 miles away. The team's bus travels at an average speed of 45 miles per hour. The trip will include one 30-minute stop for gas and food. Which of the following correctly identifies the important quantities and their relationship for finding the total time needed for the trip?

- The important quantities are distance (180 miles) and speed (45 mph), and the total time equals distance times speed: $180 \times 45 = 8100$ hours
- The important quantities are speed (45 mph) and the stop time (30 minutes), and the total time equals $45 + 0.5 = 45.5$ hours
- The important quantities are distance (180 miles) and the stop time (30 minutes), and the total time equals $180 - 30 = 150$ hours
- ✓ The important quantities are distance (180 miles) and speed (45 mph), and the total time equals distance divided by speed, then add the 30-minute stop: $\frac{180}{45} + 0.5 = 4.5$ hours

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students organize many quantities, build the time and cost relationships themselves, and weigh a time cushion against cost to make and justify a decision.

A soccer team of 20 players must travel 240 miles to a tournament. They will leave at 8:30 AM and must arrive by 1:00 PM to warm up. The trip includes one 30-minute rest stop, and the coach wants at least a 15-minute cushion before 1:00 PM in case of traffic.

Bus A: costs 850 dollars total and averages 60 miles per hour
Bus B: costs 1,200 dollars total and averages 75 miles per hour

(a) Identify the important quantities and show how they are related, using a table, diagram, or formulas.
(b) Determine whether each bus meets all of the coach's requirements. Show your work.
(c) Recommend a bus and find the cost per player for that bus.

Model response: (a) Important quantities: distance (240 miles), speed of each bus, driving time, rest stop (0.5 hour), cushion (0.25 hour), time window (8:30 AM to 1:00 PM is 4.5 hours), cost of each bus, and number of players (20). Relationships: driving time = distance ÷ speed; total trip time = driving time + 0.5; the trip must satisfy total trip time + 0.25 $\leq$ 4.5, so total trip time $\leq$ 4.25 hours; cost per player = bus cost ÷ 20.
(b) Bus A: $240 \div 60 = 4$ hours driving, total 4.5 hours. It arrives at exactly 1:00 PM with no cushion, so it does not meet the requirements. Bus B: $240 \div 75 = 3.2$ hours driving, total 3.7 hours (3 hours 42 minutes). It arrives at 12:12 PM with a 48-minute cushion, so it meets the requirements.
(c) Bus B is the only bus that meets the time requirements, even though it costs more. Cost per player: $1{,}200 \div 20 = 60$ dollars.

Rubric: 1 point: Clearly maps the quantities and relationships, correctly finds that Bus A arrives at 1:00 PM with no cushion and Bus B arrives at 12:12 PM, and recommends Bus B at 60 dollars per player.
0 points: Anything less, including a response that is only partly correct.

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Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

CLAIM 3

Claim 3 · Communicating Reasoning

Students can clearly and precisely construct viable arguments to support their own reasoning and to critique the reasoning of others. In the Test Bank, Claims 2, 3 and 4 are built in the performance task (PT) step: choose PT, then Area 3 · Claim 3. Each question card is marked with its claim and target (for example "Claim 3 · Tgt A"), so generate a set at the DOK you want and keep the cards for the target you need.

Create questions › Math 1 › PT › Area 3 · Claim 3 › Standard group › Options: DOK › Generate

MATH 1 · CLAIM 3 · COMMUNICATING REASONING

3A Test propositions or conjectures with specific examples

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students test each value against the conjecture and decide which values make it false, applying the idea of a counterexample to several cases.

Lena makes this conjecture: "For every real number x, $x^2 > x$." Select all values of x that are counterexamples to Lena's conjecture.

- [ ] $x = 3$
- [ ] $x = -2$
- [x] $x = 1$ ✓
- [x] $x = \frac{1}{2}$ ✓
- [x] $x = 0$ ✓
- [ ] $x = 10$

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Written for this guide

DOK 3 · Strategic thinking

Why DOK 3: Students test a conjecture with two different functions, reach a sometimes-true conclusion, and use algebra to explain exactly when it holds.

Marcus makes this conjecture: "For any linear function f, $f(a+b) = f(a) + f(b)$ for all numbers a and b."

(a) Test the conjecture using $f(x) = 2x + 3$ with $a = 1$ and $b = 2$.
(b) Test the conjecture using $g(x) = 4x$ with two values of a and b of your choice.
(c) Is Marcus's conjecture always true, sometimes true, or never true for linear functions? Use the general linear function $f(x) = mx + k$ to describe exactly which linear functions make the conjecture true, and explain why.

Model response: (a) $f(1+2) = f(3) = 2(3) + 3 = 9$, but $f(1) + f(2) = 5 + 7 = 12$. Since $9 \neq 12$, this is a counterexample.
(b) Example: $a = 1, b = 2$. $g(3) = 12$ and $g(1) + g(2) = 4 + 8 = 12$. The conjecture holds for this function.
(c) Sometimes true. For $f(x) = mx + k$: $f(a+b) = m(a+b) + k = ma + mb + k$, while $f(a) + f(b) = (ma + k) + (mb + k) = ma + mb + 2k$. These are equal only when $k = 2k$, which means $k = 0$. So the conjecture is true exactly for linear functions whose graphs pass through the origin, $f(x) = mx$, and false for every other linear function.

Rubric: 1 point: Correct tests in (a) and (b), concludes sometimes true, and uses algebra to show the conjecture holds exactly when the constant term is 0.
0 points: Anything less, including a response that is only partly correct.

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MATH 1 · CLAIM 3 · COMMUNICATING REASONING

3B Construct chains of reasoning that will justify or refute propositions

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 DOK 4 DOK 4 is assessed only in the performance task.

DOK 2 · Skills & concepts

Why DOK 2: Students evaluate several step-by-step arguments and choose the one where each step correctly follows from the property that justifies it.

Which argument correctly justifies that every solution of $3x - 7 > 11$ is greater than 6?

- ✓ Add 7 to both sides to get $3x > 18$, because adding the same number to both sides keeps an inequality true. Then divide both sides by 3 to get $x > 6$, because dividing by a positive number keeps the direction of the inequality.
- Divide both sides by 3 to get $x - 7 > 6$. Then add 7 to both sides to get $x > 13$, and every number greater than 13 is greater than 6.
- Subtract 7 from both sides to get $3x > 4$. Then divide both sides by 3 to get $x > \frac{4}{3}$.
- Add 7 to both sides to get $3x > 18$. Then divide both sides by 3 and reverse the inequality sign, because dividing always reverses the sign, giving $x < 6$.

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

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DOK 3 · Strategic thinking

Why DOK 3: Students must build a general argument by contradiction, linking definitions of rational numbers into a chain that works for every case, not just examples.

Kai claims: "If you add a rational number and an irrational number, the sum is always irrational."

Construct a logical argument that justifies Kai's claim. Your argument must work for every rational number and every irrational number, not just for examples. (You may want to think about what would happen if the sum were rational.)

Model response: Let r be a rational number and x be an irrational number. Suppose, for the sake of argument, that their sum $s = r + x$ is rational. Then $x = s - r$. Because s and r are both rational, we can write $s = \frac{a}{b}$ and $r = \frac{c}{d}$ with integers a, b, c, d and $b, d \neq 0$. Then $s - r = \frac{ad-bc}{bd}$, which is a ratio of two integers with a nonzero denominator, so $s - r$ is rational. That would make x rational, but x is irrational. This is a contradiction, so the assumption was false. Therefore $r + x$ must be irrational.

Rubric: 1 point: Assumes the sum is rational, shows that the irrational number would then equal a difference of two rationals, explains why that difference is rational, and concludes with the contradiction.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 3 · Claim 3 › Standard group › DOK 3 › Generate

Written for this guide

DOK 4 · Extended thinking

Why DOK 4: Students model two growth patterns, build a table, refute a claim with evidence, explain long-run behavior, and examine an assumption, an extended reasoning task like a performance task.

Two student-run social media accounts are tracked each week.

Account A has 500 followers and gains 40 followers each week.
Account B has 200 followers, and its number of followers grows by 6% each week.

Priya claims: "Account A will always have more followers than Account B, because it starts with more followers and gains more followers each week right now."

(a) Write a function for the number of followers of each account after w weeks.
(b) Make a table showing both accounts at $w = 0, 10, 20, 30, 40, 41,$ and 42. Round to the nearest whole follower.
(c) Use your models and table to construct an argument that supports or refutes Priya's claim. Identify the first week in which Account B has more followers than Account A.
(d) Explain why, once Account B passes Account A, Account B will stay ahead. Use what you know about how linear and exponential functions grow.
(e) State one assumption your argument depends on, and explain how the conclusion could change if that assumption is false.

Model response: (a) $A(w) = 500 + 40w$ and $B(w) = 200(1.06)^w$.
(b) $w = 0$: 500 and 200; $w = 10$: 900 and 358; $w = 20$: 1,300 and 641; $w = 30$: 1,700 and 1,149; $w = 40$: 2,100 and 2,057; $w = 41$: 2,140 and 2,181; $w = 42$: 2,180 and 2,311.
(c) Priya's claim is false. Account A leads for the first 40 weeks, but at week 41 Account B has about 2,181 followers and Account A has 2,140. Week 41 is the first week Account B is ahead.
(d) Account A always gains exactly 40 followers per week. Account B gains 6% of its current total each week. At week 41, 6% of about 2,181 is about 131 followers, which is already more than 40. Because Account B's total keeps increasing, its weekly gain keeps increasing too, while Account A's gain stays at 40, so the gap keeps getting wider.
(e) Example: the argument assumes both growth patterns continue for 42 weeks. If Account B's growth rate slows (for example, to 2% per week), Account B might never pass Account A, or might pass it much later.

Rubric: 1 point: All parts addressed with one error or one weak explanation.
0 points: Anything less, including a response that is only partly correct.

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Create questions › Math 1 › PT › Area 3 · Claim 3 › Standard group › DOK 4 › Generate

Written for this guide

MATH 1 · CLAIM 3 · COMMUNICATING REASONING

3C State logical assumptions being used

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students connect features of a linear model (constant slope, time variable) to the assumptions they imply, choosing among plausible statements.

Use the drop-down menus to complete the statement about the logical assumptions being made.

A coach models a runner's distance from the starting line using the equation $d = 12t + 45$, where d is distance in meters and t is time in seconds. The coach assumes that

[the runner maintains a constant speed of 12 meters per second throughout the entire run ▾],

and also assumes that

[time is non-negative since it represents time elapsed from the start ▾].

Drop-down 1 choices:

- **the runner maintains a constant speed of 12 meters per second throughout the entire run ✓**
- the runner started 12 meters ahead of the starting line
- the runner accelerates at a constant rate of 12 meters per second

Drop-down 2 choices:

- distance will always increase without limit
- time can be any real number, including negative values
- **time is non-negative since it represents time elapsed from the start ✓**

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students identify the assumption behind extrapolating a model far beyond its data and explain the consequences if it fails for real decisions.

A high school soccer team is designing a training program to track player fitness. The coach collects data on sprinting speed (in meters per second) and uses the linear model $v = 0.5t + 6$ to predict a player's maximum sprint speed v after t weeks of training. The model is based on observations of 15 players over an 8-week period, with sprint speeds ranging from 6.2 to 10 meters per second. The coach plans to use this model to project players' speeds for an entire season (20 weeks) and make decisions about which players qualify for the competitive team (those predicted to reach at least 9 m/s).

Part A: Which assumption must be made for this linear model to be valid when projecting to week 20?

Choose one answer.

- All players on the team will have identical sprint speeds by week 20.
- Sprint speed is measured in different units at week 20 than during the training period.
- The 15 players observed represent the exact population of all possible soccer players.
- ✓ The linear relationship between training weeks and sprint speed will continue at the same rate beyond the 8-week observation period.

Part B: Which statement best explains why this assumption is necessary and what could happen if it fails?

Choose one answer.

- ✓ The assumption is necessary because extrapolating beyond observed data (8 weeks to 20 weeks) relies on the pattern continuing unchanged. If this assumption fails—for example, if improvement plateaus or accelerates—then predictions could be significantly inaccurate, leading the coach to incorrectly identify or exclude players from the competitive team.
- The assumption is necessary because meters per second must be converted to kilometers per hour; if it fails, the unit conversion becomes impossible.
- The assumption is necessary to ensure that all measured speeds are positive numbers; if it fails, the model produces negative speeds.
- The assumption is necessary only to make calculations easier; if it fails, the coach can simply use different numbers.

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 3 · Claim 3 › Standard group › DOK 3 › Generate

Test Bank question

MATH 1 · CLAIM 3 · COMMUNICATING REASONING

3D Use the technique of breaking an argument into cases

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students check how an absolute value equation splits into two cases and judge statements about each case and the full solution set.

A basketball team is analyzing player performance based on points scored per game. The team uses the absolute value function $|x - 20|$ to measure how far each player's scoring deviates from the team's target of 20 points per game, where x represents points scored. To fully understand when this function equals specific values, the team breaks the analysis into cases based on whether a player scores above, below, or exactly at the target.

For each statement about the absolute value equation $|x - 20| = 8$, determine whether it is true or false by considering the two cases: Case 1 ($x \geq 20$) and Case 2 ($x < 20$).

	True	False
In Case 1 where $x \geq 20$, the equation $\|x - 20\| = 8$ simplifies to $x - 20 = 8$, which gives $x = 28$ points.	☑	☐
In Case 2 where $x < 20$, the equation $\|x - 20\| = 8$ simplifies to $-(x - 20) = 8$, which gives $x = 12$ points.	☑	☐
Both solutions $x = 28$ and $x = 12$ are valid because they satisfy the original equation $\|x - 20\| = 8$ when checked in their respective cases.	☑	☐
The complete solution set to $\|x - 20\| = 8$ is $x = 28$ only, since only Case 1 applies to absolute value problems.	☐	☑

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students set up both cases themselves, check each result against its case condition, and use that reasoning to explain why one claimed solution fails.

Jordan solved the equation $|x - 4| = 2x + 1$ and wrote: "The solutions are $x = -5$ and $x = 1$."

Use cases to solve the equation. For each case, state what the case assumes about x, solve the equation for that case, and decide whether the result fits the case. Then explain whether Jordan is correct.

Model response: Case 1: $x \geq 4$, so $x - 4 \geq 0$ and $|x - 4| = x - 4$. Then $x - 4 = 2x + 1$, so $x = -5$. But -5 is not greater than or equal to 4, so it does not fit this case and is rejected. (Check: $|-5 - 4| = 9$, but $2(-5) + 1 = -9$.)
Case 2: $x < 4$, so $x - 4 < 0$ and $|x - 4| = -(x - 4) = 4 - x$. Then $4 - x = 2x + 1$, so $3 = 3x$ and $x = 1$. Since $1 < 4$, it fits this case. (Check: $|1 - 4| = 3$ and $2(1) + 1 = 3$.)
The two cases cover every real number, so the only solution is $x = 1$. Jordan is not correct, because $x = -5$ came from a case whose condition it does not meet.

Rubric: 1 point: Sets up both cases with their conditions, solves each, rejects $x = -5$ because it does not satisfy $x \geq 4$, keeps $x = 1$, and explains that Jordan is incorrect.
0 points: Anything less, including a response that is only partly correct.

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Written for this guide

MATH 1 · CLAIM 3 · COMMUNICATING REASONING

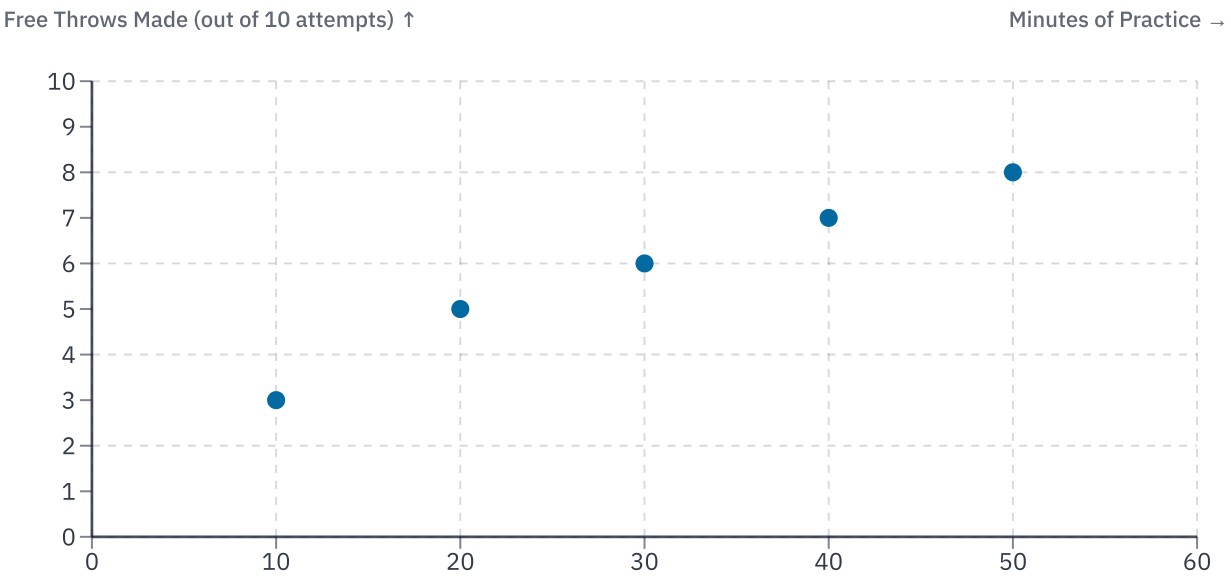
3E Distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in the argument—explain what it is

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 DOK 4 DOK 4 is assessed only in the performance task.

DOK 2 · Skills & concepts

Why DOK 2: Students check the coach's arithmetic and recognize that the flaw is extending a pattern past a real limit of 10 attempts.

A coach analyzes a player's free-throw practice data shown in the graph. The coach makes the following claim: 'Since the player made 3 free throws after 10 minutes of practice and 8 free throws after 50 minutes of practice, the player will definitely make 13 free throws after 90 minutes of practice because the pattern adds 5 free throws every 40 minutes.' Which statement best identifies the flaw in the coach's reasoning?



- ○ The coach's reasoning is completely correct because the pattern shows a clear linear relationship between practice time and free throws made.
- ○ The coach failed to identify the correct rate of improvement; the player actually makes 1 free throw per 10 minutes, not 5 per 40 minutes.
- ○ The coach should have used a bar chart instead of a line graph to display this data, so the reasoning is unreliable.

- ◯ The coach correctly identified the rate of improvement but failed to consider that the player cannot make more than 10 free throws since there are only 10 attempts. ✓

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Create questions › Math 1 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students judge five arguments about exponents, including a subtle flaw that only appears for values between 0 and 1, which requires careful reasoning, not recall.

A coach is analyzing athletic performance using exponential models. For each statement about rewriting expressions with rational exponents, determine whether the reasoning is correct or contains a logical flaw.

	Correct Reasoning	Flawed Reasoning
To rewrite $\sqrt[4]{x^3}$ using rational exponents, we apply the rule $\sqrt[n]{a^m} = a^{m/n}$, so $\sqrt[4]{x^3} = x^{3/4}$. This works because the denominator of the rational exponent matches the index of the radical.	☑	☐
Since $5^{1/2} = \sqrt{5}$ and $5^{1/3} = \sqrt[3]{5}$, it follows that $5^{1/6}$ must equal $\sqrt{5} \cdot \sqrt[3]{5}$ because we can multiply the expressions together.	☐	☑
When simplifying $(16^{1/2})^{1/2}$, we can use the power rule $(a^m)^n = a^{mn}$ to get $16^{(1/2)(1/2)} = 16^{1/4}$, which equals 2 because $16^{1/4} = \sqrt[4]{16}$. This method works regardless of the order in which we apply the operations.	☑	☐
To compare $\sqrt[3]{x^2}$ and $\sqrt{x}$ for $x > 0$, we convert both to rational exponents: $x^{2/3}$ and $x^{1/2}$. Since $2/3 > 1/2$, we can conclude that $x^{2/3} > x^{1/2}$ for all positive values of x.	☐	☑
The expression $32^{2/5}$ can be rewritten as $(32^{1/5})^2$, which equals $2^2 = 4$, because $32 = 2^5$ means $32^{1/5} = 2$. We could also compute this as $(32^2)^{1/5} = 1024^{1/5} = 4$, and both methods are valid because the power rule preserves equality.	☑	☐

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 3 · Claim 3 › Standard group › DOK 3 › Generate

Test Bank question

DOK 4 · Extended thinking

Why DOK 4: Students compute statistics, judge three separate arguments, explain how an outlier misleads two of them, and write a supported recommendation, an extended multi-source critique.

Two school clubs recorded the money (in dollars) they raised each week for 8 weeks.

Club A: 40, 42, 45, 41, 44, 43, 46, 120
Club B: 50, 52, 49, 55, 51, 53, 50, 52

(In week 8, Club A received one large donation from a local business.)

Three students made claims:

Ana: "Club A has the higher mean, so Club A usually raises more money each week."
Ben: "The median is a better measure here. Club B's median is higher, so Club B usually raises more each week."
Cal: "Club A went from 40 dollars in week 1 to 120 dollars in week 8. That is about 11.43 dollars more each week, so Club A will raise about 166 dollars in week 12."

(a) Find the mean and median for each club.
(b) Decide whether each student's reasoning is correct or flawed. For each flawed argument, explain the flaw.
(c) Write a short recommendation for the student council that describes which club usually raises more each week and gives a more reasonable estimate for Club A in week 12. Justify your estimate.

Model response: (a) Club A: mean $= 421 \div 8 \approx 52.6$ dollars; median $= (43 + 44) \div 2 = 43.5$ dollars. Club B: mean $= 412 \div 8 = 51.5$ dollars; median $= (51 + 52) \div 2 = 51.5$ dollars.
(b) Ana is flawed: Club A's mean is higher only because of the one-time 120 dollar donation, an outlier (it is far above the other values, which are all 40 to 46). Without it, Club A's mean is about 43 dollars. Ben is correct: the median resists the outlier, and Club B's median (51.5) is higher than Club A's (43.5). Cal is flawed: he built a rate from only two points, one of which is the outlier. Club A's other weeks show only small changes (about 1 dollar per week), so the 11.43 dollar rate does not describe the pattern.
(c) Club B usually raises more each week (about 51 to 52 dollars versus about 43 to 44 dollars for Club A). A more reasonable week-12 estimate for Club A is about 44 to 51 dollars, based on its typical weeks (median 43.5, with a slight upward trend of about 1 dollar per week from weeks 1 to 7), unless another large donation is expected.

Rubric: 1 point: All parts addressed with one error or one weak explanation.
0 points: Anything less, including a response that is only partly correct.

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Written for this guide

MATH 1 · CLAIM 3 · COMMUNICATING REASONING

3F Base arguments on concrete referents such as objects, drawings, diagrams, and actions

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students use the concrete data table to check each claim about speed, including what the table can and cannot show between recorded times.

A track coach recorded a runner's distance during a workout in a table:

$t = 0$ min, $d = 0$ m
$t = 5$ min, $d = 1000$ m
$t = 10$ min, $d = 2000$ m
$t = 15$ min, $d = 3000$ m

Maria uses this table as evidence to make claims about the runner's speed. Decide whether each statement, based on the concrete data in the table, is true or false.

	True	False
Since the table shows the distance increasing by 1000 meters every 5 minutes, the runner's average speed was 200 meters per minute over the whole workout.	☑	☐
The entry $t = 0, d = 0$ shows that the runner started 200 meters ahead of the starting line.	☐	☑
Using the values at $t = 10$ minutes and $t = 15$ minutes, the average speed during that interval was 200 meters per minute.	☑	☐
Using the values at $t = 5$ minutes and $t = 10$ minutes, the runner's speed during that interval was 100 meters per minute.	☐	☑
The table only gives distances at specific recorded times, so it does not prove the runner's speed was exactly 200 meters per minute at every instant between those times.	☑	☐

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Create questions › Math 1 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students use a physical cube and a square face to build an explanation of why a rational exponent equals a root followed by a power.

A coach has a storage crate shaped like a cube used to hold sports balls. The crate has a volume of 64 cubic feet, and it is built from small unit cubes (1 ft x 1 ft x 1 ft) stacked evenly in a 4-by-4-by-4 arrangement. (a) Use this concrete cube arrangement to explain why $64^{1/3} = 4$. (b) The coach then looks at just one face of the crate, a 4-by-4 square of unit squares, and uses it to represent $64^{2/3}$. Explain, using this square and the properties of exponents, why $64^{2/3} = 16$, and explain how the cube and square models together show that $64^{2/3} = \left(64^{1/3}\right)^2$.

Model response: Since the crate is built from 4 layers of 4-by-4 unit cubes, it contains 4 x 4 x 4 = 64 unit cubes, so a cube with edge length 4 has volume 64; this means the number whose cube is 64 (i.e., $64^{1/3}$) is 4, matching the definition of a cube root. The face of the crate is a 4-by-4 square made of 16 unit squares, so its area is $4^2 = 16$. Since $64^{1/3} = 4$ from the cube model, squaring that result gives $\left(64^{1/3}\right)^2 = 4^2 = 16$, which matches the face's area. By the properties of integer exponents, $\left(64^{1/3}\right)^2 = 64^{2/3}$, so the cube model (finding the edge length) and the square model (finding the face area) together physically demonstrate that $64^{2/3} = 16$: the cube gives the base value 4, and the square shows what happens when that value is raised to the second power, confirming the rational exponent rule $a^{m/n} = \left(a^{1/n}\right)^m$.

Rubric: 1 point: Correctly identifies edge length 4 from the cube model, correctly computes the square's area as 16, and clearly explains how both concrete models together justify $64^{2/3} = \left(64^{1/3}\right)^2 = 16$, connecting the physical arrangement to the exponent rule.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 3 · Claim 3 › Standard group › DOK 3 › Generate

Test Bank question

MATH 1 · CLAIM 3 · COMMUNICATING REASONING

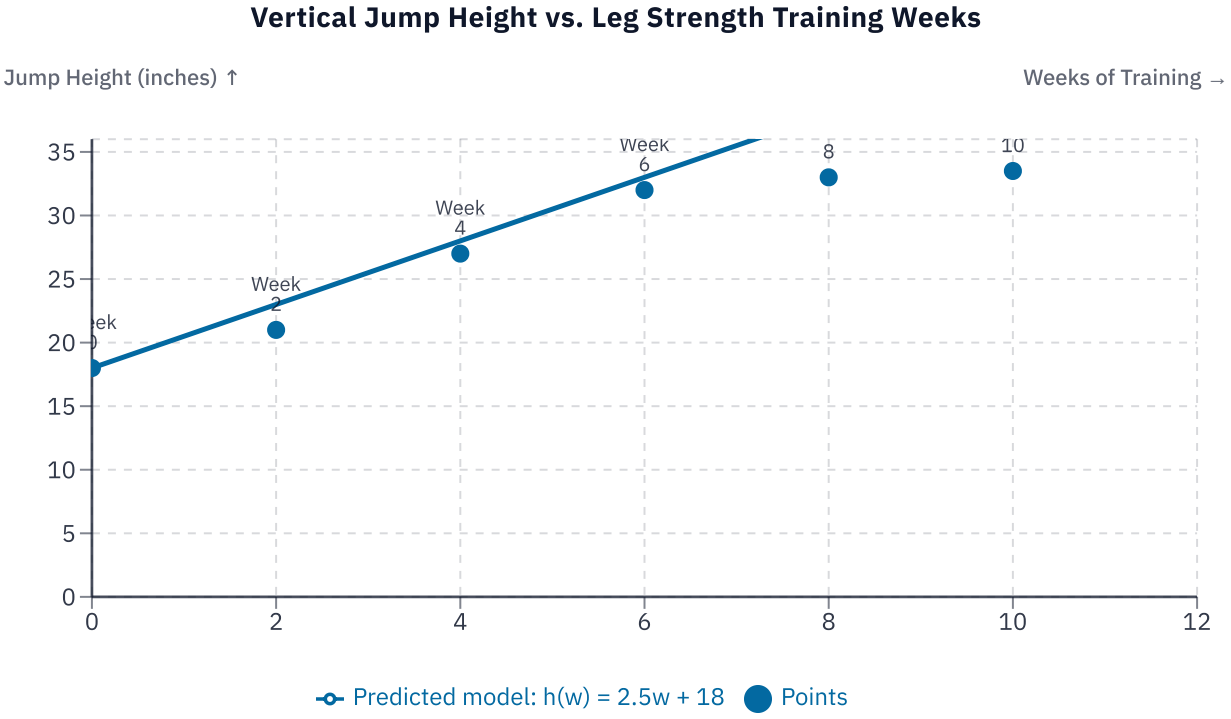
3G Determine conditions under which an argument does and does not apply

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students compare data to a model line and identify the range of weeks where the model applies and where it stops working.

A coach uses the linear model $h(w) = 2.5w + 18$ to predict jump height from weeks of leg strength training. The scatter plot shows the actual data collected. For which weeks is the linear model a good predictor, and why does it stop working outside that range?



- ◯ The model never fits well, since every data point differs at least slightly from the predicted line at every week shown.
- ◯ The model works only from week 0 to week 2, since after that the actual heights start rising faster than the line predicts.
- ◯ The model fits the data for all weeks from 0 to 10, since each point stays fairly close to the predicted line the whole time.

- [ ] The model is valid for about weeks 0 through 6, where the data follows the line. After week 6, gains level off, so the model's prediction of steady growth no longer applies. ✓

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students test an argument with chosen cases, describe exactly the conditions under which it holds, and correct it so it applies everywhere.

Ari says: "If $a > b$, then $ka > kb$ for any number k. So I can multiply both sides of an inequality by any number and the inequality stays true."

(a) Test Ari's argument using $a = 5$ and $b = 2$ with $k = 3$, $k = -3$, and $k = 0$.
(b) Describe exactly which values of k Ari's argument applies to and which values it does not apply to.
(c) Explain how to correct Ari's statement so it works for every nonzero value of k. Then use the corrected statement to solve $-2x > 8$.

Model response: (a) $k = 3$: $15 > 6$ is true. $k = -3$: $-15 > -6$ is false (actually $-15 < -6$). $k = 0$: $0 > 0$ is false (the two sides are equal).
(b) The argument applies when $k > 0$. It does not apply when $k < 0$ (the inequality reverses) or when $k = 0$ (both sides become 0).
(c) Corrected statement: if $a > b$ and $k > 0$, then $ka > kb$; if $a > b$ and $k < 0$, then $ka < kb$. Multiplying or dividing by a negative number reverses the inequality sign. To solve $-2x > 8$, divide both sides by -2 and reverse the sign: $x < -4$. Check: $x = -5$ gives $10 > 8$, which is true.

Rubric: 1 point: Correct tests for all three values of k, identifies $k > 0$ as the only case where the argument applies, gives a corrected statement for negative k, and solves to get $x < -4$.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 3 · Claim 3 › Standard group › DOK 3 › Generate

Written for this guide

CLAIM 4

Claim 4 · Modeling & Data Analysis

Students can analyze complex, real-world scenarios and can construct and use mathematical models to interpret and solve problems. In the Test Bank, Claims 2, 3 and 4 are built in the performance task (PT) step: choose PT, then Area 2 · Claims 2 + 4. Each question card is marked with its claim and target (for example "Claim 4 · Tgt A"), so generate a set at the DOK you want and keep the cards for the target you need.

Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › Options: DOK › Generate

MATH 1 · CLAIM 4 · MODELING & DATA ANALYSIS

4A Apply mathematics to solve problems from everyday life (Modeling)

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students set up a break-even equation and interpret the decimal solution in context, rounding up because partial jerseys cannot be sold.

A high school soccer team is selling spirit wear to raise money for uniforms. They paid 480 dollars for a bulk order of jerseys and plan to sell each jersey for 18 dollars. After selling some jerseys, they want to know how many they need to sell to cover their cost and break even. Which equation correctly models this situation, and what does the solution represent?

- The equation $18n - 480 = 0$ represents profit equals zero. Solving gives $n = 26.67$, so they need to sell 26 jerseys to break even.
- ✓ The equation $18n = 480$ represents total revenue equals total cost. Solving gives $n = 26.67$, so they need to sell 27 jerseys to break even.
- The equation $480n = 18$ represents the relationship between cost and selling price. Solving gives $n = 26.67$, so they need to sell 27 jerseys to break even.
- The equation $18 + n = 480$ represents total money after selling jerseys. Solving gives $n = 462$, so they need to sell 462 jerseys to break even.

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students define variables, write constraints and a profit function from a real situation, and find and justify the best combination, a non-routine planned solution.

A high school rowing team is planning a fundraiser where they will sell custom water bottles and team merchandise. Water bottles cost 3 dollars to produce and sell for 12 dollars each. Merchandise costs 8 dollars to produce and sell for 20 dollars each. The team has a budget of 500 dollars for production costs and can only store 80 items total before the event. The team wants to maximize profit. (a) Define variables and write an objective function and all constraints for this optimization problem. (b) Explain why your constraints fully capture the real-world limitations. (c) Find the combination of water bottles and merchandise that maximizes profit, and justify why this solution is optimal given your constraints.

Model response: Let w = number of water bottles and m = number of merchandise items. Objective function: Maximize $P = 9w + 12m$ (where 9 = 12 − 3 and 12 = 20 − 8). Constraints: $3w + 8m \leq 500$ (production budget), $w + m \leq 80$ (storage limit), $w \geq 0, m \geq 0$ (non-negativity). The constraints capture that production costs cannot exceed 500 dollars, total items cannot exceed storage capacity of 80, and we cannot produce negative quantities. To find the optimal solution, test corner points of the feasible region: (0, 0) gives $P = 0$; (0, 62) gives $P = 744$; (80, 0) gives $P = 720$; intersection of $3w + 8m = 500$ and $w + m = 80$ yields $w = \frac{140}{5} = 28, m = 52$, giving $P = 9(28) + 12(52) = 252 + 624 = 876$. The optimal solution is $w = 28$ water bottles and $m = 52$ merchandise items, generating a maximum profit of 876 dollars. This is optimal because it is the corner point with the highest profit value and lies within all constraints.

Rubric: 1 point: Defines variables and constraints correctly, writes objective function, finds the optimal corner point, and explains why it maximizes profit.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Test Bank question

MATH 1 · CLAIM 4 · MODELING & DATA ANALYSIS

4B Construct chains of reasoning to justify mathematical models

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 DOK 4 DOK 4 is assessed only in the performance task.

DOK 2 · Skills & concepts

Why DOK 2: Students test the model against the meaning of a percentage and recognize why a linear model fails for large inputs.

A basketball coach is modeling the relationship between players' practice hours per week and their free throw percentage. The coach collects data and creates a linear model: $y = 2.5x + 35$, where x is practice hours and y is free throw percentage. The coach then uses this model to make predictions about player performance. Select the statement that best justifies why this linear model may NOT be appropriate for this situation.

A linear model is appropriate because free throw percentage always increases as practice hours increase.

A linear model may not be appropriate because free throw percentage cannot exceed 100%, but the model predicts values greater than 100% for large values of x. ✓

A linear model is appropriate because the slope of 2.5 is positive, indicating improvement.

A linear model may not be appropriate because the y-intercept of 35 seems too low for player performance.

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students compare two models against all the data using differences and ratios, then use context to defend one prediction over the other.

A used car's value was recorded each year after it was bought.

Year 0: 24,000 dollars
Year 1: 20,400 dollars
Year 2: 17,340 dollars
Year 3: 14,739 dollars

Sam notices the car lost 3,600 dollars in the first year and models its value with $V(t) = 24{,}000 - 3{,}600t$. Rosa models its value with $V(t) = 24{,}000(0.85)^t$.

(a) Use the data to construct an argument for which model is better justified.
(b) Use each model to predict the car's value after 7 years.
(c) Explain which prediction is more reasonable and why.

Model response: (a) The yearly losses are 3,600, 3,060, and 2,601 dollars, which are not constant, so a linear model does not fit. The ratios are $20{,}400 \div 24{,}000 = 0.85$, $17{,}340 \div 20{,}400 = 0.85$, and $14{,}739 \div 17{,}340 = 0.85$, which are constant. The car keeps 85% of its value each year, so Rosa's exponential model is justified by the data. Sam's model only matches years 0 and 1; for year 3 it gives 13,200 dollars instead of 14,739 dollars.
(b) Sam: $24{,}000 - 3{,}600(7) = -1{,}200$ dollars. Rosa: $24{,}000(0.85)^7 \approx 7{,}694$ dollars.
(c) Rosa's prediction is more reasonable. A car cannot have a negative value, and the data show the car losing a smaller dollar amount each year as its value decreases, which is how an exponential decay model behaves.

Rubric: 1 point: Uses differences and ratios from the data to justify the exponential model, makes both predictions correctly, and explains why the negative value makes the linear prediction unreasonable.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

DOK 4 · Extended thinking

Why DOK 4: Students analyze data, choose and build a model, test a competing model, apply both to a planning decision, and state assumptions, an extended modeling argument.

A city's new bike-share program recorded the number of rides taken each month.

Month 1: 1,200
Month 2: 1,450

Month 3: 1,690
Month 4: 1,960
Month 5: 2,200
Month 6: 2,450

The city needs 1 bike for every 50 rides taken in a month. A council member proposes planning with the model $R(m) = 1{,}200(1.2)^{m-1}$, which assumes ridership grows by 20% each month.

(a) Analyze the data using differences and ratios. Decide whether a linear or an exponential model is better justified.
(b) Write the model you chose.
(c) Test the council member's model against the data, and explain what you find.
(d) Use both models to predict the rides in month 12 and the number of bikes the city would need. Recommend how many bikes the city should plan for, and justify your recommendation.
(e) State one assumption in your model, and describe how the city could check it as new data come in.

Model response: (a) Differences: 250, 240, 270, 240, 250, which are close to a constant 250. Ratios: about 1.21, 1.17, 1.16, 1.12, 1.11, which keep decreasing. Nearly constant differences support a linear model.
(b) Average increase $= (2{,}450 - 1{,}200) \div 5 = 250$ rides per month, so $R(m) = 1{,}200 + 250(m - 1)$, or $R(m) = 250m + 950$.
(c) The council model predicts $1{,}200(1.2)^5 \approx 2{,}986$ rides in month 6, but the actual number was 2,450. Its predictions grow too fast, and the gap gets larger each month, so it does not fit the data.
(d) Linear: $R(12) = 250(12) + 950 = 3{,}950$ rides, so $3{,}950 \div 50 = 79$ bikes. Council model: $R(12) = 1{,}200(1.2)^{11} \approx 8{,}916$ rides, so about 179 bikes. Recommend planning for about 80 bikes (or slightly more for a safety margin), because the linear model matches the data and the exponential model would more than double the number of bikes.
(e) Example: the linear model assumes ridership keeps increasing by about 250 rides per month, with no seasonal changes. The city can compare each new month's rides to the prediction and refit the model if the differences start to change, for example in winter.

Rubric: 1 point: All parts addressed with one error or one weak justification.
0 points: Anything less, including a response that is only partly correct.

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Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 4 › Generate

Written for this guide

MATH 1 · CLAIM 4 · MODELING & DATA ANALYSIS

4C State logical assumptions being used

Assessed at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall **Why DOK 1:** Students recognize the one assumption that makes a simple division work, with no calculation or reasoning chain required.

The student council says, "Each bus holds 50 students, so we need 6 buses to take all 300 students on the field trip." Which assumption is the student council making?

- ◯ Every bus will be filled with exactly 50 students. ✓
- ◯ Every student will bring a packed lunch.
- ◯ The field trip will last 6 hours.
- ◯ Some buses will hold more than 50 students.

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 1 › Generate

Written for this guide

DOK 2 · Skills & concepts **Why DOK 2:** Students identify the constant-rate assumption in a linear model and connect it to the impossible 105% prediction.

A high school basketball coach models the relationship between the number of practice hours per week and the team's free throw percentage. The coach collects data over 8 weeks and finds that the free throw percentage increases by approximately 2.5 percentage points for each additional hour of practice per week. The coach uses the linear model $F = 55 + 2.5h$, where F is the free throw percentage and h is the number of practice hours per week. The model predicts that with 20 hours of practice per week, the team's free throw percentage would be 105%.

Part A: Which of the following represents a key assumption the coach made when creating this linear model?

Choose one answer.

- ◯ All players on the team have the same natural free throw ability.
- ◯ The team will definitely improve by exactly 2.5 percentage points each week regardless of current skill level.

- ○ Free throw percentage is the only factor that affects basketball performance.
- ○ The relationship between practice hours and free throw percentage remains constant and linear across all possible values of practice hours. ✓

Part B: Which statement best explains why this assumption creates a limitation of the model?

Choose one answer.

- ○ The model assumes practice time is the only variable that matters, when in reality many factors influence free throw percentage.
- ○ The model predicts physically impossible results (like 105% free throw percentage) because the linear relationship cannot continue indefinitely, showing the assumption breaks down at extreme values. ✓
- ○ The model assumes that all basketball coaches use the same training methods.
- ○ The model requires collecting data from more teams to be valid.

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must uncover several hidden assumptions on their own, show with calculations how changing each one affects the result, and produce a better estimate.

The student council models the profit from a school dance with $P = 12n - 900$, where n is the number of tickets sold at 12 dollars each and 900 dollars pays for the DJ and decorations. A council member says, "All 400 students in our school will come, so we will make 3,900 dollars."

(a) Identify at least three assumptions built into this model and the council member's conclusion.
(b) Choose two of your assumptions. For each one, describe a realistic way it might not hold, and use the model (or an adjusted model) to show how the predicted profit changes.
(c) Give a more reasonable profit estimate. State the assumptions you used.

Model response: (a) Sample assumptions: every one of the 400 students buys a ticket; every ticket is sold at the full 12 dollar price; the only costs are the fixed 900 dollars (no cost per student); no one outside the school attends.
(b) Sample: If only 60% of students attend, $n = 240$ and $P = 12(240) - 900 = 1{,}980$ dollars. If the council also provides snacks costing 2 dollars per student, the model becomes $P = 10n - 900$, and with 400 students $P = 3{,}100$ dollars.
(c) Sample: Assuming about 60% of students attend and snacks cost 2 dollars per student, $P = 10(240) - 900 = 1{,}500$ dollars. Any reasonable estimate with clearly stated assumptions and correct calculations is acceptable.

Rubric: 1 point: States at least three reasonable assumptions, correctly shows the effect of two assumptions failing with calculations, and gives a reasonable estimate with stated assumptions.
0 points: Anything less, including a response that is only partly correct.

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Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

MATH 1 · CLAIM 4 · MODELING & DATA ANALYSIS

4D Interpret results in the context of a situation

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students compute a prediction and then judge whether it is reasonable by noticing it lies far outside the data used to build the model.

A track coach collected data on a runner's race times for distances between 2 miles and 5 miles and used it to build the linear model $T(d) = 6.5d + 2$, where d is the distance in miles and $T(d)$ is the predicted time in minutes. The coach wants to use this same model to predict the runner's time for a 10-mile race.

Part A: What time does the model predict for a 10-mile race, and is this prediction reasonable?

Choose one answer.

- ◯ 67 minutes, but the prediction is not reasonable because 10 miles is far outside the 2–5 mile range used to build the model ✓
- ◯ 65 minutes, but the prediction is not reasonable because the units of d are unclear
- ◯ 65 minutes, and the prediction is reasonable because a runner's pace never changes
- ◯ 67 minutes, and the prediction is reasonable because the model is linear

Part B: Which statement best supports your answer to Part A?

Choose one answer.

- ◯ Linear models can always be extended to any input value without loss of accuracy
- ◯ Since 10 is a multiple of 5, the model automatically applies to it
- ◯ The model's slope of 6.5 minutes per mile is too large to be realistic for any distance
- ◯ A runner's pace over a short race distance often differs from the pace they can sustain over a much longer distance, so extrapolating far beyond the original data range is unreliable ✓

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students interpret a break-even result, compare it with the team size, and discuss what the model assumes, building an open-ended, evidence-based judgment.

A high school soccer team is planning to sell team merchandise to raise funds. The coach models the relationship between the number of shirts sold, x, and the profit in dollars as $P(x) = 8x - 120$, where the 120 represents fixed costs for design and equipment. Based on this model, the team would need to sell $x = 15$ shirts to break even (earn zero profit). Interpret what this result means for the team's fundraising plan. Does this seem reasonable given that the team has about 45 members who could each buy a shirt? Explain your reasoning, including any concerns or advantages this model reveals.

Model response: Breaking even at $x = 15$ shirts means the team must sell at least 15 shirts just to cover their fixed costs of 120 dollars before making any profit. We can verify: $P(15) = 8(15) - 120 = 120 - 120 = 0$ ✓. This is reasonable and actually favorable because the team has 45 members, so selling 15 shirts represents only one-third of potential buyers from the team alone, making the break-even point very achievable. After selling 15 shirts, each additional shirt generates 8 dollars in profit. This suggests the plan is viable—the team can likely exceed break-even quickly and earn substantial funds by reaching all members and potentially other customers. However, the model assumes they can actually sell the shirts at the price used in the calculation and that fixed costs don't change.

Rubric: 1 point: Student interprets break-even correctly, verifies math, and compares to context, but does not fully explore implications or assumptions.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Test Bank question

MATH 1 · CLAIM 4 · MODELING & DATA ANALYSIS

4E Analyze adequacy and make improvements to existing models

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 DOK 4 DOK 4 is assessed only in the performance task.

DOK 2 · Skills & concepts

Why DOK 2: Students compare model and actual values to find where the model fits, where it fails, and which adjustment would improve it.

A track coach models a sprinter's 100-meter dash time (in seconds) as a function of weeks of training using $T(w) = 13.5 - 0.15w$, where w is the number of weeks since training began. The table shows the sprinter's actual recorded times.

$w = 0$: actual $= 13.5$ s, model $= 13.5$ s
$w = 2$: actual $= 13.2$ s, model $= 13.2$ s
$w = 4$: actual $= 12.9$ s, model $= 12.9$ s
$w = 6$: actual $= 12.8$ s, model $= 12.6$ s
$w = 8$: actual $= 12.75$ s, model $= 12.3$ s
$w = 10$: actual $= 12.7$ s, model $= 12.0$ s

Based on this data, which statements about the model's accuracy and possible improvements are correct? Select all that apply.

- [ ] Since the sprinter's time cannot keep decreasing forever, a linear model should never be used for any part of this data.
- [ ] The model underestimates the sprinter's improvement at every point in the data set.
- [x] The model closely matches the sprinter's actual times for $w = 0$ through $w = 4$.
- [ ] To fix the model, the slope after $w = 6$ should be changed to -0.30 seconds per week to better match the data.
- [x] A better model could use a smaller rate of decrease (a less negative slope) for weeks after $w = 6$ to reflect the sprinter's slowing rate of improvement.
- [x] After $w = 6$, the model overestimates the sprinter's improvement, predicting times that decrease faster than the sprinter's actual times.

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students compute residuals, interpret their pattern to diagnose the model's flaw, build a better model, and show with evidence that it fits better.

An ice cream stand owner uses the model $S = 4T - 200$ to predict the number of cones sold, S, from the day's high temperature, T, in degrees Fahrenheit. The table shows actual sales on six days.

Temperature (°F): 70, 75, 80, 85, 90, 95
Cones sold: 85, 98, 118, 130, 148, 160

(a) Find the residual (actual minus predicted) for each day.
(b) Describe the pattern in the residuals and what it tells you about the model.
(c) Write an improved linear model, and use residuals or another check to show that it fits the data better.
(d) Use your improved model to predict sales on a 100°F day.

Model response: (a) Predicted values: 80, 100, 120, 140, 160, 180. Residuals: $+5, -2, -2, -10, -12, -20$.
(b) The residuals get more negative as the temperature rises, so the model predicts too many cones on hot days. The slope of 4 cones per degree is too large.
(c) Using the first and last data points, the slope is $(160 - 85) \div (95 - 70) = 3$ cones per degree, so $S = 85 + 3(T - 70)$, or $S = 3T - 125$. Predicted values: 85, 100, 115, 130, 145, 160. Residuals: $0, -2, +3, 0, +3, 0$, which are small and show no pattern, so this model fits better.
(d) $S = 3(100) - 125 = 175$ cones.

Rubric: 1 point: Correct residuals, explains that the growing negative residuals show the slope is too large, writes an improved model with evidence that it fits better, and makes a correct prediction.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

DOK 4 · Extended thinking

Why DOK 4: Students analyze residuals for two groups, find two different weaknesses, build new models with a capacity limit, and use them to defend a staffing decision.

A city pool manager uses the model $A = 12T - 700$ to predict daily attendance, A, from the high temperature, T, in degrees Fahrenheit. The pool can hold at most 400 swimmers. The table shows actual attendance.

Temperature (°F): 75, 80, 85, 90, 95
Weekday attendance: 150, 190, 230, 270, 310
Weekend attendance: 230, 290, 350, 400, 400

(a) Find the model's residuals (actual minus predicted) for the weekday data and for the weekend data.
(b) Describe what the residual patterns show about the model.
(c) Build an improved model, or a set of models, that accounts for the differences you found and for the pool's capacity.
(d) The manager schedules 1 lifeguard for every 40 swimmers (rounded up). Use your improved model to find the number of lifeguards needed on an 88°F weekday and on an 88°F weekend day. Compare with the number the original model would give, and explain why your model is better for planning.

Model response: (a) Predicted: 200, 260, 320, 380, 440. Weekday residuals: $-50, -70, -90, -110, -130$. Weekend residuals: $+30, +30, +30, +20, -40$.
(b) The model overpredicts weekdays more and more as it gets hotter, so its slope is too steep for weekdays. On weekends it underpredicts by a constant 30 until attendance reaches the capacity of 400; after that the model keeps rising but attendance cannot.
(c) Weekday model: the slope is $(310 - 150) \div 20 = 8$, so $A = 8T - 450$. Weekend model: $A = 12T - 670$, but never more than 400 (use 400 whenever $12T - 670 > 400$, which is when T is above about 89°F).
(d) Weekday at 88°F: $8(88) - 450 = 254$ swimmers, $254 \div 40 = 6.35$, so 7 lifeguards. Weekend at 88°F: $12(88) - 670 = 386$ swimmers, so 10 lifeguards. The original model gives $12(88) - 700 = 356$ swimmers, or 9 lifeguards, for both days. That would schedule too many lifeguards on weekdays and too few on weekends. The improved models match the data and the capacity limit.

Rubric: 1 point: All parts addressed with one error or one weak explanation.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 4 › Generate

Written for this guide

MATH 1 · CLAIM 4 · MODELING & DATA ANALYSIS

4F Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flow charts, or formulas)

Assessed at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students identify the independent variable from a table, a direct recognition task with no relationship building.

A high school basketball team tracks the relationship between the number of three-point shots attempted and the number made during their games. The coach creates a table to analyze this data:

Game	Three-Pointers Attempted	Three-Pointers Made
1	12	5
2	18	7
3	15	6
4	24	9

Which variable should be identified as the independent variable when mapping the relationship between these quantities?

- ○ The game number, because it changes throughout the season
- ○ Three-pointers attempted, because this is the quantity the team can directly control ✓
- ○ Both variables equally, because they both appear in the table
- ○ Three-pointers made, because this is what the team wants to maximize

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students define variables, write the revenue relationship and two constraints, and organize them in a table or diagram, mapping several connected quantities.

A high school basketball team is planning a fundraiser where they sell two types of items: team t-shirts for $12 each and hoodies for $28 each. The team wants to raise at least $840 and estimates they can sell at most 50 items total. Create a diagram or table that maps the relationship between the number of t-shirts sold, the number of hoodies sold, and the total revenue. Clearly label your variables and identify which quantities are independent and which are dependent. Explain how your representation helps you understand the constraints of this situation.

Model response: Let t = number of t-shirts sold (independent variable) and h = number of hoodies sold (independent variable). Total revenue R (dependent variable) = $12t + 28h$. Constraints: $t + h \leq 50$ and $12t + 28h \geq 840$. A table or diagram should show: (1) the two independent variables t and h as inputs, (2) the dependent variable R as output with the formula $R = 12t + 28h$ clearly labeled, and (3) the two constraints listed separately. For example, a sample table might show: if $t = 30$ and $h = 20$, then total items = 50 and $R = 360 + 560 = 920$ dollars (meets both constraints). The representation clarifies that revenue depends on both sales quantities and helps visualize which combinations of t and h satisfy both the item limit and revenue goal.

Rubric: 1 point: Student clearly identifies both independent variables (t and h) and dependent variable (R), writes the revenue formula correctly, lists both constraints, and either creates a table/diagram with labeled quantities or provides a written explanation of how the representation supports understanding the problem.

0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must organize scattered facts into a two-way table, use conditional relative frequencies, and show that an overall total hides a difference between groups.

The student council surveyed 240 ninth and tenth graders about whether they prefer a car wash or a bake sale as a fundraiser.

130 of the students surveyed were ninth graders.
150 students in all preferred the car wash.
60 tenth graders preferred the bake sale.

(a) Organize the information in a two-way frequency table. Include all row and column totals.
(b) The council claims, "More students overall prefer a car wash, so each grade should hold a car wash." Use conditional relative frequencies to decide whether the data support this claim for each grade.
(c) Recommend a fundraiser for each grade, and justify your recommendation.

Model response: (a)

	Car wash	Bake sale	Total
9th grade	100	30	130
10th grade	50	60	110
Total	150	90	240

(Tenth graders: $240 - 130 = 110$; tenth-grade car wash: $110 - 60 = 50$; ninth-grade car wash: $150 - 50 = 100$; ninth-grade bake sale: $130 - 100 = 30$.)
(b) Of the ninth graders, $100 \div 130 \approx 77\%$ prefer the car wash. Of the tenth graders, only $50 \div 110 \approx 45\%$ prefer the car wash and $60 \div 110 \approx 55\%$ prefer the bake sale. The claim is supported for ninth grade but not for tenth grade.
(c) Ninth grade should hold a car wash, and tenth grade should hold a bake sale, because a majority within each grade prefers that event. The overall total hides the difference between the grades.

Rubric: 1 point: Complete and correct table, correct conditional relative frequencies for both grades, and a recommendation for each grade justified by those frequencies.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

MATH 1 · CLAIM 4 · MODELING & DATA ANALYSIS

4G Identify, analyze, and synthesize relevant external resources to pose or solve problems

Assessed at: ~~DOK 1~~ ~~DOK 2~~ DOK 3 DOK 4 Assessed only in the performance task, at DOK 3 and 4.

DOK 3 · Strategic thinking

Why DOK 3: Students judge the reliability and relevance of three outside sources and decide which combination best tests a model assumption.

A student is building a model to predict the relationship between a musician's weekly practice hours and their audition score. She finds three data sources: (A) official records from a regional youth orchestra over the past 5 years, (B) a music blog ranking performers by 'stage presence,' and (C) middle school band records from her district. To validate her model assumption that practice hours strongly predict audition scores, which combination of resources would provide the most reliable evidence, and why?

- ○ Use only source C, since middle school records are easier to collect than orchestra data and require less analysis to use.
- ○ Combine all three sources equally, since adding more sources always makes a model more accurate no matter their quality.
- ○ Use source B, since stage presence rankings are made by experts and already reflect skilled judgment.
- ○ Use source A as the main dataset since it is standardized, but also check source C to see if the same pattern holds for younger, less trained musicians. ✓

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Test Bank question

DOK 4 · Extended thinking

Why DOK 4: Students evaluate four outside sources, combine three of them with unit conversions into a model, and adapt their estimate to a new condition, an extended synthesis task.

A school is planting a vegetable garden that measures 20 feet by 20 feet. The garden club wants to estimate how much water it will need to add with a hose during the 12-week growing season and how much that water will cost. A student found these four sources:

Source 1 (university gardening guide): Vegetable gardens need about 1 inch of water per week. One inch of water over 1 square foot is about 0.623 gallon.
Source 2 (national weather service): Average rainfall in the area during the growing season is 0.4 inch per week.
Source 3 (city water department): Water costs 5.20 dollars for every 748 gallons.
Source 4 (a personal blog with no sources listed): "Gardens need at least 2 inches of water every day in summer."

(a) Decide which sources to use and which to ignore. Justify your decisions.
(b) Write a model for the number of gallons of hose water the garden needs each week.
(c) Estimate the total hose water and the total cost for the 12-week season.
(d) Explain how your estimate would change in a dry summer with only half the average rainfall, and give the new cost.

Model response: (a) Use Sources 1, 2, and 3: they come from reliable organizations and give the water need, the rainfall, and the price. Ignore Source 4: it lists no evidence, comes from a personal blog, and disagrees with the university guide by a large amount (14 inches per week).
(b) Area $= 20 \times 20 = 400$ square feet. Water needed per week from all sources $= 400 \times 0.623 = 249.2$ gallons. Rain supplies 0.4 inch, so the hose must supply $1 - 0.4 = 0.6$ inch: $G = 0.6 \times 249.2 \approx 149.5$ gallons per week. In general, $G = (1 - r)(400)(0.623)$, where r is the weekly rainfall in inches.
(c) Season: $149.52 \times 12 \approx 1{,}794$ gallons. Cost: $1{,}794.24 \div 748 \times 5.20 \approx 12.47$ dollars.
(d) With half the rainfall ($r = 0.2$), the hose must supply 0.8 inch per week: $0.8 \times 249.2 = 199.36$ gallons per week, or about 2,392 gallons for the season, costing about $2{,}392.32 \div 748 \times 5.20 \approx 16.63$ dollars. The cost rises by about 4 dollars.

Rubric: 1 point: All parts addressed with one computational error or one weak justification.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 1 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 4 › Generate

Written for this guide

Sources

- Smarter Balanced Assessment Consortium, 2015–16 Summative Technical Report: claim statements, and the Appendix 2.A test blueprints (pp. 43–48), which list the DOK levels assessed for every claim and target. https://www.cde.ca.gov/ta/tg/ca/documents/sb16sbtechrpt.pdf
- Target wording and standards: Smarter Balanced Mathematics Content Specifications and the CCSS for Mathematics, as stored in the AchieveMetrics Test Bank.
- DOK level definitions: Smarter Balanced Content Specifications (Webb Depth of Knowledge), summarised on the "How to use" page.
- Example questions: the AchieveMetrics Test Bank, reviewed for this guide.

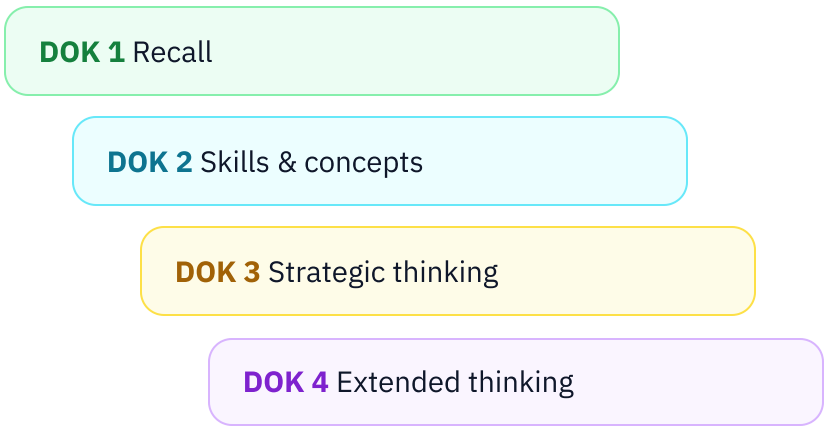
AchieveMetrics Test Bank · DOK Progression Guide · Math 1 · October 2026 edition.

AchieveMetrics Test Bank

DOK PROGRESSION GUIDE · SBAC MATHEMATICS

Math 2

Every SBAC claim and target for Math 2, with a Test Bank question at each Depth of Knowledge (DOK) level the blueprint assesses, and the clicks to find more.



For Math 2 teachers. Claims, targets and DOK levels follow the official Smarter Balanced blueprint.

achievemetricstestbank.com · October 2026 edition

How to use this booklet

Depth of Knowledge (DOK) describes the kind of thinking a question asks for, not how hard it is. A long calculation can still be DOK 1, and a short question can be DOK 3. For each target, this booklet shows one question at every DOK level SBAC assesses it at, so you can see the climb and then pick questions at the level your students need next.

The four DOK levels

DOK 1 · Recall — Recall a fact, term or property, or carry out a routine one-step procedure. Read a value straight from a table or graph.

DOK 2 · Skills & concepts — Decide how to approach it and use two or more steps: compare, classify, interpret data, or move between representations.

DOK 3 · Strategic thinking — Reason and plan: justify an answer, critique an argument, use evidence, or solve a problem with no routine path.

DOK 4 · Extended thinking — Carry out an extended investigation that connects several ideas, conditions or sources. On SBAC, DOK 4 is assessed only in the performance task, and only for Claim 3 and Claim 4 targets.

Reading a target page

1. The heading names the claim, the target code and the official target wording, with the standards it draws on.
2. The DOK ladder shows which levels the SBAC blueprint assesses for this target in this grade. Levels in grey with a line through them are not assessed for this target.
3. One example question at each assessed level, lowest first, with the answer shown. Read them top to bottom to see how the thinking climbs.
4. "Why DOK n" explains in one sentence what makes the question that level, so you can spot the same thing in your own questions.
5. "Find more like this" lists the exact Test Bank clicks that generate more questions for the same target at the same level.

Which DOK levels each target is assessed at comes from the official Smarter Balanced test blueprint for this grade (2015–16 Summative Technical Report, Appendix 2.A). Every example was checked by hand against the DOK definitions above, not just its Test Bank tag. A few targets had no Test Bank question that truly fit a level, so we wrote one; those are marked "Written for this guide."

Finding these questions in the Test Bank

Every example page ends with the exact clicks. These are the two routes, starting from Create questions with Math 2 chosen as the course.

Claim 1 targets (CAT)

Claim 1 questions are filed by target and standard.

Create questions › Math 2 › CAT › Claim 1 target › Standard › Options: DOK 1 or 2 › Item types (optional) › Generate

The DOK buttons only allow the levels the blueprint assesses for that target, so a level that is greyed out in this booklet is greyed out in the Test Bank too.

Claims 2, 3 and 4 (PT)

These claims are built from performance-task standard groups.

Create questions › Math 2 › PT › Area 2 (Claims 2 + 4) or Area 3 (Claim 3) › Standard group › Options: DOK › Generate

Each question card shows its claim and target, such as "Claim 3 · Tgt B". Generate at the DOK you want, then keep the cards for your target.

Questions you have saved

Saved questions are filed the same way in your Item Bank.

More › Item Bank › Math 2 › CAT or PT › Area › Target › DOK

Tip: to move a class up the ladder, generate the same target at the next DOK level. To check that a skill is secure before going further, generate a set at the lowest assessed level.

All targets at a glance

A dot means the SBAC blueprint assesses the target at that DOK level in this grade. Each dot has an example question in this booklet.

Claim 1 · Concepts & Procedures

Target		DOK 1	DOK 2	DOK 3	DOK 4
1A	Extend the properties of exponents to rational exponents	●	●	–	–
1B	Use properties of rational and irrational numbers	●	●	–	–
1D	Interpret the structure of expressions	●	●	–	–
1E	Write expressions in equivalent forms to solve problems	●	●	–	–
1F	Perform arithmetic operations on polynomials	–	●	–	–
1G	Create equations that describe numbers or relationships	●	●	–	–
1I	Solve equations and inequalities in one variable	●	●	–	–
1J	Represent and solve equations and inequalities graphically	●	●	–	–
1L	Interpret functions that arise in applications in terms of a context	●	●	–	–
1M	Analyze functions using different representations	●	●	●	–
1N	Build a function that models a relationship between two quantities	–	●	–	–
1O	Define trigonometric ratios and solve problems involving right triangles	●	●	–	–
1P	Summarize, represent, and interpret data on a single measurement variable	–	●	–	–

Claim 2 · Problem Solving

Target		DOK 1	DOK 2	DOK 3	DOK 4
2A	Apply mathematics to solve well-posed problems from everyday life	–	●	●	–
2B	Select and use appropriate tools strategically	●	●	●	–
2C	Interpret results in the context of a situation	●	●	●	–
2D	Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flow charts, or formulas)	●	●	●	–

Claim 3 · Communicating Reasoning

Target		DOK 1	DOK 2	DOK 3	DOK 4
3A	Test propositions or conjectures with specific examples	–	●	●	–
3B	Construct chains of reasoning that will justify or refute propositions	–	●	●	●
3C	State logical assumptions being used	–	●	●	–
3D	Use the technique of breaking an argument into cases	–	●	●	–
3E	Distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in the argument—explain what it is	–	●	●	●
3F	Base arguments on concrete referents such as objects, drawings, diagrams, and actions	–	●	●	–
3G	Determine conditions under which an argument does and does not apply	–	●	●	–

Claim 4 · Modeling & Data Analysis

Target		DOK 1	DOK 2	DOK 3	DOK 4
4A	Apply mathematics to solve problems from everyday life (Modeling)	–	●	●	–
4B	Construct chains of reasoning to justify mathematical models	–	●	●	●
4C	State logical assumptions being used	●	●	●	–
4D	Interpret results in the context of a situation	–	●	●	–
4E	Analyze adequacy and make improvements to existing models	–	●	●	●
4F	Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flow charts, or formulas)	●	●	●	–
4G	Identify, analyze, and synthesize relevant external resources to pose or solve problems	–	–	●	●

CLAIM 1

Claim 1 · Concepts & Procedures

Students can explain and apply mathematical concepts and interpret and carry out mathematical procedures with precision and fluency. Claim 1 is tested with individual items on the computer adaptive test (CAT). In the Test Bank, choose CAT, then the target.

Create questions › Math 2 › CAT › Claim 1 target › Standard › Options: DOK › Generate

MATH 2 · CLAIM 1 · CONCEPTS & PROCEDURES

1A Extend the properties of exponents to rational exponents

Standards: N-RN.1; N-RN.2

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students apply the definition that a cube root equals the one-third power in a single step, which is recall of a rule rather than a decision about how to proceed.

A basketball player's vertical jump height can be modeled using the expression $\sqrt[3]{512}$. Which of the following expressions is equivalent to $\sqrt[3]{512}$ using rational exponents?

- ◯ $512^{1/3}$ ✓
- ◯ $512^{1/2}$
- ◯ 512^{3}
- ◯ 3^{512}

FIND MORE LIKE THIS

Create questions › Math 2 › CAT › Target A › N-RN.2 › DOK 1 › Generate Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Each expression requires interpreting the exponent as both a root and a power and carrying out two steps in order, such as cube root then square, which moves beyond recall.

A basketball player's vertical jump height (in inches) can be modeled using rational exponents. Complete the table by rewriting each expression involving radicals or rational exponents in simplified form.

Original Expression	Simplified Form
$16^{1/2}$	4
$27^{2/3}$	9
$32^{3/5}$	8
$\sqrt[4]{81}$ or $81^{1/4}$	3

FIND MORE LIKE THIS

Create questions › Math 2 › CAT › Target A › N-RN.2 › DOK 2 › Generate Test Bank question

MATH 2 · CLAIM 1 · CONCEPTS & PROCEDURES

1B Use properties of rational and irrational numbers

Standards: N-RN.3

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall and state one property, that a rational plus an irrational number is irrational, and apply it directly to a single sum.

A basketball player's vertical jump height can be expressed as $3 + \sqrt{5}$ feet. Explain whether this height is a rational or irrational number. Use properties of rational and irrational numbers to justify your answer.

Model response: The height $3 + \sqrt{5}$ feet is irrational. Since 3 is a rational number and $\sqrt{5}$ is an irrational number, their sum must be irrational. According to the properties of rational and irrational numbers, the sum of a rational number and an irrational number is always irrational.

Rubric: 1 point: Correctly identifies the number as irrational and provides clear reasoning that the sum of a rational number (3) and an irrational number ($\sqrt{5}$) is irrational.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 2 › CAT › Target B › N-RN.3 › DOK 1 › Generate Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must first rationalize and simplify the expression, then classify the result using the product property, linking two steps together.

Use the drop-down menus to complete the statement about a runner's training data.

A coach records that a runner's average speed is $\frac{12}{\sqrt{3}}$ miles per hour. When rationalized, this speed equals [$4\sqrt{3}$ ▾] miles per hour. Since $4\sqrt{3}$ is [irrational ▾], the runner's speed is a(n) [irrational ▾] number.

Drop-down 1 choices: $\frac{4}{\sqrt{3}}$ | $12\sqrt{3}$ | $4\sqrt{3}$ ✓

Drop-down 2 choices: irrational ✓ | rational

Drop-down 3 choices: irrational ✓ | rational

FIND MORE LIKE THIS

Create questions › Math 2 › CAT › Target B › N-RN.3 › DOK 2 › Generate Test Bank question

MATH 2 · CLAIM 1 · CONCEPTS & PROCEDURES

1D Interpret the structure of expressions

Standards: A-SSE.1; A-SSE.2

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students identify what each part of a given expression is (root, coefficient, constant term), which is recognizing terms and factors rather than reasoning.

A coach models a player's total season points with the expression $x^2 + 11x + 24$, which can be rewritten in factored form as $(x + 3)(x + 8)$. Decide whether each statement about this expression is True or False.

	True	False
The factor $(x + 3)$ shows that -3 is a root of the expression.	☑	☐
The factor $(x + 8)$ shows that -8 is a root of the expression.	☑	☐
In the expanded form $x^2 + 11x + 24$, the number 11 is a root of the expression.	☐	☑
The factored form $(x + 3)(x + 8)$ reveals the roots of the expression directly.	☑	☐
In the expanded form $x^2 + 11x + 24$, the number 24 is a factor multiplied by x.	☐	☑

FIND MORE LIKE THIS

Create questions › Math 2 › CAT › Target D › Standard › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students compare three equivalent forms and interpret which structure shows the field's dimensions in context, connecting the factors to length and width.

A rectangular soccer field's area (in square yards) is modeled by $A(x) = x^2 + 10x + 21$, where x is a scale factor. A student rewrote the expression in three equivalent forms. Select the form that directly reveals the field's length and width as expressions in x.

Form 1: $x^2 + 10x + 21$

Form 2: $(x + 3)(x + 7)$ ✓

Form 3: $(x + 5)^2 - 4$

FIND MORE LIKE THIS

Create questions › Math 2 › CAT › Target D › A-SSE.2 › DOK 2 › Generate

Test Bank question

MATH 2 · CLAIM 1 · CONCEPTS & PROCEDURES

1E Write expressions in equivalent forms to solve problems

Standards: A-SSE.3

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: The vertex form is already given, so students read the maximum straight from the expression and recognize why it is the maximum.

A kicker punts a football during practice. The height of the ball in feet, x seconds after being kicked, is modeled by $h(x) = -x^2 + 8x + 9$. A coach rewrites the expression in the equivalent form $h(x) = -(x - 4)^2 + 25$ to analyze the punt.

Part A: What is the maximum height, in feet, that the football reaches?

Choose one answer.

- ○ 9 feet
- ✓ ○ 25 feet
- ○ 4 feet
- ○ 16 feet

Part B: Which statement explains how the equivalent form $h(x) = -(x - 4)^2 + 25$ reveals the maximum height?

Choose one answer.

- ○ The maximum occurs where $x = 25$, since that is the constant added in the completed square form
- ✓ ○ Since $-(x - 4)^2 \leq 0$ for all x, the maximum value of $h(x)$ occurs when $-(x - 4)^2 = 0$, giving $h(x) = 25$
- ○ Since $(x - 4)^2$ is always positive, $h(x)$ increases without bound as x increases
- ○ The constant term 9 in the original expression directly gives the maximum height

FIND MORE LIKE THIS

Create questions › Math 2 › CAT › Target E › A-SSE.3 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must carry out the multi-step completing-the-square process with fractions and then interpret the vertex in context.

A basketball player's height above the ground during a jump can be modeled by the quadratic function $h(t) = -16t^2 + 24t + 6$, where h is measured in feet and t is time in seconds. By completing the square, rewrite this function in vertex form $h(t) = a(t - h)^2 + k$. Then explain what the vertex tells you about the player's jump.

Model response: $h(t) = -16(t - \frac{3}{4})^2 + 15$. The vertex is at $(\frac{3}{4}, 15)$, which means the player reaches a maximum height of 15 feet at $\frac{3}{4}$ second (or 0.75 seconds) after jumping.

Rubric: 1 point: Correctly completes the square to obtain vertex form with accurate vertex coordinates, and clearly interprets both the time and maximum height in context.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 2 › CAT › Target E › A-SSE.3 › DOK 2 › Generate

Test Bank question

MATH 2 · CLAIM 1 · CONCEPTS & PROCEDURES

1F Perform arithmetic operations on polynomials

Standards: A-APR.1

Assessed at: ~~DOK 1~~ DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students multiply binomials and must recognize several equivalent forms at different stages of the process, evaluating each choice against their work.

A rectangular soccer practice field has a length of $(x + 6)$ meters and a width of $(x + 4)$ meters. The area of the field is given by $(x + 6)(x + 4)$. Which of the following are equivalent expressions for the area of the field, in square meters? Select all that apply.

- [x] $x^2 + 4x + 6x + 24$ ✓
- [x] $x \cdot x + x \cdot 4 + 6 \cdot x + 6 \cdot 4$ ✓
- [ ] $x^2 + 24x + 10$
- [ ] $x^2 + 6x + 4x + 10$
- [x] $x^2 + 10x + 24$ ✓
- [ ] $2x^2 + 10x + 24$

FIND MORE LIKE THIS

Create questions › Math 2 › CAT › Target F › A-APR.1 › DOK 2 › Generate

Test Bank question

MATH 2 · CLAIM 1 · CONCEPTS & PROCEDURES

1G Create equations that describe numbers or relationships

Standards: A-CED.1; A-CED.2; A-CED.4

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students translate a direct verbal description into an area equation, a routine setup with the relationships stated explicitly.

A rectangular soccer practice field has a length that is 5 yards more than its width. The area of the field is 84 square yards. Let w represent the width, in yards, of the field. Which equations correctly represent this relationship? Select all that apply.

- [x] $w^2 + 5w = 84$
- [x] $w(w + 5) = 84$
- [ ] $2w + 5 = 84$
- [ ] $w(w + 5) = 42$
- [ ] $w^2 - 5w = 84$
- [x] $w^2 + 5w - 84 = 0$

FIND MORE LIKE THIS

Create questions › Math 2 › CAT › Target G › Standard › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must build a linear demand equation from two data points, then multiply by price to create the revenue model, planning two linked steps.

A volleyball team assumes ticket demand is linear in price. It sells 150 tickets at 12 dollars each and 120 tickets at 15 dollars each. Revenue equals price times demand. Write the revenue model as $R(p) = ap^2 + bp + c$. Enter only the coefficient b as a number.

Correct answer: **270**

FIND MORE LIKE THIS

Create questions › Math 2 › CAT › Target G › A-CED.2 › DOK 2 › Generate

Test Bank question

MATH 2 · CLAIM 1 · CONCEPTS & PROCEDURES

1I Solve equations and inequalities in one variable

Standards: A-REI.4

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students solve a quadratic by factoring out a common factor, a routine one-procedure task, and check simple statements about the solutions.

A basketball player's jump height can be modeled by the equation $h(t) = -16t^2 + 32t$, where h is height in feet and t is time in seconds. Determine whether each statement about solving $-16t^2 + 32t = 0$ is true or false.

	True	False
The equation factors as $-16t(t - 2) = 0$.	☑	☐
One solution is $t = 2$ seconds.	☑	☐
The solutions are $t = 0$ and $t = 32$.	☐	☑
The solution $t = 0$ represents the moment the player leaves the ground.	☑	☐

FIND MORE LIKE THIS

Create questions › Math 2 › CAT › Target I › A-REI.4 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must work through the quadratic formula themselves and compare each step to find where the discriminant was miscalculated, which requires analyzing a procedure.

A punter kicks a football. The horizontal distance traveled satisfies the equation $x^2 - 6x - 7 = 0$, where x is measured in yards. Kai used the quadratic formula to solve for x. Select the step where Kai made his first error.

Step 1: $x^2 - 6x - 7 = 0$, so $a = 1,\ b = -6,\ c = -7$

Step 2: $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \dfrac{6 \pm \sqrt{(-6)^2 - 4(1)(-7)}}{2(1)}$

Step 3: $x = \dfrac{6 \pm \sqrt{36 - 28}}{2} = \dfrac{6 \pm \sqrt{8}}{2}$ ✓

Step 4: $x = \dfrac{6 \pm \sqrt{64}}{2} = \dfrac{6 \pm 8}{2}$

Step 5: $x = 7$ or $x = -1$

FIND MORE LIKE THIS

Create questions › Math 2 › CAT › Target I › Standard › DOK 2 › Generate

Test Bank question

MATH 2 · CLAIM 1 · CONCEPTS & PROCEDURES

1J Represent and solve equations and inequalities graphically

Standards: A-REI.7

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students substitute a point into two equations to verify it satisfies both, a routine check that requires no choice of strategy.

Which ordered pair is a solution to the system of equations $y = x^2 - 3$ and $y = 2x$?

- ◯ $(3, 6)$ ✓
- ◯ $(1, -2)$
- ◯ $(2, 4)$
- ◯ $(-3, 6)$

FIND MORE LIKE THIS

Create questions › Math 2 › CAT › Target J › A-REI.7 › DOK 1 › Generate

Written for this guide

DOK 2 · Skills & concepts

Why DOK 2: Students explain how the intersection of a parabola and a line represents solutions and interpret the coordinates in context, connecting graphs to equations.

A basketball player's height above the ground during a jump can be modeled by $h(t) = -16t^2 + 20t + 6$, where h is height in feet and t is time in seconds. The rim is at a constant height of $h(t) = 10$ feet. By looking at a graph of both functions, explain how you would find the time(s) when the player's hand reaches the rim height. What does the x-coordinate of each intersection point represent?

Model response: To find when the player's hand reaches the rim, I would graph both $h(t) = -16t^2 + 20t + 6$ (the parabola representing the player's hand) and $h(t) = 10$ (the horizontal line representing the rim). The x-coordinates of the intersection points are the solutions to $-16t^2 + 20t + 6 = 10$, which simplifies to $-16t^2 + 20t - 4 = 0$. Each x-coordinate represents the time (in seconds) when the player's hand is at rim height—once on the way up and once on the way down.

Rubric: 1 point: Correctly identifies that intersection points represent solutions to the equation, accurately explains that x-coordinates are times when heights are equal, and describes the physical meaning (rising and falling).

0 points: Anything less, including a response that is only partly correct.

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Test Bank question

MATH 2 · CLAIM 1 · CONCEPTS & PROCEDURES

1L Interpret functions that arise in applications in terms of a context

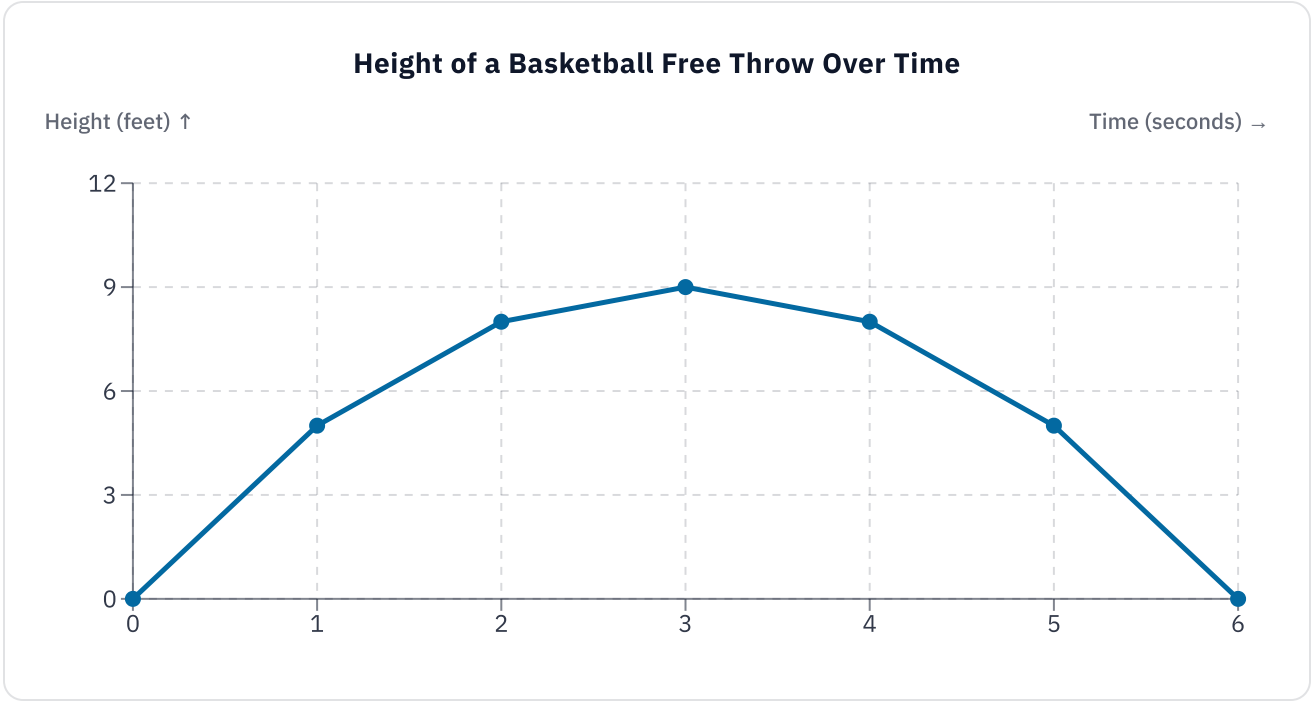
Standards: F-IF.4; F-IF.5; F-IF.6

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students read the highest point directly off the graph, which is locating a value rather than interpreting or calculating.

The graph shows the height of a basketball, in feet, t seconds after it is thrown. Based on the graph, what is the maximum height of the basketball, and at what time does it occur?



- ○ The maximum height is 9 feet, occurring at $t = 6$ seconds
- ○ The maximum height is 8 feet, occurring at $t = 2$ seconds
- ○ The maximum height is 6 feet, occurring at $t = 6$ seconds
- ○ The maximum height is 9 feet, occurring at $t = 3$ seconds ✓

FIND MORE LIKE THIS

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Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students compute average rates of change, the initial value, and the vertex, then interpret each in context to judge several statements.

A soccer ball is kicked into the air. Its height above the ground, in feet, is modeled by $h(t) = -16t^2 + 64t + 4$, where t is the time in seconds after the kick. Based on this function, which statements are true? Select all that apply.

- [x] The average rate of change in height from $t = 0$ to $t = 2$ seconds is 32 feet per second. ✓
- [ ] The average rate of change in height from $t = 2$ to $t = 4$ seconds is 32 feet per second.
- [x] The ball was kicked from an initial height of 4 feet above the ground. ✓
- [x] The ball reaches a maximum height of 68 feet, occurring at $t = 2$ seconds. ✓
- [ ] The ball was kicked from ground level, so $h(0) = 0$.
- [ ] The ball reaches its maximum height at $t = 4$ seconds.

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Test Bank question

MATH 2 · CLAIM 1 · CONCEPTS & PROCEDURES

1M Analyze functions using different representations

Standards: F-IF.7; F-IF.8; F-IF.9; F-BF.3; F-BF.4a

Assessed at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: With the vertex form given, students simply read the maximum height and its time from the expression, a direct recall of what vertex form shows.

Use the drop-down menus to complete the statement.

A basketball player's height above the ground during a jump can be modeled by $h(t) = -16t^2 + 32t$, where h is in feet and t is time in seconds. The vertex form of this function is $h(t) = -16(t-1)^2 + 16$. Based on these two representations, the maximum height reached is [16 ▾] feet, and this maximum occurs at [$t = 1$ ▾] seconds.

Drop-down 1 choices: 8 | 16 ✓ | 32

Drop-down 2 choices: $t = 2$ | $t = 1$ ✓ | $t = 0.5$

FIND MORE LIKE THIS

Create questions › Math 2 › CAT › Target M › F-IF.9 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students extract the vertex and zeros from two representations and explain what each representation makes easiest to see, comparing features.

A basketball player's height above the ground during a jump is modeled by two different representations:

Equation (vertex form): $h(t) = -16(t-0.5)^2 + 4$

Table (selected values):

Time (seconds)	Height (feet)
0	0
0.5	4
1	0

where t is time in seconds and $h(t)$ is height in feet.

Identify the vertex, the time(s) when the player is at ground level, and explain what each representation makes easiest to see. Why would you choose vertex form over the table to analyze this jump?

Model response: Vertex: The vertex is $(0.5, 4)$, meaning the player reaches a maximum height of 4 feet at 0.5 seconds.

Times at ground level: The player is at ground level at $t = 0$ and $t = 1$ second. These are visible directly in the table.

What each representation shows best:
- The **vertex form equation** $h(t) = -16(t - 0.5)^2 + 4$ immediately reveals the maximum height (4 feet) and when it occurs (0.5 seconds), as well as the symmetry of the jump.
- The **table** clearly shows specific input-output pairs, making the ground-level times easy to read without calculation.

Why vertex form is more useful: Vertex form directly shows the extreme value (maximum height) and its timing without needing to convert or calculate further. This is strategic when analyzing the peak of a jump, whereas the table only shows discrete points and requires inference or calculation to identify the true maximum.

Rubric: 1 point: Student correctly identifies vertex as $(0.5, 4)$ and ground-level times as $t = 0$ and $t = 1$; clearly explains what each representation reveals; provides a thoughtful comparison of why vertex form is more efficient for analyzing the jump's maximum.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must plan a path through two representations, build an equation from the table, compare features, and justify conclusions, which goes well beyond reading a vertex.

Two balls are launched during a physics lab. Ball A's height, in feet, t seconds after launch is $h_A(t) = -16t^2 + 48t + 4$. Ball B's height was recorded in a table:

t (seconds)	0	0.5	1	1.5	2	2.5
$h_B(t)$ (feet)	6	26	38	42	38	26

Ball B's height also follows a quadratic function.

(a) Which ball reaches the greater maximum height?
(b) Which ball hits the ground first?

Justify each answer using features of the two representations, and show your work.

Model response: (a) For Ball A, the axis of symmetry is $t = -\frac{48}{2(-16)} = 1.5$, so its maximum height is $h_A(1.5) = -36 + 72 + 4 = 40$ feet. Ball B's table is symmetric about $t = 1.5$ (38 and 38, 26 and 26), so its vertex is $(1.5, 42)$ and its maximum height is 42 feet. Ball B reaches the greater maximum height.

(b) Using the vertex $(1.5, 42)$ and the point $(0, 6)$: $6 = a(0 - 1.5)^2 + 42$, so $a = -16$ and $h_B(t) = -16(t - 1.5)^2 + 42$. Ball B lands when $(t - 1.5)^2 = \frac{42}{16} = 2.625$, so $t = 1.5 + \sqrt{2.625} \approx 3.12$ seconds. Ball A in vertex form is $h_A(t) = -16(t - 1.5)^2 + 40$, so it lands when $(t - 1.5)^2 = 2.5$, giving $t = 1.5 + \sqrt{2.5} \approx 3.08$ seconds. Ball A hits the ground first: both balls peak at the same time and fall the same way, but Ball A starts its fall from a lower maximum.

Rubric: 1 point: Finds both maximum heights (40 ft and 42 ft) and both landing times (about 3.08 s and 3.12 s), concludes that Ball B goes higher and Ball A lands first, and justifies each conclusion with features of the representations (vertex, symmetry of the table, equation built from the table).
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 2 › CAT › Target M › F-IF.9 › DOK 3 › Generate

Written for this guide

MATH 2 · CLAIM 1 · CONCEPTS & PROCEDURES

1N Build a function that models a relationship between two quantities

Standards: F-BF.1; F-LE.3; F-LE.6

Assessed at: ~~DOK 1~~ DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students use the vertex and a second point to find the leading coefficient and write the function, building a model from given features in several steps.

A lacrosse player kicks a ball from ground level. The height of the ball above the ground (in feet) can be modeled as a function of time (in seconds) after the kick. The ball reaches a maximum height of 64 feet at 2 seconds, and returns to ground level at 4 seconds.

Write a quadratic function $h(t)$ that models the height of the ball. Use the vertex form $h(t) = a(t - h)^2 + k$, where the vertex is (h, k). Expand your answer to standard form $h(t) = at^2 + bt + c$.

Write your answer in the form $h(t) = at^2 + bt + c$.

Correct answer: $h(t) = -16t^2 + 64t$

FIND MORE LIKE THIS

Create questions › Math 2 › CAT › Target N › F-BF.1 › DOK 2 › Generate

Test Bank question

MATH 2 · CLAIM 1 · CONCEPTS & PROCEDURES

10 Define trigonometric ratios and solve problems involving right triangles

Standards: G-SRT.6; G-SRT.7; G-SRT.8; G-SRT.8.1

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students identify which trigonometric ratio links the opposite and adjacent sides, recalling a definition in a single step.

A basketball player is standing 12 feet away from the base of the hoop. The angle of elevation from the player's eyes to the center of the hoop is 35°. Which trigonometric ratio should be used to find the height of the hoop above the player's eyes?

- ◯ $\tan(35^\circ) = \frac{\text{height}}{12}$ ✓
- ◯ $\tan(35^\circ) = \frac{12}{\text{height}}$
- ◯ $\sin(35^\circ) = \frac{\text{height}}{12}$
- ◯ $\cos(35^\circ) = \frac{\text{height}}{12}$

FIND MORE LIKE THIS

Create questions › Math 2 › CAT › Target O › G-SRT.8 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must set up the triangle from the description, choose tangent, and use an inverse ratio to find the angle, a multi-step application.

Use the drop-down menus to complete the statement.

A volleyball player is practicing spike serves. The ball is hit from a height of 2 meters above the court, and it travels horizontally a distance of 8 meters before hitting the ground. The angle of depression from the player's hand to the point where the ball lands is approximately [14 ▾] degrees. (Round to the nearest whole degree.) To find this angle, the player uses the ratio [$\tan(\theta) = \frac{\text{opposite}}{\text{adjacent}}$ ▾].

Drop-down 1 choices: 14 ✓ | 24 | 76

Drop-down 2 choices: $\tan(\theta) = \frac{\text{opposite}}{\text{adjacent}}$ ✓ | $\cos(\theta) = \frac{\text{adjacent}}{\text{hypotenuse}}$ | $\sin(\theta) = \frac{\text{opposite}}{\text{hypotenuse}}$

FIND MORE LIKE THIS

Create questions › Math 2 › CAT › Target O › G-SRT.8 › DOK 2 › Generate

Test Bank question

MATH 2 · CLAIM 1 · CONCEPTS & PROCEDURES

1P Summarize, represent, and interpret data on a single measurement variable

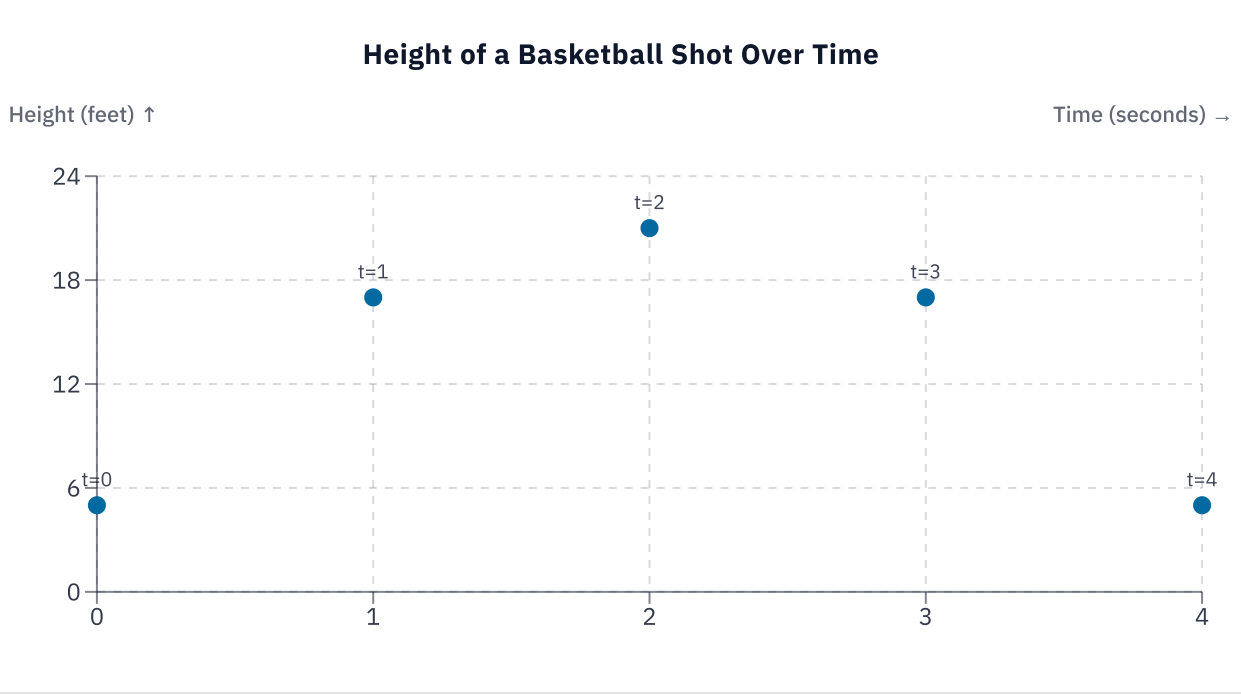
Standards: S-ID.6

Assessed at: ~~DOK 1~~ **DOK 2** ~~DOK 3~~ ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students use features of the plotted data (initial value, vertex, symmetry) to select and verify the quadratic function that fits, linking data to an equation.

A basketball is thrown into the air. The scatter plot shows the ball's height (in feet) at several times (in seconds) during its flight. The path of the ball can be modeled by a quadratic equation of the form $h(t) = at^2 + bt + c$, where $h(t)$ is the height in feet and t is the time in seconds. Based on the pattern of the data (initial height of 5 feet, maximum height of 21 feet at $t = 2$, and symmetric heights of 17 feet at $t = 1$ and $t = 3$), which equation correctly models the height of the ball?



- ○ $h(t) = 4t^2 + 16t + 5$
- ○ $h(t) = -2t^2 + 16t + 5$
- ○ $h(t) = -4t^2 + 8t + 5$
- ○ $h(t) = -4t^2 + 16t + 5$ ✓

FIND MORE LIKE THIS

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CLAIM 2

Claim 2 · Problem Solving

Students can solve a range of complex well-posed problems in pure and applied mathematics, making productive use of knowledge and problem-solving strategies. In the Test Bank, Claims 2, 3 and 4 are built in the performance task (PT) step: choose PT, then Area 2 · Claims 2 + 4. Each question card is marked with its claim and target (for example "Claim 2 · Tgt A"), so generate a set at the DOK you want and keep the cards for the target you need.

Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › Options: DOK › Generate

MATH 2 · CLAIM 2 · PROBLEM SOLVING

2A Apply mathematics to solve well-posed problems from everyday life

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students solve a well-posed problem by isolating the rational-exponent term and raising both sides to the reciprocal power, a two-step process with a clear path.

On a family road trip, the number of gallons of gas used, G, is modeled by $G = d^{2/3}/10$, where d is the distance traveled in miles. The family used 6.4 gallons of gas on one leg of the trip. Solve for d, the distance traveled in miles.

Correct answer: **512**

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must model the situation with right triangles, choose the right ratios, compare results to constraints, and evaluate a redesign, which takes planning across several steps.

A school is adding a wheelchair ramp to a stage that is 3 feet high. Building rules say the ramp may make an angle of at most $4.8°$ with the floor. The space in front of the stage allows at most 32 feet of horizontal run.

(a) Can a single straight ramp fit in the space? Show the calculation that supports your answer.
(b) The designer instead plans a ramp with two straight sections that each rise half the height of the stage, connected by a flat landing, with the second section turning back alongside the first. Each section must fit within 20 feet of horizontal run. Using the steepest allowed angle, does this design work? Find the length of the ramp surface for each section, to the nearest tenth of a foot.

Model response: (a) No. The ramp is the hypotenuse of a right triangle with a vertical rise of 3 ft. At the steepest allowed angle, the horizontal run is $\frac{3}{\tan 4.8°} \approx \frac{3}{0.0840} \approx 35.7$ feet. That is more than the 32 feet available, and any smaller angle would need an even longer run, so a single straight ramp does not fit.

(b) Yes. Each section rises 1.5 ft. At $4.8°$, each section needs a horizontal run of $\frac{1.5}{\tan 4.8°} \approx 17.9$ feet, which is less than 20 feet, so each section fits. The ramp surface for each section is $\frac{1.5}{\sin 4.8°} \approx 17.9$ feet (about 17.93 ft).

Rubric: 1 point: Correctly shows the single ramp needs about 35.7 ft of run and does not fit, shows each section of the two-part design needs about 17.9 ft of run and fits, and finds each section's surface length of about 17.9 ft, with appropriate trigonometric ratios.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

MATH 2 · CLAIM 2 · PROBLEM SOLVING

2B Select and use appropriate tools strategically

Assessed at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recognize whether a single known rule applies to each task, a quick yes-or-no identification without carrying out a strategy.

A coach is using a calculator and algebraic rules to convert between radical and exponential forms when analyzing player performance metrics. For each expression, decide whether using the property $a^{m/n} = \sqrt[n]{a^m}$ (or its inverse) is the most appropriate tool to evaluate or simplify it. Select Yes or No for each.

	Yes, use rational exponent property	No, use a different approach
Simplifying $16^{1/2}$ to find a player's speed rating	☑	☐
Rewriting $\sqrt[3]{27}$ in exponential form as $27^{1/3}$	☑	☐
Finding the value of $8^{2/3}$ to calculate a fitness score	☑	☐
Adding the two expressions $3x + 5$ and $2x + 7$	☐	☑
Converting $\sqrt[4]{x^3}$ to $x^{3/4}$ for a performance model	☑	☐

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students compare four solution approaches and judge which tool gives an exact value most efficiently, which requires weighing methods rather than recalling one.

A sports analyst needs the exact value of a player's power rating, given by $P = 32^{3/5}$. Four students describe how they solved this. Select the step that shows the most strategic and efficient use of mathematical tools to find the exact value.

Step 1: Typed $32^{3/5}$ into a calculator and rounded the decimal result to two places, reporting $P \approx 8.00$.

Step 2: Rewrote $32^{3/5}$ as $\left(32^{1/5}\right)^3$, recognized $32^{1/5} = 2$ since $2^5 = 32$, then computed $2^3 = 8$ to get the exact value $P = 8$. ✓

Step 3: Guessed and checked whole numbers, testing $5^{3/5}$, $6^{3/5}$, and $7^{3/5}$ on a calculator until one was close to a whole number.

Step 4: Graphed $y = 32^x$ on a graphing calculator and traced the curve near $x = 3/5$ to estimate the y-value.

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must evaluate which tools fit the problem, use the discriminant to justify rejecting factoring, solve with an appropriate tool, and verify with another, which requires strategic decisions.

A ball is tossed upward. Its height, in feet, t seconds after it is tossed is $h(t) = -16t^2 + 40t + 5$. Three students plan how to find when the ball hits the ground.

- Ana: factor $-16t^2 + 40t + 5$ and use the zero product property.
- Ben: use the quadratic formula.
- Cam: graph $h(t)$ on a graphing calculator and find the positive t-intercept.

Decide which method or methods will work, and explain why any method will not work well here. Then find the time the ball hits the ground, to the nearest hundredth of a second, and explain how one of the other methods could be used to check your answer.

Model response: Setting $h(t) = 0$ gives $-16t^2 + 40t + 5 = 0$, or $16t^2 - 40t - 5 = 0$. The discriminant is $(-40)^2 - 4(16)(-5) = 1600 + 320 = 1920$, which is not a perfect square, so the expression does not factor over the integers. Ana's factoring method will not work well. Ben's quadratic formula works and gives exact answers: $t = \frac{40 \pm \sqrt{1920}}{32} = \frac{5 \pm \sqrt{30}}{4}$. The negative root does not make sense for time, so the ball lands at $t = \frac{5 + \sqrt{30}}{4} \approx 2.62$ seconds. Cam's graphing method also works but gives an approximate value; the graph's positive t-intercept near 2.62 can be used to check the answer from the formula.

Rubric: 1 point: Explains why factoring does not work (for example, by showing the discriminant 1920 is not a perfect square), identifies the quadratic formula and graphing as workable, finds $t \approx 2.62$ seconds while rejecting the negative root, and describes how graphing (or substitution) checks the result.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

MATH 2 · CLAIM 2 · PROBLEM SOLVING

2C Interpret results in the context of a situation

Assessed at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students identify what each factor and coefficient represents in context and check simple statements, a direct interpretation of given parts.

A sports arena's revenue from selling tickets to a basketball game is modeled by $R(x) = -5x^2 + 300x$, where x is the ticket price in dollars and $R(x)$ is revenue in dollars. This expression can be rewritten in factored form as $R(x) = x(300 - 5x)$. Decide whether each statement about this model is True or False.

	True	False
In the factored form $R(x) = x(300 - 5x)$, the factor x represents the ticket price in dollars.	☑	☐
In the factored form $R(x) = x(300 - 5x)$, the factor $(300 - 5x)$ represents the number of tickets sold at price x.	☑	☐
The negative coefficient -5 in $-5x^2$ means that revenue always decreases as the ticket price increases, for every value of x.	☐	☑
Setting $R(x) = 0$ shows that revenue is zero when the ticket price is $x = 0$ dollars or $x = 60$ dollars.	☑	☐
Maximum revenue occurs when $300 - 5x = 0$, that is, when the ticket price is $x = 300$ dollars.	☐	☑

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students evaluate the model at two inputs and then interpret the change and the downward-opening shape to explain what happens with more practice.

A basketball team's scoring model estimates points per game as $P(x) = -2x^2 + 40x + 15$, where x represents the number of hours spent in practice per week. The team currently practices 8 hours per week. The coach is considering increasing practice to 10 hours per week. Calculate the predicted points per game at both practice levels, then explain what this change tells you about the relationship between practice time and scoring, including any concerns about continuing to increase practice indefinitely.

Model response: At $x = 8$: $P(8) = -2(8)^2 + 40(8) + 15 = -128 + 320 + 15 = 207$ points per game. At $x = 10$: $P(10) = -2(10)^2 + 40(10) + 15 = -200 + 400 + 15 = 215$ points per game. The increase of 8 points shows that more practice improves scoring in this range. However, the negative leading coefficient (-2) indicates this is a downward-opening parabola with a maximum around $x = 10$ hours. Beyond this point, additional practice would actually decrease scoring, suggesting diminishing returns or potential fatigue and overtraining. This model suggests there is an optimal practice duration rather than a linear benefit to more practice.

Rubric: 1 point: Correctly calculates both values, identifies the 8-point increase, and explains that the negative coefficient creates a maximum point beyond which scoring declines—demonstrating understanding of polynomial structure and practical implications.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students compute two predictions and then must judge each against the data range used to build the model, justifying which result is meaningful.

A track coach studies how standing vertical jump height relates to body mass using the rational-exponent model $H(m) = 120\,m^{-1/3}$, where $H(m)$ is predicted jump height in centimeters and m is body mass in kilograms. The coach built this model using data from adult sprinters with masses between 50 kg and 100 kg. Use the properties of rational exponents to find the exact values of $H(64)$ and $H(8)$. Then explain whether each result is a meaningful prediction in the context of the coach's athletes, discussing the model's range of validity and your confidence in each prediction. Explain your reasoning.

Model response: Since $64^{1/3} = 4$, $H(64) = 120/4 = 30$ cm. Since $8^{1/3} = 2$, $H(8) = 120/2 = 60$ cm. The value $H(64) = 30$ cm is a reasonable, trustworthy prediction because 64 kg falls within the 50–100 kg range of the sprinters whose data built the model. However, $H(8) = 60$ cm is not a meaningful prediction: no adult sprinter has a mass of 8 kg, so this input lies far outside the data used to create the model. Using the formula there is an extrapolation beyond the model's valid domain, so the result, while mathematically correct, has no real-world confidence and should not be interpreted as an actual jump height.

Rubric: 1 point: Correctly computes $H(64) = 30$ cm and $H(8) = 60$ cm using rational exponent properties, and clearly explains that the first is a valid prediction within the model's data range while the second is an invalid extrapolation outside the realistic mass domain, discussing prediction confidence and model limitations.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Test Bank question

MATH 2 · CLAIM 2 · PROBLEM SOLVING

2D Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flow charts, or formulas)

Assessed at: DOK 1 | DOK 2 | DOK 3 | ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students match an equation to the table that represents it by evaluating simple cube roots, identifying the relationship between two quantities directly.

A soccer coach is analyzing player performance. She measures how a player's running speed relates to the oxygen uptake required. The relationship is modeled by the equation $s = o^{1/3}$, where s is the player's speed in meters per second and o is the oxygen uptake in milliliters per kilogram per minute. Which table correctly shows the relationship between the quantities in this model?

- ○ Oxygen uptake (o): 2, 3, 4 | Speed (s): 8, 27, 64
- ○ Oxygen uptake (o): 8, 27, 64 | Speed (s): 4, 9, 16
- ✓ Oxygen uptake (o): 8, 27, 64 | Speed (s): 2, 3, 4
- ○ Oxygen uptake (o): 1, 2, 3 | Speed (s): 2, 3, 4

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students identify independent and dependent quantities, rewrite the rational exponent as a radical, and compute the output, connecting several pieces of the relationship.

A sports scientist uses the formula $P = 4M^{3/2}$ to estimate an athlete's maximum sprint power output P (in watts) based on the athlete's body mass M (in kilograms). Identify which quantity is the independent variable and which is the dependent variable, rewrite the expression $M^{3/2}$ using radical notation to show what it means, and then find the power output for an athlete with a mass of 64 kg. Explain your reasoning.

Model response: Mass M is the independent variable (it is chosen/measured first), and power P is the dependent variable because it is calculated from M. The rational exponent means $M^{3/2} = (\sqrt{M})^3 = \sqrt{M^3}$, so raising M to the 3/2 power is the same as taking the square root of M then cubing the result. For $M = 64$: $\sqrt{64} = 8$, and $8^3 = 512$, so $M^{3/2} = 512$. Then $P = 4(512) = 2048$ watts.

Rubric: 1 point: Correctly identifies M as independent and P as dependent, correctly rewrites $M^{3/2}$ as $(\sqrt{M})^3$ or $\sqrt{M^3}$, and computes P = 2048 watts with clear reasoning connecting the quantities.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must identify several linked quantities (outer dimensions, walkway area, cost), map them into one equation, solve it, and judge which solution fits, which requires planning.

A rectangular garden is 10 feet long and 6 feet wide. A walkway of uniform width x feet will be built around the garden. The walkway material costs 3 dollars per square foot, and the budget for material is 240 dollars.

(a) Write expressions in terms of x for the outer length, the outer width, and the area of the walkway only.
(b) Write and solve an equation or inequality to find the greatest walkway width the budget allows.
(c) Explain why any other solution of your equation does not make sense in this situation.

Model response: (a) Outer length: $10 + 2x$ feet. Outer width: $6 + 2x$ feet. Walkway area: $(10 + 2x)(6 + 2x) - 60 = 4x^2 + 32x$ square feet.

(b) Cost: $3(4x^2 + 32x) \leq 240$, so $4x^2 + 32x \leq 80$, or $x^2 + 8x - 20 \leq 0$. Solving $x^2 + 8x - 20 = 0$ gives $(x + 10)(x - 2) = 0$, so $x = 2$ or $x = -10$. The greatest walkway width the budget allows is 2 feet. Check: the walkway area is $14 \cdot 10 - 60 = 80$ square feet, which costs $3 \cdot 80 = 240$ dollars.

(c) $x = -10$ would mean a negative walkway width, which is impossible, so it is rejected.

Rubric: 1 point: Writes correct expressions for the outer length, outer width, and walkway area; sets up and solves a correct equation or inequality to get a width of 2 feet; and explains why $x = -10$ is rejected.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

CLAIM 3

Claim 3 · Communicating Reasoning

Students can clearly and precisely construct viable arguments to support their own reasoning and to critique the reasoning of others. In the Test Bank, Claims 2, 3 and 4 are built in the performance task (PT) step: choose PT, then Area 3 · Claim 3. Each question card is marked with its claim and target (for example "Claim 3 · Tgt A"), so generate a set at the DOK you want and keep the cards for the target you need.

Create questions › Math 2 › PT › Area 3 · Claim 3 › Standard group › Options: DOK › Generate

MATH 2 · CLAIM 3 · COMMUNICATING REASONING

3A Test propositions or conjectures with specific examples

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students test each given statement with numbers to decide whether a counterexample exists, applying exponent properties to several specific cases.

A coach models the relationship between a sprinter's training intensity and performance using rational exponents. For each statement about rational exponent properties, test it with specific numerical examples. Determine whether the statement is always true or whether you can find a counterexample that makes it false.

	Always True	Can Be False (Counterexample Exists)
For any positive number x, the expression $x^{1/2} \cdot x^{1/3}$ equals $x^{5/6}$.	☑	☐
For any positive number x, we have $(x^{1/2})^2 = x$.	☑	☐
For any positive numbers x and y, the expression $(xy)^{1/3}$ equals $x^{1/3} + y^{1/3}$.	☐	☑
For any positive number x, the radical expression $\sqrt[4]{x^3}$ can be rewritten as $x^{3/4}$ using rational exponents.	☑	☐
For any positive number x, if $x^{1/2} = 4$, then $x = 2$.	☐	☑

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must choose strategic test values from different cases, evaluate them, and generalize a pattern to decide the conjecture, which requires reasoning and planning.

A student claims that for any positive number a, the expression $a^{1/2}$ is always smaller than $a^{1/3}$. Test this conjecture with at least three specific examples, choosing values that represent different cases (such as values between 0 and 1, and values greater than 1). Based on your tests, determine whether the claim is true or false, and explain what your examples show.

Model response: Testing $a = 8$: $8^{1/2} = \sqrt{8} \approx 2.83$ and $8^{1/3} = \sqrt[3]{8} = 2$. Since $2.83 > 2$, the claim is false for $a = 8$. Testing $a = 0.5$: $(0.5)^{1/2} \approx 0.71$ and $(0.5)^{1/3} \approx 0.79$. Here $0.71 < 0.79$, so the claim is true for $a = 0.5$. Testing $a = 1$: $1^{1/2} = 1$ and $1^{1/3} = 1$, so they are equal. The claim is false because it is not always true—when $a > 1$, we have $a^{1/2} > a^{1/3}$, which contradicts the conjecture. The examples show that whether $a^{1/2}$ or $a^{1/3}$ is larger depends on whether a is greater than 1 or between 0 and 1.

Rubric: 1 point: Student tests at least three strategic examples (including values greater than 1, between 0 and 1, and/or the boundary case $a = 1$), correctly evaluates each using properties of rational exponents, identifies the claim as false, and explains the pattern discovered (that the relationship reverses depending on the value of a).
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 3 · Claim 3 › Standard group › DOK 3 › Generate

Test Bank question

MATH 2 · CLAIM 3 · COMMUNICATING REASONING

3B Construct chains of reasoning that will justify or refute propositions

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 DOK 4 DOK 4 is assessed only in the performance task.

DOK 2 · Skills & concepts

Why DOK 2: Students expand the proposed form and compare it term by term to choose the justification that actually proves the claim wrong.

A bakery's weekly profit from selling bread can be modeled by the polynomial expression $P(x) = 45x^2 + 180x + 135$, where x represents the number of extra loaves baked. A student claims that this expression can be rewritten as $P(x) = 45(x + 2)^2 + 45$. Which of the following gives the most rigorous justification for whether this claim is correct or incorrect?

- ○ The claim is correct because factoring 45 from the original expression gives $45(x^2 + 4x + 3)$, which is another valid way to write $45(x + 2)^2 + 45$.
- ○ The claim is incorrect because the original expression starts with $45x^2$ while the rewritten form starts with $45(x + 2)^2$, and these two leading terms cannot represent the same variable.
- ○ The claim is incorrect because expanding $45(x + 2)^2 + 45$ gives $45x^2 + 180x + 225$, which has a constant term of 225 instead of 135, so the two expressions are not equal. ✓
- ○ The claim is correct because both expressions share the terms $45x^2$ and $180x$, so their constant terms must also automatically match.

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must build a general argument linking the sign of each part of the discriminant to the number of solutions, rather than testing examples, which is strategic reasoning.

Jada makes this claim: "If c is a negative number, then the equation $x^2 + bx + c = 0$ always has two different real solutions, no matter what real number b is."

Construct a chain of reasoning to justify or refute Jada's claim. Your argument must work for every real value of b, not just a few examples.

Model response: The claim is true. Whether $x^2 + bx + c = 0$ has real solutions depends on the discriminant $b^2 - 4ac$, which here is $b^2 - 4(1)(c) = b^2 - 4c$. For any real number b, $b^2 \geq 0$. Because $c < 0$, the term $-4c$ is positive. A nonnegative number plus a positive number is positive, so $b^2 - 4c > 0$ for every real b. A positive discriminant means the quadratic formula $x = \frac{-b \pm \sqrt{b^2 - 4c}}{2}$ gives two different real values. Therefore, whenever c is negative, the equation has two different real solutions, no matter what b is. (Check: $b = 0$, $c = -4$ gives $x = \pm 2$.)

Rubric: 1 point: States that the claim is true and gives a complete general argument: the discriminant is $b^2 - 4c$, $b^2 \geq 0$, $-4c > 0$, so the discriminant is positive and there are two different real solutions.
0 points: Anything less, including a response that is only partly correct.

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Written for this guide

DOK 4 · Extended thinking

Why DOK 4: Students carry out an extended investigation, testing cases, generalizing with algebra, and analyzing a new condition before synthesizing a conclusion, which is extended thinking.

A student conjectures: "For a fixed amount of fencing, the rectangle with the greatest area is always a square."

Investigate this conjecture.

(a) With 40 feet of fencing around all four sides, make a table of at least four possible widths and their areas. Then write the area A as a function of the width w, rewrite it by completing the square, and use the result to justify which rectangle has the greatest area.
(b) Generalize: show that for any total length of fencing P around all four sides, the greatest area occurs when the rectangle is a square.
(c) Now suppose one side of the rectangle is a barn wall, so the P feet of fencing are used for only the other three sides (two widths and one length). Write the area function, find the dimensions that give the greatest area, and decide whether the conjecture still holds.

(d) Write a final statement that tells when the conjecture is true and when it is not, supported by your work.

Model response: (a) The length is $20 - w$, so $A(w) = w(20 - w) = -w^2 + 20w = -(w - 10)^2 + 100$. Sample table: $w = 4$, $A = 64$; $w = 6$, $A = 84$; $w = 8$, $A = 96$; $w = 10$, $A = 100$; $w = 12$, $A = 96$. Since $-(w - 10)^2 \leq 0$, the greatest area is 100 square feet when $w = 10$ and the length is 10: a square.

(b) With P feet of fencing, the length is $\frac{P}{2} - w$, so $A(w) = w\left(\frac{P}{2} - w\right) = -\left(w - \frac{P}{4}\right)^2 + \frac{P^2}{16}$. The maximum occurs at $w = \frac{P}{4}$, and then the length is $\frac{P}{2} - \frac{P}{4} = \frac{P}{4}$. The best rectangle is always a square.

(c) With fencing on two widths and one length, the length is $P - 2w$ and $A(w) = w(P - 2w) = -2\left(w - \frac{P}{4}\right)^2 + \frac{P^2}{8}$. The maximum occurs at $w = \frac{P}{4}$, so the length is $P - \frac{P}{2} = \frac{P}{2}$, twice the width. The best rectangle is not a square, so the conjecture fails here.

(d) The conjecture is true when the fencing goes around all four sides. It is false when one side is a wall; then the greatest area occurs when the side parallel to the wall is twice as long as each side perpendicular to it.

Rubric: 1 point: Three of the four parts complete and correct.
0 points: Anything less, including a response that is only partly correct.

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Create questions › Math 2 › PT › Area 3 · Claim 3 › Standard group › DOK 4 › Generate

Written for this guide

MATH 2 · CLAIM 3 · COMMUNICATING REASONING

3C State logical assumptions being used

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students identify the hidden assumption that time is positive and explain why taking a square root requires it, connecting a step to its condition.

A basketball player's vertical jump height can be modeled using the equation $h = \frac{1}{2}gt^2$, where h is height in feet, g is the gravitational constant, and t is time in seconds. A coach claims that if a player can jump to height h, then the time spent in the air is $t = \sqrt{\frac{2h}{g}}$. The coach derives this by rewriting $h = \frac{1}{2}gt^2$ as $t^2 = \frac{2h}{g}$ and then taking the square root of both sides to get $t = \sqrt{\frac{2h}{g}}$.

Part A: Which logical assumption must the coach be making when deriving the time equation from $t^2 = \frac{2h}{g}$?

Choose one answer.

- That the height h must be greater than or equal to 32 feet
- That the basketball player's mass does not affect the jump height
- That the gravitational constant g equals 32 feet per second squared
- That t is positive (representing time after the jump begins) ✓

Part B: Which statement best explains why this assumption is necessary for the coach's derivation?

Choose one answer.

- Because when taking the square root of t^2, we get $|t| = \sqrt{\frac{2h}{g}}$, which gives both positive and negative solutions; the coach must assume $t > 0$ to select the physically meaningful solution for time ✓
- Because rational exponents like $\frac{1}{2}$ require all variables to be positive numbers
- Because $\sqrt{\frac{2h}{g}}$ can only be evaluated when g is a positive constant

- ◯ Because the original equation $h = \frac{1}{2}gt^2$ only applies to basketball players, not other athletes

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must uncover unstated assumptions behind a model and reason about how changing each one would affect the conclusions, which calls for strategic thinking beyond computing.

A coach models the height of a basketball shot, in feet, t seconds after it is released with $h(t) = -16t^2 + 32t + 6$. The coach concludes: "The ball reaches a maximum height of 22 feet after 1 second and would hit the floor after about 2.17 seconds."

(a) Verify the coach's two numerical conclusions.
(b) Identify at least three assumptions the coach must be making for the model and these conclusions to be valid.
(c) For two of your assumptions, explain how the coach's conclusions would change if that assumption were not true.

Model response: (a) The vertex is at $t = -\frac{32}{2(-16)} = 1$, and $h(1) = -16 + 32 + 6 = 22$ feet. Setting $h(t) = 0$ gives $8t^2 - 16t - 3 = 0$, so $t = \frac{16 \pm \sqrt{352}}{16}$; the positive root is $t \approx 2.17$ seconds (the negative root is rejected). Both conclusions are correct.

(b) Possible assumptions: the ball is released at $t = 0$ from a height of 6 feet; only gravity acts on the ball, so air resistance is ignored; nothing such as the rim, the backboard, or another player interrupts the ball's path; the floor is level at height 0; the model applies only for $0 \le t \le 2.17$, since negative times and heights below the floor have no meaning.

(c) Sample: If air resistance is not negligible, the ball would rise to less than 22 feet and reach the floor sooner than 2.17 seconds. If the ball hits the rim, the model stops describing the ball at that moment, so the 2.17-second landing time would not happen. If the ball were released from higher than 6 feet, the maximum height and the landing time would both be greater.

Rubric: 1 point: Verifies both numerical conclusions, states at least three reasonable assumptions, and correctly explains how two of the conclusions would change if an assumption were false.
0 points: Anything less, including a response that is only partly correct.

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Written for this guide

MATH 2 · CLAIM 3 · COMMUNICATING REASONING

3D Use the technique of breaking an argument into cases

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students compute the discriminant and use the three discriminant cases to decide how many solutions exist and what that means in context.

Use the drop-down menus to complete the reasoning about when a quadratic equation has real solutions.

A soccer ball's height above ground after a kick is modeled by $h(t) = -16t^2 + 32t + 6$, where t is time in seconds. To determine if the ball ever reaches a height of 22 feet, we set $-16t^2 + 32t + 6 = 22$ and solve $-16t^2 + 32t - 16 = 0$. Using case analysis on the discriminant $\Delta = b^2 - 4ac$: The discriminant equals [0 ▾]. Since Δ [equals zero ▾], the quadratic equation [has one ▾] real solutions, which means the ball [will ▾] reach exactly 22 feet.

Drop-down 1 choices: -512 | 0 ✓ | 256

Drop-down 2 choices: is positive | is negative | **equals zero ✓**

Drop-down 3 choices: **has one ✓** | has no | has two

Drop-down 4 choices: may or may not | will not | **will ✓**

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Create questions › Math 2 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must set up exhaustive cases (odd n; even n with nonnegative or negative x), analyze each, and argue why the cases cover every possibility.

A sports statistician models a runner's change in speed with a real number x (positive means speeding up, negative means slowing down). To simplify formulas, she uses the identity $(x^n)^{1/n} = x$, where n is a positive integer, and claims this is true for every real number x and every positive integer n. Break this claim into the necessary cases based on whether n is odd or even (and, when needed, the sign of x), determine whether the claim holds in each case, and explain why your set of cases covers every possibility. Use an example runner speed such as $x = -2$ to support your reasoning.

Model response: There are three cases, and together they cover every possible combination of n and x:

Case 1 (n odd, any real x): Since odd roots preserve sign, $(x^n)^{1/n} = x$ always. Example: $((-2)^3)^{1/3} = (-8)^{1/3} = -2$. The claim holds.

Case 2 (n even, $x \geq 0$): $x^n \geq 0$, and taking the positive nth root gives back x, so $(x^n)^{1/n} = x$. The claim holds.

Case 3 (n even, $x < 0$): $x^n > 0$, but the nth root symbol/rational exponent gives the nonnegative root, so $(x^n)^{1/n} = |x| = -x \neq x$. Example: $x = -2$, $n = 2$: $((-2)^2)^{1/2} = 4^{1/2} = 2 \neq -2$. The claim fails.

These three cases are exhaustive because every integer n is either odd or even, and for even n every real x is either nonnegative or negative — no other possibilities exist. Since Case 3 produces a counterexample, the statistician's general claim $(x^n)^{1/n} = x$ is false for negative speed changes when n is even; it must instead be written as $|x|$ in that case.

Rubric: 1 point: Correctly separates the argument into the three exhaustive cases (odd n; even n with x≥0; even n with x<0), correctly analyzes each case using rational exponent reasoning, gives a valid counterexample for the failing case, and explicitly explains why the cases are exhaustive.
0 points: Anything less, including a response that is only partly correct.

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Create questions › Math 2 › PT › Area 3 · Claim 3 › Standard group › DOK 3 › Generate

Test Bank question

MATH 2 · CLAIM 3 · COMMUNICATING REASONING

3E Distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in the argument—explain what it is

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 DOK 4 DOK 4 is assessed only in the performance task.

DOK 2 · Skills & concepts

Why DOK 2: Students check each step of a worked solution and recognize that a negative number of games does not make sense in context, locating the flaw.

A basketball analyst models the point differential of a team after x games using the expression $x^2 - 64$. She wants to find the number of games after which the differential equals zero. Select the step where her reasoning first contains an error.

Step 1: Start with the expression $x^2 - 64$, representing the point differential after x games.

Step 2: Recognize the expression as a difference of squares and rewrite it as $(x - 8)(x + 8)$.

Step 3: Set the expression equal to zero: $(x - 8)(x + 8) = 0$, so $x - 8 = 0$ or $x + 8 = 0$.

Step 4: Solve to get $x = 8$ or $x = -8$, and conclude both values represent valid numbers of games played. ✓

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Create questions › Math 2 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must analyze several arguments, including a subtle overgeneralization that fails for values between 0 and 1, and decide which reasoning is valid.

A coach is analyzing athletic performance using exponential models. For each statement about rewriting expressions with rational exponents, determine whether the reasoning is correct or contains a logical flaw.

	Correct Reasoning	Flawed Reasoning
To rewrite $\sqrt[4]{x^3}$ using rational exponents, we apply the rule $\sqrt[n]{a^m} = a^{m/n}$, so $\sqrt[4]{x^3} = x^{3/4}$. This works because the denominator of the rational exponent matches the index of the radical.	☑	☐
Since $5^{1/2} = \sqrt{5}$ and $5^{1/3} = \sqrt[3]{5}$, it follows that $5^{1/6}$ must equal $\sqrt{5} \cdot \sqrt[3]{5}$ because we can multiply the expressions together.	☐	☑
When simplifying $(16^{1/2})^{1/2}$, we can use the power rule $(a^m)^n = a^{mn}$ to get $16^{(1/2)(1/2)} = 16^{1/4}$, which equals 2 because $16^{1/4} = \sqrt[4]{16}$. This method works regardless of the order in which we apply the operations.	☑	☐
To compare $\sqrt[3]{x^2}$ and $\sqrt{x}$ for $x > 0$, we convert both to rational exponents: $x^{2/3}$ and $x^{1/2}$. Since $2/3 > 1/2$, we can conclude that $x^{2/3} > x^{1/2}$ for all positive values of x.	☐	☑
The expression $32^{2/5}$ can be rewritten as $(32^{1/5})^2$, which equals $2^2 = 4$, because $32 = 2^5$ means $32^{1/5} = 2$. We could also compute this as $(32^2)^{1/5} = 1024^{1/5} = 4$, and both methods are valid because the power rule preserves equality.	☑	☐

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Test Bank question

DOK 4 · Extended thinking

Why DOK 4: Students investigate many cases, diagnose a flawed generalization, then build and prove a corrected rule, an extended analysis that goes beyond a single error check.

Riley studied quadratic functions written in vertex form, $y = a(x - h)^2 + k$, and wrote this rule:

"The number of x-intercepts depends only on k. If $k < 0$, the graph has two x-intercepts. If $k = 0$, it

has one. If $k > 0$, it has none."

(a) Test Riley's rule with at least four functions that use different combinations of signs for a and k. For each function, find the actual number of x-intercepts and record whether Riley's rule gives the right answer.
(b) Explain the flaw in Riley's reasoning.
(c) Write a corrected rule that works for every quadratic function in vertex form, and justify it algebraically by solving $a(x-h)^2 + k = 0$ for $(x-h)^2$.
(d) Explain why Riley's rule gives the right answer for every function with $a > 0$.

Model response: (a) Sample tests:
- $y = (x-1)^2 - 4$: $a > 0, k < 0$; intercepts at $x = -1$ and $x = 3$ (two). Rule correct.
- $y = (x-1)^2 + 4$: $a > 0, k > 0$; no intercepts. Rule correct.
- $y = -(x-1)^2 + 4$: $a < 0, k > 0$; intercepts at $x = -1$ and $x = 3$ (two). Rule says none, so it is wrong.
- $y = -(x-1)^2 - 4$: $a < 0, k < 0$; no intercepts. Rule says two, so it is wrong.
- $y = -2(x+3)^2$: $k = 0$; one intercept at $x = -3$. Rule correct.

(b) Riley looked only at k, the height of the vertex. Whether the graph reaches the x-axis also depends on whether the parabola opens up or down, which is given by the sign of a.

(c) Solving $a(x-h)^2 + k = 0$ gives $(x-h)^2 = -\frac{k}{a}$. A square cannot be negative. If $-\frac{k}{a} > 0$ (a and k have opposite signs), there are two x-intercepts, $x = h \pm \sqrt{-\frac{k}{a}}$. If $k = 0$, there is one, $x = h$. If $-\frac{k}{a} < 0$ (a and k have the same sign), there are none.

(d) When $a > 0$, $-\frac{k}{a}$ has the opposite sign of k, so "opposite signs" is the same as "$k < 0$." Riley's rule matches the correct rule for every parabola that opens upward, which is why it seemed true.

Rubric: 1 point: Three of the four parts complete and correct.
0 points: Anything less, including a response that is only partly correct.

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Create questions › Math 2 › PT › Area 3 · Claim 3 › Standard group › DOK 4 › Generate

Written for this guide

MATH 2 · CLAIM 3 · COMMUNICATING REASONING

3F Base arguments on concrete referents such as objects, drawings, diagrams, and actions

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students connect a cube model to the meaning of a one-third exponent and choose the reasoning that matches it, linking a concrete picture to a rule.

A baker models how baking time relates to dough size using $t = 5 \cdot d^{1/3}$, where d is dough weight and t is baking time in minutes. The baker explains that $d^{1/3}$ means "the number that, when multiplied by itself three times, equals d." She then says $2^{1/3}$ represents the cube root of 2 because $(2^{1/3})^3 = 2$. Which of the following best completes the baker's reasoning using this concrete model?

- ○ Therefore, $2^{1/3} \approx 1.26$, and multiplying 1.26 by itself three times gives roughly 2.
- ○ Therefore, $2^{1/3} = \frac{2}{3}$, since the denominator tells us to divide the base by 3.
- ✓ Therefore, $2^{1/3}$ equals the side length of a cube with volume 2, showing that $(2^{1/3})^3 = 2^{3/3} = 2^1 = 2$.
- ○ Therefore, $d^{1/3}$ is always smaller than d, so baking time will always be less than the dough weight.

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Create questions › Math 2 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must use two physical models together, a cube and one of its faces, to explain and justify a rational exponent rule.

A coach has a storage crate shaped like a cube used to hold sports balls. The crate has a volume of 64 cubic feet, and it is built from small unit cubes (1 ft x 1 ft x 1 ft) stacked evenly in a 4-by-4-by-4 arrangement. (a) Use this concrete cube arrangement to explain why $64^{1/3} = 4$. (b) The coach then looks at just one face of the crate, a 4-by-4 square of unit squares, and uses it to represent $64^{2/3}$. Explain, using this square and the properties of exponents, why $64^{2/3} = 16$, and explain how the cube and square models together show that $64^{2/3} = \left(64^{1/3}\right)^2$.

Model response: Since the crate is built from 4 layers of 4-by-4 unit cubes, it contains 4 x 4 x 4 = 64 unit cubes, so a cube with edge length 4 has volume 64; this means the number whose cube is 64 (i.e., $64^{1/3}$) is 4, matching the definition of a cube root. The face of the crate is a 4-by-4 square made of 16 unit squares, so its area is $4^2 = 16$. Since $64^{1/3} = 4$ from the cube model, squaring that result gives $\left(64^{1/3}\right)^2 = 4^2 = 16$, which matches the face's area. By the properties of integer exponents, $\left(64^{1/3}\right)^2 = 64^{2/3}$, so the cube model (finding the edge length) and the square model (finding the face area) together physically demonstrate that $64^{2/3} = 16$: the cube gives the base value 4, and the square shows what happens when that value is raised to the second power, confirming the rational exponent rule $a^{m/n} = \left(a^{1/n}\right)^m$.

Rubric: 1 point: Correctly identifies edge length 4 from the cube model, correctly computes the square's area as 16, and clearly explains how both concrete models together justify $64^{2/3} = \left(64^{1/3}\right)^2 = 16$, connecting the physical arrangement to the exponent rule.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 3 · Claim 3 › Standard group › DOK 3 › Generate

Test Bank question

MATH 2 · CLAIM 3 · COMMUNICATING REASONING

3G Determine conditions under which an argument does and does not apply

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students test a general claim on specific values and identify the case (negative base, even root) where it does not apply.

At a science fair, Maya is presenting a poster about rational exponents. She claims: 'For any real number a and positive integer n, the expression $a^{1/n}$ always equals $\sqrt[n]{a}$ and is a real number.' Use the table to test her claim on different values of a and n, and complete the missing entries.

a	n	$a^{1/n}$	**Is the result a real number?**
32	5	**2**	yes
-32	5	**-2**	yes
-16	2	not real	no ▾
81	4	**3**	yes

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must determine and justify exactly when a rule holds and fails, state a corrected general rule, and explain why the exponent property changes.

A track analyst is modeling a sprinter's stride data and writes the rule $(x^2)^{1/2} = x$ to simplify expressions where x represents a sprinter's velocity change (in meters per second), which can be positive (speeding up) or negative (slowing down). The analyst claims this rule, following from the properties of exponents, works for every real number x. Determine the conditions on x for which the analyst's rule is valid and the conditions for which it fails. If it fails, state the correct general rule that applies for all real x, and explain why the exponent property that works for integer exponents needs modification when extended to rational exponents like $1/2$.

Model response: The rule $(x^2)^{1/2} = x$ only holds when $x \geq 0$. Since $x^{1/2}$ denotes the principal (non-negative) square root, $(x^2)^{1/2}$ must equal a non-negative number. For $x \geq 0$, $(x^2)^{1/2} = x$ since x itself is non-negative and squares back to x^2. But if $x < 0$, say $x = -3$ (a sprinter slowing down by 3 m/s), then $x^2 = 9$ and $9^{1/2} = 3$, not -3. So the correct general rule for all real x is $(x^2)^{1/2} = |x|$. This modification is necessary because when extending integer exponent rules (where $(x^n)^{1/n}$ simply undoes raising to the nth power for any real x when n is odd) to even denominators, the rational exponent $1/2$ is defined only to produce a non-negative output, so the sign information about x is lost when x is squared first. Thus the analyst's rule applies only to non-negative velocity changes; for negative changes, the absolute value form must be used instead.

Rubric: 1 point: complete and correct with clear reasoning.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 3 · Claim 3 › Standard group › DOK 3 › Generate

Test Bank question

CLAIM 4

Claim 4 · Modeling & Data Analysis

Students can analyze complex, real-world scenarios and can construct and use mathematical models to interpret and solve problems. In the Test Bank, Claims 2, 3 and 4 are built in the performance task (PT) step: choose PT, then Area 2 · Claims 2 + 4. Each question card is marked with its claim and target (for example "Claim 4 · Tgt A"), so generate a set at the DOK you want and keep the cards for the target you need.

Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › Options: DOK › Generate

MATH 2 · CLAIM 4 · MODELING & DATA ANALYSIS

4A Apply mathematics to solve problems from everyday life (Modeling)

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students apply a given model to a real situation and solve by isolating the cube root and cubing, a short two-step process.

Sports scientists modeling cycling performance found that a cyclist's top speed v (in meters per second) relates to their power output P (in watts) by the equation $v = 4P^{1/3}$. If a cyclist reaches a top speed of 12 meters per second, find the power output P, in watts, using this model.

Correct answer: **27**

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must build a profit model, find its maximum, recognize that a constraint rules it out, and reason about where the best allowed price is, which requires planning and justification.

The student council will sell T-shirts. A survey suggests that if the price is p dollars, they will sell $300 - 10p$ shirts. Each shirt costs the council 8 dollars. The supplier requires a minimum order of 150 shirts, and the council will order exactly as many shirts as it expects to sell.

What price should the council charge to earn the greatest possible profit while meeting the supplier's minimum order? Show your work, and explain why the price that maximizes the profit function by itself is not the answer.

Model response: Profit is (price minus cost) times the number sold: $P(p) = (p - 8)(300 - 10p) = -10p^2 + 380p - 2400$. The vertex is at $p = -\frac{380}{2(-10)} = 19$, giving a profit of $(11)(110) = 1210$ dollars. However, at 19 dollars the council expects to sell only $300 - 190 = 110$ shirts, which is below the minimum order of 150. The minimum order requires $300 - 10p \geq 150$, so $p \leq 15$. Because the parabola opens downward with its vertex at $p = 19$, profit increases as p increases toward 19, so on the allowed prices $p \leq 15$ the greatest profit is at $p = 15$: $(15 - 8)(150) = 1050$ dollars. The council should charge 15 dollars per shirt.

Rubric: 1 point: Writes a correct profit model, finds the unconstrained maximum at 19 dollars, recognizes that it violates the minimum order, determines that $p \leq 15$, and justifies that 15 dollars (profit 1050 dollars) is the best allowed price.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

MATH 2 · CLAIM 4 · MODELING & DATA ANALYSIS

4B Construct chains of reasoning to justify mathematical models

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 DOK 4 DOK 4 is assessed only in the performance task.

DOK 2 · Skills & concepts

Why DOK 2: Students choose the explanation that connects the square-root shape to diminishing returns, interpreting a model's form at a basic level.

A strength coach models the relationship between an athlete's training intensity and muscle growth. After analyzing data, the coach proposes that muscle fiber thickness t (in micrometers) can be expressed as $t = 50 \cdot I^{1/2}$, where I is a training intensity index from 0 to 100. The coach justifies this model by noting that: (1) doubling the intensity does not double the growth, (2) increases in thickness become more gradual at higher intensities, and (3) the model uses a rational exponent because muscle adaptation follows a square-root pattern rather than a linear or exponential pattern. Which statement best explains why the rational exponent $1/2$ (rather than 1 or 2) is the most appropriate choice for this modeling context?

- ✓ A rational exponent of $1/2$ is appropriate because $50 \cdot I^{1/2} = 50\sqrt{I}$ captures diminishing returns—each unit increase in intensity produces progressively smaller gains in thickness, matching observed biological data where adaptation rates decrease at high intensity.
- A rational exponent of $1/2$ should be used because it always produces smaller numbers than a linear model, and muscle thickness measurements are typically small values in micrometers.
- A rational exponent of $1/2$ works best because it converts the intensity index into a square root, which is the standard form for all sports science models regardless of the specific phenomenon being measured.
- A rational exponent of $1/2$ is better than an exponent of 2 because $I^{1/2}$ and I^2 are reciprocals, so $1/2$ automatically gives the correct inverse relationship for biological systems.

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must test three competing models against data, argue which fits and why, and reason about what the exponent implies for larger inputs.

A sports scientist studies how a weightlifter's maximum lift capacity L (in hundreds of kg) depends on body mass m (in kg). She collects three data points: $(m, L) = (8, 4),\ (27, 9),\ (64, 16)$. She proposes the power model $L = m^{2/3}$, but a colleague suggests instead the linear model $L = 0.5m$ or the model $L = m^{1/3}$. Rewrite $m^{2/3}$ as a radical expression, use it to test all three models against the data, and explain which model best fits the data and why. Discuss what the exponent implies about how lift capacity scales as body mass increases, and explain the risk of using the linear model to predict lift capacity for a much heavier athlete.

Model response: Since $m^{2/3} = (m^{1/3})^2 = (\sqrt[3]{m})^2$, testing the data: for $m = 8$, $\sqrt[3]{8} = 2$, so $2^2 = 4$ ✓; for $m = 27$, $\sqrt[3]{27} = 3$, so $3^2 = 9$ ✓; for $m = 64$, $\sqrt[3]{64} = 4$, so $4^2 = 16$ ✓. The model $L = m^{2/3}$ fits all three points exactly. The linear model $L = 0.5m$ only matches the first point ($0.5(8) = 4$) but fails badly for the others ($0.5(27) = 13.5 \neq 9$; $0.5(64) = 32 \neq 16$), overestimating lift capacity as mass grows — a serious risk if used to predict values for heavier athletes, since it assumes lift capacity grows proportionally with mass rather than sublinearly. The model $L = m^{1/3}$ fails even at the first point ($8^{1/3} = 2 \neq 4$), so it is rejected outright. Because $L = m^{2/3}$ matches every data point exactly while the alternatives fail, it is the best choice; the exponent $2/3$ reflects a sublinear (diminishing-returns) relationship, consistent with strength scaling roughly with muscle cross-sectional area rather than total body volume, meaning heavier athletes gain lift capacity more slowly than their mass increases.

Rubric: 1 point: Correctly rewrites $m^{2/3}$ as $(\sqrt[3]{m})^2$, verifies it fits all three data points exactly, shows the linear and $m^{1/3}$ models fail with specific calculations, identifies $m^{2/3}$ as the best model, and explains the sublinear scaling implication and risk of the linear model for larger masses.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Test Bank question

DOK 4 · Extended thinking

Why DOK 4: Students build a model from data, justify its form, optimize under a whole-number condition, then revise for costs and judge limits, an extended chain of modeling reasoning.

The soccer team surveyed families about a car wash fundraiser. The table shows the price per car and the number of cars the team expects at that price.

Price per car (dollars)	4	6	8	10	12
Expected cars	130	110	90	70	50

(a) Show that a linear function fits the expected number of cars, and write it as a function of the price p.

(b) Use your function to write a revenue model $R(p)$. Explain why revenue is modeled by a quadratic function even though the number of cars is linear.
(c) Find the price that gives the greatest revenue. The team will charge only a whole-dollar price. Which price or prices should they choose? Justify your answer.
(d) Supplies cost 1.50 dollars per car. Write a profit model and decide whether the best whole-dollar price changes. Justify your decision with calculations.
(e) Describe one limitation of using this model to predict the number of cars at a price of 18 dollars.

Model response: (a) Each 2-dollar increase in price lowers the expected number of cars by 20, a constant rate of -10 cars per dollar, so the data are linear. Using $(4, 130)$: $c(p) = 130 - 10(p - 4) = 170 - 10p$. Check: $c(12) = 50$.

(b) $R(p) = p \cdot c(p) = p(170 - 10p) = -10p^2 + 170p$. Revenue is a price times a number of cars, and the number of cars itself depends on price, so the product contains a p^2 term. Raising the price earns more per car but loses cars, so revenue rises and then falls, which is a quadratic pattern.

(c) The vertex is at $p = -\frac{170}{2(-10)} = 8.5$, with $R(8.5) = 722.50$ dollars. For whole-dollar prices, $R(8) = 8 \cdot 90 = 720$ and $R(9) = 9 \cdot 80 = 720$. These are equally good and better than any other whole-dollar price, so the team can choose 8 or 9 dollars.

(d) Profit $= (p - 1.5)(170 - 10p) = -10p^2 + 185p - 255$, with vertex at $p = 9.25$. Profit at 9 dollars: $7.5 \cdot 80 = 600$ dollars. Profit at 10 dollars: $8.5 \cdot 70 = 595$ dollars. Profit at 8 dollars: $6.5 \cdot 90 = 585$ dollars. The best whole-dollar price is now 9 dollars, so the supply cost breaks the tie.

(e) At 18 dollars the model predicts $170 - 180 = -10$ cars, which is impossible. The model only makes sense for prices up to 17 dollars, and the survey only covered prices from 4 to 12 dollars, so predictions far outside that range are unreliable.

Rubric: 1 point: Four parts correct and justified.
0 points: Anything less, including a response that is only partly correct.

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Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 4 › Generate

Written for this guide

MATH 2 · CLAIM 4 · MODELING & DATA ANALYSIS

4C State logical assumptions being used

Assessed at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recognize a standard modeling assumption, that air resistance is ignored, which is identifying a familiar fact rather than reasoning about it.

A coach models the distance a shot put travels using the formula $d = v_0^{2/3}$, where d is the distance in meters and v_0 is the initial velocity. Which of the following is a logical assumption the coach is making in this model?

- ○ The shot put will travel in a perfectly straight line regardless of angle.
- ○ The effects of air resistance and other real-world factors are negligible and can be ignored. ✓
- ○ The initial velocity must be expressed as a fraction rather than a whole number.
- ○ The distance traveled is inversely proportional to the square root of velocity.

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must connect the scaling factor to the shape of the crate and explain which assumption makes the rational-exponent model valid.

A strength coach stores weight plates in cube-shaped crates. For a cube with side length s feet, the volume is $V = s^3$, so solving for the side length gives $s = V^{1/3}$. The coach wants to build a new crate with twice the volume of his current crate, so he calculates the new side length as $s_{new} = s_{old} \cdot 2^{1/3}$. Which assumption must hold for this rational-exponent model to correctly give the new side length?

- [x] The crate must remain a cube, with all three dimensions scaling by the same factor as volume changes
- [ ] The weight of material used to build the crate stays exactly the same when volume doubles
- [ ] The formula $s = V^{1/3}$ only applies when the side length s is a whole number
- [ ] The volume of the crate increases at a constant rate as the side length increases

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students analyze several stated assumptions about domain, structure, and population, judging which hold and which are unjustified, which requires evaluating the model's limits.

A coach models the relationship between athletes' training intensity (measured on a scale from 1 to 10) and their vertical jump height using the equation $h = 18 + 6\sqrt[3]{t}$, where h is jump height in inches and t is training intensity. For each statement about the assumptions embedded in this model, determine whether it is true or false.

	True	False
The model assumes that the relationship between training intensity and jump height follows a cube root function, which implicitly assumes that increases in training intensity produce diminishing returns in jump improvement—a key structural assumption needed to justify why the rate of height gain slows as t increases.	☑	☐
The model assumes that training intensity values outside the stated 1–10 scale (such as $t = 0$ or $t = 15$) will produce reliable predictions, meaning no boundary conditions or practical limitations constrain the model's domain.	☐	☑
The model assumes that all athletes respond identically to the same training intensity level, which means individual variation in factors like genetics, prior training history, and biomechanics are either negligible or averaged across the athlete population.	☑	☐
The model assumes that jump height depends only on current training intensity and is independent of cumulative fatigue, recovery time, or changes in training methods —an assumption that simplifies reality but may break down over longer time periods.	☑	☐
The constant term 18 in the model represents the baseline jump height when training intensity is zero, which is a valid assumption for all athletes regardless of their initial fitness level.	☐	☑

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Test Bank question

MATH 2 · CLAIM 4 · MODELING & DATA ANALYSIS

4D Interpret results in the context of a situation

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students check a computed result against real-world speeds and interpret whether it makes sense, connecting the math to context.

A sports analyst is building a model to estimate race times. She proposes the formula $T = 0.6\,d^{1/2}$, where T is the predicted time in seconds and d is the race distance in meters. She uses the formula to predict the time for a 400-meter race: $T = 0.6(400)^{1/2} = 0.6(20) = 12$ seconds. Which statement best interprets whether this result makes sense?

- ○ The result makes sense because 12 seconds is less than the current world record of about 43 seconds for 400 meters, so the model gives a reasonable, achievable time.
- ○ The result does not make sense because a time of 12 seconds for 400 meters implies an average speed of about 33 m/s, which is far faster than any human can run (top sprinters reach only about 10 m/s), so the model is unrealistic at this distance. ✓
- ○ The result does not make sense because $400^{1/2}$ should have been calculated as $400/2 = 200$, not 20, so the time should be much larger.
- ○ The result makes sense because the units of the formula work out correctly, so any value the formula produces must be physically reasonable.

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students compute two outputs, compare the ratio to a manager's claim, and justify with exponent reasoning why area grows more slowly than volume.

A sporting goods company models the amount of rubber coating needed for a training ball using $C = 4.8V^{2/3}$, where C is the coating area in square inches and V is the ball's volume in cubic inches. A standard ball has $V = 36$ cubic inches, and a larger training ball has $V = 288$ cubic inches (8 times the volume). The manager assumes that because the volume is 8 times larger, the company should budget 8 times as much rubber coating for the larger ball. Calculate the coating area C for each ball, and use the properties of rational exponents to explain whether the manager's reasoning makes sense. Should the coating budget scale by a factor of 8? Justify your answer.

Model response: For the standard ball: $C = 4.8(36)^{2/3} \approx 4.8(10.90) \approx 52.3$ square inches. For the larger ball: $C = 4.8(288)^{2/3} \approx 4.8(43.6) \approx 209.3$ square inches. The ratio of coating areas is $209.3/52.3 \approx 4$, not 8. This makes sense because $288/36 = 8$, and $8^{2/3} = (2^3)^{2/3} = 2^2 = 4$: since volume scales with the cube of the linear dimension but surface area (and coating) scales with the square, an 8-fold increase in volume corresponds to only a 4-fold increase in coating area. The manager's assumption is incorrect — the company should budget about 4 times as much coating, not 8, since surface area grows more slowly than volume as size increases.

Rubric: 1 point: Correctly computes both coating areas (about 52.3 and 209.3 square inches), identifies the ratio as 4 (not 8), and explains using rational-exponent reasoning ($8^{2/3} = 4$) why area scales more slowly than volume, connecting this to the manager's flawed budgeting assumption.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Test Bank question

MATH 2 · CLAIM 4 · MODELING & DATA ANALYSIS

4E Analyze adequacy and make improvements to existing models

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 DOK 4 DOK 4 is assessed only in the performance task.

DOK 2 · Skills & concepts

Why DOK 2: Students compare a model's predictions to data and interpret the mismatch to choose a better model, which takes more than one step but follows a direct path.

A coach recorded the height of a tossed ball at several times.

Time t (seconds)	0	0.5	1	1.5	2
Height (feet)	5	17	21	17	5

An assistant used the first two data points to build the linear model $h = 24t + 5$. Which statement best evaluates the linear model and gives a better model?

- ○ The linear model is adequate because it matches the heights at $t = 0$ and $t = 0.5$.
- ○ The linear model is not adequate because it predicts the ball keeps rising (29 feet at $t = 1$ and 53 feet at $t = 2$) while the data rise and then fall; the quadratic model $h = -16t^2 + 32t + 5$ matches every data point. ✓
- ○ The linear model is not adequate, but the steeper linear model $h = 32t + 5$ would match every data point.
- ○ The linear model is not adequate; the quadratic model $h = 16t^2 + 32t + 5$ matches every data point.

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Written for this guide

DOK 3 · Strategic thinking

Why DOK 3: Students analyze residuals to judge a model's adequacy, test an improved model, and defend which prediction to trust, which requires reasoning from evidence across several steps.

A driving instructor collected data on the total stopping distance of a car at different speeds.

Speed v (mph)	20	30	40	50	60
Stopping distance d (feet)	40	75	120	175	240

A student proposes the linear model $d = 5v - 60$.

(a) Find the residual (actual minus predicted) for each data point.
(b) Describe the pattern in the residuals and explain what it shows about the linear model.
(c) Test the model $d = 0.05v^2 + v$ against the data, and explain whether it is an improvement.
(d) Use both models to predict the stopping distance at 70 mph. Which prediction would you trust more for a safety poster? Explain why.

Model response: (a) Predictions from $d = 5v - 60$: 40, 90, 140, 190, 240. Residuals: $40 - 40 = 0$, $75 - 90 = -15$, $120 - 140 = -20$, $175 - 190 = -15$, $240 - 240 = 0$.

(b) The residuals are 0, negative in the middle, and 0 again, forming a U-shaped (curved) pattern instead of a random scatter around 0. This shows the data curve upward and a straight line is the wrong shape: it overestimates in the middle and will underestimate beyond the data.

(c) $d = 0.05v^2 + v$ gives $20 + 20 = 40$, $45 + 30 = 75$, $80 + 40 = 120$, $125 + 50 = 175$, and $180 + 60 = 240$. Every residual is 0, so the quadratic model is a clear improvement.

(d) Linear: $5(70) - 60 = 290$ feet. Quadratic: $0.05(4900) + 70 = 315$ feet. I would trust the quadratic prediction, because it fits all the data and follows the curved pattern. The linear model underestimates stopping distance at higher speeds, which would be dangerous on a safety poster.

Rubric: 1 point: Computes all residuals correctly, explains that the curved residual pattern shows the linear model is the wrong shape, verifies that the quadratic model fits the data, and makes both predictions at 70 mph with a reasoned choice of the quadratic model.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

DOK 4 · Extended thinking

Why DOK 4: Students analyze residuals, revise a model, apply it under new conditions, and evaluate its limits, an extended investigation across several conditions.

A physics class launches a ball straight up from the top of a 6-foot platform. A textbook model for the height of a ball launched upward at 20 feet per second is $h(t) = -16t^2 + 20t$, where h is the height in feet and t is the time in seconds. The class recorded this data:

t (seconds)	0	0.25	0.5	0.75	1
Height above the ground (feet)	6	10	12	12	10

(a) Compute the textbook model's prediction and the residual (actual minus predicted) for each time. Describe the pattern.
(b) Explain what the pattern reveals about why the textbook model is not adequate here, and write an improved model.
(c) Use both models to predict when the ball hits the ground. Explain which prediction is reasonable and why.
(d) The class plans a second trial with the same launch speed from a 10-foot platform. Adjust your model and predict when the ball will hit the ground, to the nearest hundredth of a second.
(e) Describe one factor not included in any of these models that could make real results differ, and explain how it could affect the results.

Model response: (a) Textbook predictions $h(t) = -16t^2 + 20t$: 0, 4, 6, 6, 4. Residuals: 6, 6, 6, 6, 6. Every residual is exactly 6 feet.

(b) A constant residual of 6 means the textbook model has the right shape but is shifted down by 6 feet: it assumes the ball starts at ground level, but it was launched from a 6-foot platform. Improved model: $h(t) = -16t^2 + 20t + 6$, which matches all five data points.

(c) Textbook model: $-16t^2 + 20t = 0$ gives $t = 0$ or $t = 1.25$ seconds. Improved model: $-16t^2 + 20t + 6 = 0$ gives $8t^2 - 10t - 3 = 0$, so $(4t + 1)(2t - 3) = 0$ and $t = 1.5$ seconds (the root $t = -0.25$ is rejected). The improved prediction of 1.5 seconds is reasonable because it accounts for the extra 6 feet the ball must fall; the textbook model predicts landing on the platform level, not the ground.

(d) From a 10-foot platform: $h(t) = -16t^2 + 20t + 10$. Setting $h(t) = 0$ gives $8t^2 - 10t - 5 = 0$, so $t = \frac{10 + \sqrt{260}}{16} \approx 1.63$ seconds.

(e) Sample: Air resistance is ignored. It would slow the ball, so the ball would not rise as high as predicted and the landing time would differ from the model's value. Another factor: if the actual launch speed is not exactly 20 feet per second, a faster launch would make the ball land later and a slower launch would make it land sooner.

Rubric: 1 point: Four parts correct.

0 points: Anything less, including a response that is only partly correct.

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Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 4 › Generate

Written for this guide

MATH 2 · CLAIM 4 · MODELING & DATA ANALYSIS

4F Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flow charts, or formulas)

Assessed at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students combine exponents with one rule and name the input and output quantities, a direct identification task.

Use the drop-down menus to complete the statement.

A track coach models an athlete's "training load index" using the expression $L = 4t^{1/2} \cdot t^{1/3}$, where t is the number of minutes the athlete trains. Applying the properties of exponents, this expression can be rewritten as $L =$ [$4t^{5/6}$ ▾]. In this model, the independent (input) quantity is [the training time t ▾], and the dependent (output) quantity that the coach is trying to determine is [the training load index L ▾].

Drop-down 1 choices: $4t^{2/5}$ | $8t^{5/6}$ | $4t^{1/6}$ | $4t^{5/6}$ ✓

Drop-down 2 choices: the number of athletes | the training load index L | **the training time t ✓**

Drop-down 3 choices: **the training load index L ✓** | the training time t | the constant 4

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students evaluate several statements by connecting two linked formulas, substituting one into the other, and checking how the quantities depend on each other.

A sports analyst builds a model for a 100-meter training program. For a sprint of distance d meters, she models the completion time as $t(d) = 2d^{1/2}$ seconds, and defines average speed as $v(d) = \dfrac{d}{t(d)}$ meters per second. Which statements correctly describe the quantities and relationships in this system? Select all that apply.

- [x] In this system, distance d is the independent variable, while time t and speed v are dependent variables that respond to changes in d.
- [x] Because $d^{1/2} = \sqrt{d}$, increasing the distance from 4 meters to 16 meters changes the time from $t(4) = 2\sqrt{4} = 4$ seconds to $t(16) = 2\sqrt{16} = 8$ seconds.
- [x] Substituting $t(d) = 2d^{1/2}$ into $v(d) = \dfrac{d}{t(d)}$ gives $v(d) = \dfrac{1}{2}d^{1/2}$, showing that v and t are linked through the same rational exponent $\frac{1}{2}$ rather than by independent formulas.
- [ ] Time t is the independent variable in this model, and it determines both d and v.
- [ ] Since $d^{1/2}$ means d divided by 2, tripling the distance d will triple the time t.
- [ ] The exponent $\frac{1}{2}$ in $d^{1/2}$ means the distance d is squared before the time is calculated.
- [x] If the distance d decreases, the model predicts that the time t also decreases, since t is an increasing function of d.

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must identify several related quantities, map them onto a right-triangle diagram, apply two different relationships, and decide which constraint controls, which requires strategic thinking.

A drone operator stands in an open field. The drone flies at a constant altitude of 150 feet. Two safety rules apply:

- The straight-line distance from the operator to the drone must be at most 400 feet.
- The angle of elevation from the operator to the drone must be at least 30° so the drone stays visible above a tree line.

(a) Draw and label a diagram that shows the operator, the drone, the altitude, the horizontal distance d, the line-of-sight distance s, and the angle of elevation θ.
(b) Write an equation or inequality that relates d to each rule.
(c) Determine the greatest horizontal distance the drone can fly from the operator while following both rules, to the nearest tenth of a foot. Explain which rule limits the distance and why.

Model response: (a) The diagram is a right triangle: the operator at one acute angle, the drone at the top, the 150-foot altitude as the vertical leg, the horizontal distance d as the horizontal leg, the line of sight s as the hypotenuse, and the angle of elevation θ at the operator.

(b) Rule 1: $s = \sqrt{d^2 + 150^2} \le 400$, so $d^2 + 22500 \le 160000$. Rule 2: $\tan\theta = \frac{150}{d}$, and $\theta \ge 30^\circ$ means $\frac{150}{d} \ge \tan 30^\circ$, so $d \le \frac{150}{\tan 30^\circ}$.

(c) Rule 1 gives $d \le \sqrt{137500} \approx 370.8$ feet. Rule 2 gives $d \le \frac{150}{\tan 30^\circ} = 150\sqrt{3} \approx 259.8$ feet. Both rules must hold, so the greatest horizontal distance is about 259.8 feet. The angle rule is the one that limits the distance: at 259.8 feet the line of sight is only $\sqrt{259.8^2 + 150^2} = 300$ feet, well under 400, but any farther and the angle of elevation drops below 30°.

Rubric: 1 point: Draws a correctly labeled right-triangle diagram, writes a correct relationship for each rule, finds both limits (about 370.8 ft and 259.8 ft), and concludes that the angle rule limits the distance to about 259.8 ft with an explanation.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

MATH 2 · CLAIM 4 · MODELING & DATA ANALYSIS

4G Identify, analyze, and synthesize relevant external resources to pose or solve problems

Assessed at: ~~DOK 1~~ ~~DOK 2~~ DOK 3 DOK 4 Assessed only in the performance task, at DOK 3 and 4.

DOK 3 · Strategic thinking

Why DOK 3: Students must judge which of two external sources is reliable and why, then use that information in the model, combining evaluation of evidence with computation.

A sports-biomechanics researcher models a sprinter's peak ground reaction force F (in newtons) as a function of the sprinter's maximum velocity v (in meters per second) using the equation $F = 200v^{3/2}$. Two resources report the sprinter's measured maximum velocity: (1) a peer-reviewed biomechanics journal, using laser-timing gates calibrated to 0.01 s accuracy, reports $v = 9$ m/s; (2) a fitness-tracking phone app, using consumer GPS known to overestimate speed due to signal lag, reports $v = 9.61$ m/s. Using the more reliable data source, find F, in newtons.

Correct answer: **5400**

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Test Bank question

DOK 4 · Extended thinking

Why DOK 4: Students must select relevant information from several sources, ignore distractors, build and analyze a model, and synthesize a recommendation, which is extended thinking.

The softball coach wants to use a pitching machine indoors to launch balls straight up for pop-fly practice. She has gathered these resources:

Resource 1 (physics reference): An object launched straight up with an initial velocity of v_0 feet per second from an initial height of h_0 feet has height $h(t) = -16t^2 + v_0 t + h_0$ feet after t seconds, if air resistance is ignored.

Resource 2 (machine manual): The machine launches balls from a height of 3 feet. Its speed dial can be set anywhere from 30 to 60 feet per second. The coach's usual setting is 48 feet per second.

Resource 3 (gym facility sheet): The ceiling is 40 feet high. Light fixtures hang 4 feet below the ceiling. The gym floor is 94 feet by 50 feet.

Resource 4 (weather report): Outdoor winds today are 15 miles per hour from the west.

(a) Decide which resources and which pieces of information are relevant to whether a ball will hit the lights, and explain why the others are not needed.

(b) Determine whether a ball launched at the usual setting will hit the light fixtures. Show your work.
(c) Find the greatest whole-number speed setting, in feet per second, that keeps the ball at least 1 foot below the light fixtures.
(d) Write a short recommendation to the coach that uses your results and states one assumption that could affect it.

Model response: (a) Relevant: Resource 1 (the height formula), the 3-foot launch height and the speed settings from Resource 2, and the ceiling height and light position from Resource 3 (lights hang at $40 - 4 = 36$ feet). Not needed: the floor dimensions (the ball goes straight up) and Resource 4 (outdoor wind does not affect an indoor launch).

(b) At the usual setting, $h(t) = -16t^2 + 48t + 3$. The vertex is at $t = \frac{48}{32} = 1.5$ seconds, and $h(1.5) = -36 + 72 + 3 = 39$ feet. Since 39 feet is above the 36-foot lights, the ball will hit the light fixtures.

(c) The maximum height for launch speed v_0 occurs at $t = \frac{v_0}{32}$, giving $h_{max} = 3 + \frac{v_0^2}{64}$. To stay at least 1 foot below the lights: $3 + \frac{v_0^2}{64} \leq 35$, so $v_0^2 \leq 2048$ and $v_0 \leq 45.25$. The greatest whole-number setting is 45 feet per second (maximum height about 34.6 feet). A setting of 46 gives about 36.1 feet, which is too high.

(d) Sample: "Do not use the usual 48 ft/s setting indoors; the balls would reach about 39 feet and hit the lights at 36 feet. Set the machine to 45 ft/s or lower, which keeps the highest point about 34.6 feet. This assumes the machine's speed dial is accurate and that the launch height stays at 3 feet; if the dial reads low, choose a lower setting for safety."

Rubric: 1 point: Three of the four parts correct.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 2 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 4 › Generate

Written for this guide

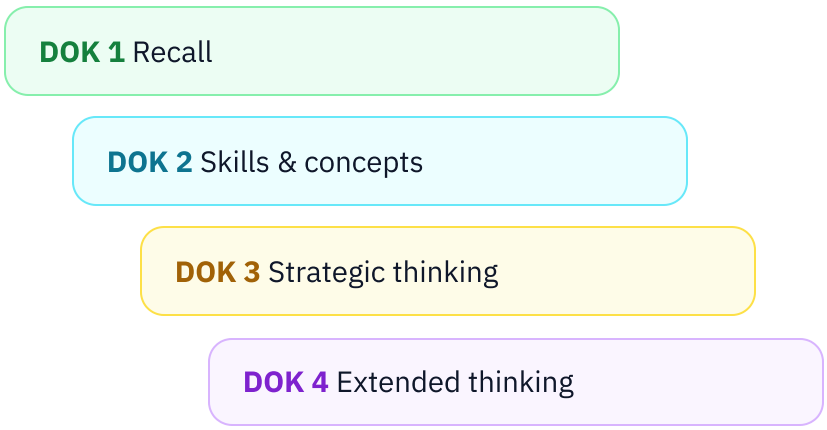
Sources

- Smarter Balanced Assessment Consortium, 2015–16 Summative Technical Report: claim statements, and the Appendix 2.A test blueprints (pp. 43–48), which list the DOK levels assessed for every claim and target. https://www.cde.ca.gov/ta/tg/ca/documents/sb16sbtechrpt.pdf
- Target wording and standards: Smarter Balanced Mathematics Content Specifications and the CCSS for Mathematics, as stored in the AchieveMetrics Test Bank.
- DOK level definitions: Smarter Balanced Content Specifications (Webb Depth of Knowledge), summarised on the "How to use" page.
- Example questions: the AchieveMetrics Test Bank, reviewed for this guide.

DOK PROGRESSION GUIDE · SBAC MATHEMATICS

Math 3

Every SBAC claim and target for Math 3, with a Test Bank question at each Depth of Knowledge (DOK) level the blueprint assesses, and the clicks to find more.



For Math 3 teachers. Claims, targets and DOK levels follow the official Smarter Balanced blueprint.

achievemetricstestbank.com · October 2026 edition

How to use this booklet

Depth of Knowledge (DOK) describes the kind of thinking a question asks for, not how hard it is. A long calculation can still be DOK 1, and a short question can be DOK 3. For each target, this booklet shows one question at every DOK level SBAC assesses it at, so you can see the climb and then pick questions at the level your students need next.

The four DOK levels

DOK 1 · Recall — Recall a fact, term or property, or carry out a routine one-step procedure. Read a value straight from a table or graph.

DOK 2 · Skills & concepts — Decide how to approach it and use two or more steps: compare, classify, interpret data, or move between representations.

DOK 3 · Strategic thinking — Reason and plan: justify an answer, critique an argument, use evidence, or solve a problem with no routine path.

DOK 4 · Extended thinking — Carry out an extended investigation that connects several ideas, conditions or sources. On SBAC, DOK 4 is assessed only in the performance task, and only for Claim 3 and Claim 4 targets.

Reading a target page

1. The heading names the claim, the target code and the official target wording, with the standards it draws on.
2. The DOK ladder shows which levels the SBAC blueprint assesses for this target in this grade. Levels in grey with a line through them are not assessed for this target.
3. One example question at each assessed level, lowest first, with the answer shown. Read them top to bottom to see how the thinking climbs.
4. "Why DOK n" explains in one sentence what makes the question that level, so you can spot the same thing in your own questions.
5. "Find more like this" lists the exact Test Bank clicks that generate more questions for the same target at the same level.

Which DOK levels each target is assessed at comes from the official Smarter Balanced test blueprint for this grade (2015–16 Summative Technical Report, Appendix 2.A). Every example was checked by hand against the DOK definitions above, not just its Test Bank tag. A few targets had no Test Bank question that truly fit a level, so we wrote one; those are marked "Written for this guide."

Finding these questions in the Test Bank

Every example page ends with the exact clicks. These are the two routes, starting from Create questions with Math 3 chosen as the course.

Claim 1 targets (CAT)

Claim 1 questions are filed by target and standard.

Create questions › Math 3 › CAT › Claim 1 target › Standard › Options: DOK 1 or 2 › Item types (optional) › Generate

The DOK buttons only allow the levels the blueprint assesses for that target, so a level that is greyed out in this booklet is greyed out in the Test Bank too.

Claims 2, 3 and 4 (PT)

These claims are built from performance-task standard groups.

Create questions › Math 3 › PT › Area 2 (Claims 2 + 4) or Area 3 (Claim 3) › Standard group › Options: DOK › Generate

Each question card shows its claim and target, such as "Claim 3 · Tgt B". Generate at the DOK you want, then keep the cards for your target.

Questions you have saved

Saved questions are filed the same way in your Item Bank.

More › Item Bank › Math 3 › CAT or PT › Area › Target › DOK

Tip: to move a class up the ladder, generate the same target at the next DOK level. To check that a skill is secure before going further, generate a set at the lowest assessed level.

All targets at a glance

A dot means the SBAC blueprint assesses the target at that DOK level in this grade. Each dot has an example question in this booklet.

Claim 1 · Concepts & Procedures

Target		DOK 1	DOK 2	DOK 3	DOK 4
1B	Use properties of rational and irrational numbers	●	●	–	–
1D	Interpret the structure of expressions	●	●	–	–
1E	Write expressions in equivalent forms to solve problems	●	●	–	–
1F	Perform arithmetic operations on polynomials	–	●	–	–
1G	Create equations that describe numbers or relationships	●	●	–	–
1H	Understand solving equations as a process of reasoning and explain the reasoning	●	●	–	–
1J	Represent and solve equations and inequalities graphically	●	●	–	–
1L	Interpret functions that arise in applications in terms of a context	●	●	–	–
1M	Analyze functions using different representations	●	●	●	–
1N	Build a function that models a relationship between two quantities	–	●	–	–
1P	Summarize, represent, and interpret data on a single measurement variable	–	●	–	–

Claim 2 · Problem Solving

Target		DOK 1	DOK 2	DOK 3	DOK 4
2A	Apply mathematics to solve well-posed problems from everyday life	–	●	●	–
2B	Select and use appropriate tools strategically	●	●	●	–
2C	Interpret results in the context of a situation	●	●	●	–
2D	Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flow charts, or formulas)	●	●	●	–

Claim 3 · Communicating Reasoning

Target		DOK 1	DOK 2	DOK 3	DOK 4
3A	Test propositions or conjectures with specific examples	–	●	●	–
3B	Construct chains of reasoning that will justify or refute propositions	–	●	●	●
3C	State logical assumptions being used	–	●	●	–
3D	Use the technique of breaking an argument into cases	–	●	●	–
3E	Distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in the argument—explain what it is	–	●	●	●
3F	Base arguments on concrete referents such as objects, drawings, diagrams, and actions	–	●	●	–
3G	Determine conditions under which an argument does and does not apply	–	●	●	–

Claim 4 · Modeling & Data Analysis

Target		DOK 1	DOK 2	DOK 3	DOK 4
4A	Apply mathematics to solve problems from everyday life (Modeling)	–	●	●	–
4B	Construct chains of reasoning to justify mathematical models	–	●	●	●
4C	State logical assumptions being used	●	●	●	–
4D	Interpret results in the context of a situation	–	●	●	–
4E	Analyze adequacy and make improvements to existing models	–	●	●	●
4F	Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flow charts, or formulas)	●	●	●	–
4G	Identify, analyze, and synthesize relevant external resources to pose or solve problems	–	–	●	●

CLAIM 1

Claim 1 · Concepts & Procedures

Students can explain and apply mathematical concepts and interpret and carry out mathematical procedures with precision and fluency. Claim 1 is tested with individual items on the computer adaptive test (CAT). In the Test Bank, choose CAT, then the target.

Create questions › Math 3 › CAT › Claim 1 target › Standard › Options: DOK › Generate

MATH 3 · CLAIM 1 · CONCEPTS & PROCEDURES

1B Use properties of rational and irrational numbers

Standards: N-CN.1; N-CN.2; N-CN.7

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students carry out one routine procedure, adding real parts and imaginary parts, with no decisions about strategy, so this is recall and reproduction.

Which expression is equivalent to $(4 + 3i) + (2 - 5i)$?

- ◯ $6 - 2i$ ✓
- ◯ $6 + 8i$
- ◯ $2 + 8i$
- ◯ $4i$

FIND MORE LIKE THIS

Create questions › Math 3 › CAT › Target B › Standard › DOK 1 › Generate Written for this guide

DOK 2 · Skills & concepts

Why DOK 2: Students must choose a method, recognize a negative discriminant, and use $i^2 = -1$ to rewrite the square root, combining several steps.

What are the solutions of $x^2 - 4x + 13 = 0$?

- ◯ $x = 2 \pm 3i$ ✓
- ◯ $x = -2 \pm 3i$
- ◯ $x = 2 \pm 3$
- ◯ $x = 4 \pm 6i$

FIND MORE LIKE THIS

Create questions › Math 3 › CAT › Target B › Standard › DOK 2 › Generate Written for this guide

MATH 3 · CLAIM 1 · CONCEPTS & PROCEDURES

1D Interpret the structure of expressions

Standards: A-SSE.1; A-SSE.2

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students identify and factor out a greatest common factor, a single routine step that reveals the structure, so it is recall of a procedure.

A sports equipment company models the revenue from selling basketballs using the expression $\frac{48x^2-12x}{12x}$, where x represents the number of cases sold. Which of the following correctly identifies the structure of this expression by factoring out the greatest common factor from the numerator?

- ○ $\frac{12(4x^2-x)}{12x} = \frac{4x^2-x}{x}$
- ✓ ○ $\frac{12x(4x-1)}{12x} = 4x - 1$
- ○ $\frac{48x(x-1)}{12x} = 4(x - 1)$
- ○ $\frac{6x(8x-2)}{12x} = \frac{8x-2}{2}$

FIND MORE LIKE THIS

Create questions › Math 3 › CAT › Target D › A-SSE.1 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must factor, decide which parts can cancel, and judge the domain restriction for each statement, interpreting structure rather than just performing one step.

A sports analytics team is analyzing a quarterback's passing performance. The expression $\frac{3x^2+12x}{3x}$ represents the average yards gained per play across multiple games, where x represents the number of plays. Which of the following statements correctly interpret the structure of this expression? Select all that apply.

- [ ] The simplified form $x + 4$ is valid for all real values of x including $x = 0$.
- [x] The coefficient 3 is a common factor of all terms in both the numerator and denominator.
- [ ] The terms $3x^2$ and $12x$ in the numerator are like terms that combine to $15x^2$.
- [x] The common factor $3x$ appears in both the numerator and denominator and can be canceled.
- [x] The numerator can be factored as $3x(x + 4)$, so the expression simplifies to $x + 4$ when $x \neq 0$.

FIND MORE LIKE THIS

Create questions › Math 3 › CAT › Target D › A-SSE.1 › DOK 2 › Generate

Test Bank question

MATH 3 · CLAIM 1 · CONCEPTS & PROCEDURES

1E Write expressions in equivalent forms to solve problems

Standards: A-SSE.4

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students identify the first term, ratio, and number of terms and substitute directly into the geometric series formula, a routine application.

A basketball player practices free throws every day. On Day 1, she makes 2 shots. Each day after, she makes twice as many shots as the previous day. Using the formula for the sum of a finite geometric series, find the total number of shots she makes over the first 6 days. Write your answer as a whole number.

Correct answer: 126

FIND MORE LIKE THIS

Create questions › Math 3 › CAT › Target E › A-SSE.4 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must recognize the doubling pattern as a geometric series, set up the formula correctly, and explain why it applies, linking a context to a representation.

A sports team is selling raffle tickets to raise money for equipment. On the first day, they sell 100 tickets. Each day after, they sell twice as many tickets as the previous day. The team plans to sell tickets for 6 days total.

The sum of a finite geometric series with first term a, common ratio r (where $r \neq 1$), and n terms is:

$$S_n = a \cdot \frac{r^n - 1}{r - 1}$$

Part A: Using the geometric series formula, which expression correctly represents the total number of tickets sold over all 6 days?

Choose one answer.

- ○ $100 \cdot \frac{6^2-1}{6-1} = 700$ tickets
- ✓ ○ $100 \cdot \frac{2^6-1}{2-1} = 6300$ tickets
- ○ $6 \cdot (100 + 2) = 612$ tickets

- ○ $100 \cdot \frac{2^6-1}{2} = 3150$ tickets

Part B: Which explanation best supports why the geometric series formula with $a = 100$, $r = 2$, and $n = 6$ is the correct approach for this problem?

Choose one answer.

- ○ The formula applies because the team sells tickets on both odd and even days, making it geometric in nature.
- ○ The daily ticket sales form a geometric sequence $(100, 200, 400, 800, 1600, 3200)$ where each term is multiplied by the common ratio $r = 2$, and we need the sum of all 6 terms. ✓
- ○ Since there are 6 days, we multiply 100 tickets by 6 to get the total regardless of how sales change each day.
- ○ The total is found by adding 100 plus 6 days, so we use simple arithmetic instead of a formula.

FIND MORE LIKE THIS

Create questions › Math 3 › CAT › Target E › A-SSE.4 › DOK 2 › Generate

Test Bank question

MATH 3 · CLAIM 1 · CONCEPTS & PROCEDURES

1F Perform arithmetic operations on polynomials

Standards: A-APR.1; A-APR.2; A-APR.3; A-APR.4; A-APR.6

Assessed at: ~~DOK 1~~ DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students divide a cubic, check the quotient and remainder, and verify a product, then judge several statements, which takes multiple connected steps.

A student divides $x^3 + 2x^2 - 5x - 6$ by $x - 2$ using polynomial long division. Decide whether each statement about this division is True or False.

	True	False
The quotient is $x^2 + 4x + 3$.	☑	☐
The remainder is 0.	☑	☐
$(x - 2)(x^2 + 4x + 3) = x^3 + 2x^2 - 5x - 6$.	☑	☐
The quotient is $x^2 + 4x - 3$.	☐	☑
The remainder is 5.	☐	☑

FIND MORE LIKE THIS

Create questions › Math 3 › CAT › Target F › A-APR.1 › DOK 2 › Generate

Test Bank question

MATH 3 · CLAIM 1 · CONCEPTS & PROCEDURES

1G Create equations that describe numbers or relationships

Standards: A-CED.1; A-CED.2; A-CED.3; A-CED.4

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students rearrange a familiar formula with standard inverse operations to isolate one variable, a routine procedure with no modeling decisions.

The volume of a cylinder is $V = \pi r^2 h$. Which equation correctly solves this formula for r, where $r > 0$?

- ✓ $r = \sqrt{\dfrac{V}{\pi h}}$
- $r = \dfrac{V}{2\pi h}$
- $r = \sqrt{V - \pi h}$
- $r = \dfrac{\sqrt{V}}{\pi h}$

FIND MORE LIKE THIS

Create questions › Math 3 › CAT › Target G › Standard › DOK 1 › Generate — Written for this guide

DOK 2 · Skills & concepts

Why DOK 2: Students must translate a description into a cubic equation and then choose a way to solve it, which combines creating and solving in more than one step.

A shipping box has a square base. Its height is 3 inches more than the side length of the base, and its volume is 112 cubic inches. Write an equation for the volume in terms of the side length x, and solve it. What is the side length of the base, in inches?

Correct answer: **4**

FIND MORE LIKE THIS

Create questions › Math 3 › CAT › Target G › Standard › DOK 2 › Generate — Written for this guide

MATH 3 · CLAIM 1 · CONCEPTS & PROCEDURES

1H Understand solving equations as a process of reasoning and explain the reasoning

Standards: A-REI.2

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students square both sides of a simple radical equation and check the result, a routine procedure they recognize step by step.

A soccer coach is analyzing player performance using the equation $\sqrt{x-5}=3$, which models the relationship between training hours and goal-scoring improvement. Select all statements that correctly describe the solution process and the solution.

- [x] We must check that $x=14$ makes the original equation true because squaring both sides can introduce extraneous solutions
- [x] When we substitute $x=14$ back into the original equation, we get $\sqrt{14-5}=\sqrt{9}=3$, which is true
- [x] The solution is $x=14$
- [ ] We do not need to check the solution because the equation has no radical sign in the final form
- [x] To solve, square both sides of the equation to get $x-5=9$
- [ ] The solution $x=14$ is extraneous and should be rejected

FIND MORE LIKE THIS

Create questions › Math 3 › CAT › Target H › A-REI.2 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must test both candidate roots in the original equation and reason about why one is extraneous, connecting the squaring step to the check.

Use the drop-down menus to complete the statement.

For $\sqrt{x-5} = x - 7$, squaring gives candidate roots 6 and 9. At $x = 6$, the left side is [1 ▾] and the right side is [-1 ▾], so 6 is rejected. The valid solution is [9 ▾].

Drop-down 1 choices: -1 | **1 ✓** | 2

Drop-down 2 choices: **-1 ✓** | 0 | 1

Drop-down 3 choices: 6 | 7 | **9 ✓**

FIND MORE LIKE THIS

Create questions › Math 3 › CAT › Target H › A-REI.2 › DOK 2 › Generate

Test Bank question

MATH 3 · CLAIM 1 · CONCEPTS & PROCEDURES

1J Represent and solve equations and inequalities graphically

Standards: A-REI.11

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students read directly from a table where two functions have equal outputs, which is recall of what a solution to f(x) = g(x) means.

The table shows values of $f(x) = 2^x$ and $g(x) = x + 1$.
x: $-1, 0, 1, 2, 3$
$f(x)$: $0.5, 1, 2, 4, 8$
$g(x)$: $0, 1, 2, 3, 4$
Which values of x are solutions of the equation $2^x = x + 1$? Select all that apply.

- [ ] $x = -1$
- [x] $x = 0$ ✓
- [x] $x = 1$ ✓
- [ ] $x = 2$
- [ ] $x = 3$

FIND MORE LIKE THIS

Create questions › Math 3 › CAT › Target J › Standard › DOK 1 › Generate

Written for this guide

DOK 2 · Skills & concepts

Why DOK 2: Students must plan a successive-approximation strategy, evaluate both functions at several inputs, and interpret a sign change, which goes beyond reading a single value.

The graphs of $f(x) = 2^x$ and $g(x) = 7 - x$ intersect at exactly one point. Between which two values does the x-coordinate of the intersection point lie?

- ○ between 2.0 and 2.1
- ○ between 2.1 and 2.2
- ✓ between 2.2 and 2.3
- ○ between 2.3 and 2.4

FIND MORE LIKE THIS

Create questions › Math 3 › CAT › Target J › Standard › DOK 2 › Generate

Written for this guide

MATH 3 · CLAIM 1 · CONCEPTS & PROCEDURES

1L Interpret functions that arise in applications in terms of a context

Standards: F-IF.4; F-IF.5; F-IF.6

Assessed at: DOK 1 DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students identify the domain directly from the stated start and end times of the climb, recalling what a domain means in context.

A rock climber's height above ground during an ascent is modeled by the function $h(t) = \sqrt{t} + 2$, where h is height in meters and t is time in seconds. The climber starts at $t = 0$ and reaches the top of the wall at $t = 36$. Which statement correctly describes the domain of this function in the context of the climb?

- ✓ The domain is $0 \leq t \leq 36$ because the climber begins at $t = 0$ seconds and finishes at $t = 36$ seconds.
- The domain is $t \geq 0$ because time cannot be negative.
- The domain is all real numbers because the square root function is defined for all real values.
- The domain is $2 \leq h \leq 8$ because those are the minimum and maximum heights reached.

FIND MORE LIKE THIS

Create questions › Math 3 › CAT › Target L › F-IF.5 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must evaluate the function at two inputs, compute a rate over an interval, and interpret its units in context, which combines several steps.

The number of members in an online club is modeled by $M(t) = 500(1.2)^t$, where t is the number of years since the club started. What is the average rate of change of M from $t = 2$ to $t = 5$, and what does it mean?

- ✓ About 175 members per year; between years 2 and 5 the club gained about 175 members each year on average.
- About 524 members per year; the club had about 524 more members in year 5 than in year 2.
- About 1.2 members per year; membership grows by a factor of 1.2 each year.
- About 415 members per year; this is the average number of members during years 2 through 5.

FIND MORE LIKE THIS

Create questions › Math 3 › CAT › Target L › Standard › DOK 2 › Generate

Written for this guide

MATH 3 · CLAIM 1 · CONCEPTS & PROCEDURES

1M Analyze functions using different representations

Standards: F-IF.7; F-IF.8; F-IF.9; F-BF.3; F-BF.4a

Assessed at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall that the constant added to a trigonometric function sets the midline and read it straight from the equation.

What is the midline of the graph of $y = 4\cos\left(\frac{\pi}{6}x\right) + 10$?

- ◯ $y = 10$ ✓
- ◯ $y = 4$
- ◯ $y = 14$
- ◯ $y = 12$

FIND MORE LIKE THIS

Create questions › Math 3 › CAT › Target M › Standard › DOK 1 › Generate

Written for this guide

DOK 2 · Skills & concepts

Why DOK 2: Students connect the factored form to the graph, finding each zero and using multiplicity to decide whether the graph crosses, translating between representations.

For all real t, let $h(t) = -16t(t - 0.75)(t - 1.5)$. Which statement correctly describes the zeros and crossing behavior of this polynomial graph?

- ◯ Zeros 0.75 and 1.5 only; the factor t gives no zero.
- ◯ Zeros 0, 0.75 and 1.5; the graph only touches at all three zeros.
- ◯ Zeros 0, 0.75 and 1.5; the graph crosses at all three because each factor has multiplicity 1. ✓
- ◯ Zeros 0, 0.75 and 1.5; the graph only touches at 0.75 because it is a repeated root.

FIND MORE LIKE THIS

Create questions › Math 3 › CAT › Target M › F-IF.7 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students compare a table and an exponential equation, compute rates over intervals, and reason about long-run behavior to judge each claim, drawing conclusions from several sources.

Two youth sports leagues are tracking participant growth. League A's number of participants is given by the table below, where x is years since 2015. League B's number of participants is modeled by the exponential function $B(x) = 200(1.15)^x$.

x: 0, 1, 2, 3
League A participants: 200, 240, 280, 320

Decide whether each statement is True or False.

	True	False
Both League A and League B start with 200 participants when $x = 0$.	☑	☐
League A grows by a constant number of participants each year, while League B grows by a constant percentage each year.	☑	☐
At $x = 3$, League B has fewer participants than League A.	☑	☐
As x increases without bound, League A will always have more participants than League B.	☐	☑
The rate of change of League A from $x = 1$ to $x = 2$ (40 participants/year) is greater than the average rate of change of League B over the same interval.	☑	☐

FIND MORE LIKE THIS

Create questions › Math 3 › CAT › Target M › F-IF.9 › DOK 3 › Generate

Test Bank question

MATH 3 · CLAIM 1 · CONCEPTS & PROCEDURES

1N Build a function that models a relationship between two quantities

Standards: F-BF.1b; F-LE.4

Assessed at: ~~DOK 1~~ DOK 2 ~~DOK 3~~ ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students substitute into a combined constant-plus-exponential model, isolate the exponential, and use a logarithm to solve, a multi-step process they must organize.

Soup begins at 180°F in a 75°F room. Its temperature is modeled by $T(t) = 75 + 105e^{kt}$. After 20 minutes the soup is 90°F. Find k using logarithms. Enter a number rounded to the nearest thousandth.

Correct answer: **-0.097**

FIND MORE LIKE THIS

Create questions › Math 3 › CAT › Target N › F-LE.4 › DOK 2 › Generate

Test Bank question

MATH 3 · CLAIM 1 · CONCEPTS & PROCEDURES

1P Summarize, represent, and interpret data on a single measurement variable

Standards: S-ID.4; S-IC.1; S-IC.2; S-IC.3–6; S-CP.1–5; S-CP.6–7

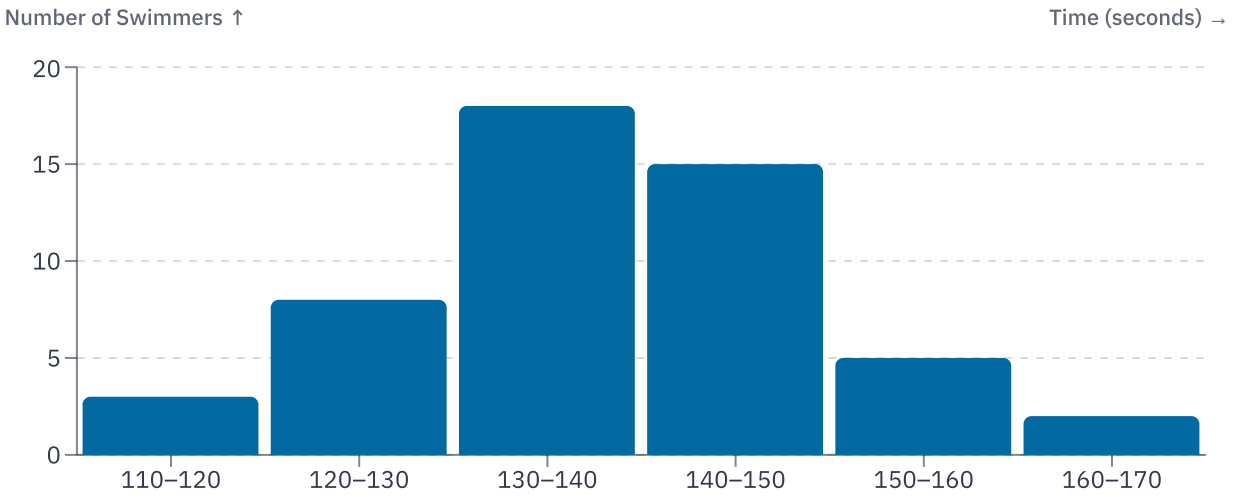
Assessed at: ~~DOK 1~~ **DOK 2** ~~DOK 3~~ ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students apply the empirical rule and compare it with a histogram to judge whether a normal model fits, interpreting data rather than just computing.

A coach analyzing 51 swimmers' times in the 200-yard freestyle finds that the mean time is 135 seconds and the standard deviation is approximately 12 seconds. The distribution appears approximately normal. Using the empirical rule (68-95-99.7), which statement best describes what this tells us about the swimmers' performance and the appropriateness of using a normal model?

Distribution of Swimming Times in 200-Yard Freestyle (High School Regional Championship)



- ○ The mean of 135 seconds represents the time that exactly half the swimmers beat, and the standard deviation tells us the range of acceptable swimming times for the team.
- ○ About 68% of swimmers finished between 123 and 147 seconds, which matches the histogram showing most swimmers in the 120–150 second range. The normal model is appropriate here because the data is roughly symmetric and unimodal. ✓
- ○ Since the histogram shows a normal distribution, we can use it to predict that next year's swimmers will have identical mean and standard deviation, making a normal model always reliable for future predictions.

○ About 95% of swimmers finished between 111 and 159 seconds, so we can conclude that any time outside this range is an outlier that should be removed from the data.

FIND MORE LIKE THIS

Create questions › Math 3 › CAT › Target P › S-ID.4 › DOK 2 › Generate

Test Bank question

CLAIM 2

Claim 2 · Problem Solving

Students can solve a range of complex well-posed problems in pure and applied mathematics, making productive use of knowledge and problem-solving strategies. In the Test Bank, Claims 2, 3 and 4 are built in the performance task (PT) step: choose PT, then Area 2 · Claims 2 + 4. Each question card is marked with its claim and target (for example "Claim 2 · Tgt A"), so generate a set at the DOK you want and keep the cards for the target you need.

Create questions › Math 3 › PT › Area 2 · Claims 2 + 4 › Standard group › Options: DOK › Generate

MATH 3 · CLAIM 2 · PROBLEM SOLVING

2A Apply mathematics to solve well-posed problems from everyday life

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students must recognize a geometric series in an everyday situation, identify the first term, ratio, and number of terms, and then compute, which takes several decisions.

Maya starts a savings plan. She deposits $50 in the first month, and each month after that she deposits 10% more than the month before. How much money will she have deposited in total after 12 months? Round to the nearest cent. (Ignore interest.)

Correct answer: **1069.21**

FIND MORE LIKE THIS

Create questions › Math 3 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Written for this guide

DOK 3 · Strategic thinking

Why DOK 3: Students must plan a solution that uses two different series, compute and compare totals, and explain why the early-year comparison is misleading, which requires strategic reasoning.

Jordan has two job offers for the next 10 years.
Offer A: starting salary $\$40{,}000$, with a raise of $\$2{,}000$ every year.
Offer B: starting salary $\$38{,}000$, with a raise of 6% every year.
Which offer pays more in total over the 10 years, and by about how much? Show your work and explain how the year-by-year comparison differs from the 10-year total.

Model response: Offer A is an arithmetic series: total $= \frac{10}{2}(40{,}000 + 58{,}000) = 490{,}000$. Offer B is a geometric series: total $= \frac{38{,}000(1.06^{10} - 1)}{0.06} \approx 500{,}870$. Offer B pays about $\$10{,}870$ more over 10 years. Offer A pays more in the early years (for example, $\$40{,}000$ vs. $\$38{,}000$ in year 1), but Offer B's percent raises grow larger each year, so Offer B's yearly salary passes Offer A's (in year 6) and its later years more than make up the early difference.

Rubric: 1 point: Correct totals for both offers (about $490,000 and about $500,870), correct conclusion that Offer B pays about $10,870 more, and an explanation that Offer A leads early but Offer B overtakes it.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 3 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

MATH 3 · CLAIM 2 · PROBLEM SOLVING

2B Select and use appropriate tools strategically

Assessed at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall the change of base formula to use a calculator correctly, a single known procedure with no planning required.

Lena needs to evaluate $\log_3 20$. Her calculator has only LOG (base 10) and LN (base e) keys. Which expression could she enter to get the correct value?

- ✓ $\dfrac{\log 20}{\log 3}$
- $\dfrac{\log 3}{\log 20}$
- $\log\left(\dfrac{20}{3}\right)$
- $\log 20 - \log 3$

FIND MORE LIKE THIS

Create questions › Math 3 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 1 › Generate

Written for this guide

DOK 2 · Skills & concepts

Why DOK 2: Students must evaluate several possible tools and decide which ones actually produce the needed precision, comparing approaches rather than carrying out one.

An investment of \$500 grows according to $A(t) = 500(1.04)^{t}\$, where t is in years. Sam wants to find when the investment reaches \$800, to the nearest tenth of a year. Which methods would give this answer? Select all that apply.

- [x] Graph $y = 500(1.04)^x$ and $y = 800$ on a graphing calculator and find the x-coordinate of the intersection.
- [x] Rewrite as $1.04^t = 1.6$ and compute $t = \dfrac{\log 1.6}{\log 1.04}$ on a calculator.
- [ ] Make a table of $A(t)$ for $t = 0, 1, 2, \ldots$ and report the first whole number of years where $A(t) \geq 800$.
- [ ] Divide 800 by 500 and then divide by 0.04.
- [ ] Take the square root of both sides of $500(1.04)^t = 800$.

FIND MORE LIKE THIS

Create questions › Math 3 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Written for this guide

DOK 3 · Strategic thinking

Why DOK 3: Students must recognize why an algebraic method fails, choose and justify a different tool, and verify their answer, which requires strategic planning.

A biologist models a fish population with $P(t) = 200(1.05)^t$ and the food supply (in fish that can be supported) with $F(t) = 300 + 12t$, where t is in years. She wants to know the first whole year in which the population exceeds the food supply.

(a) Explain why solving $200(1.05)^t = 300 + 12t$ with logarithms alone will not isolate t.

(b) Choose a tool or method that will work, use it to answer the question, and justify your answer.

Model response: (a) The variable appears both in an exponent and in a linear term. Taking logarithms gives $\log 200 + t \log 1.05 = \log(300 + 12t)$, which still has t inside a logarithm, so it cannot be solved by algebra alone.

(b) Use a table or graph. $P(20) \approx 531 < F(20) = 540$, and $P(21) \approx 557 > F(21) = 552$. The population first exceeds the food supply in year 21. (A graphing calculator shows the intersection near $t \approx 20.6$.)

Rubric: 1 point: Correct explanation for (a), an appropriate tool for (b), and the correct answer (year 21) supported by values on both sides of the crossing.

0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 3 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

MATH 3 · CLAIM 2 · PROBLEM SOLVING

2C Interpret results in the context of a situation

Assessed at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students directly interpret what an already-computed solution means in context, matching the variable and output to the situation.

A town's population is modeled by $P(t) = 12{,}000(0.92)^t$, where t is the number of years since 2020. Solving $P(t) = 6{,}000$ gives $t \approx 8.3$. What does this solution mean in this situation?

- ◯ About 8.3 years after 2020, the population is predicted to be half of its 2020 value. ✓
- ◯ The population decreases by about 8.3 people each year.
- ◯ The population decreases by 8.3% each year.
- ◯ In 2020 the population was about 8,300 people.

FIND MORE LIKE THIS

Create questions › Math 3 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 1 › Generate

Written for this guide

DOK 2 · Skills & concepts

Why DOK 2: Students interpret a computed probability in context and identify limits of the rational model, explaining what the result does and does not mean.

A high school volleyball team's coach models the probability of winning a match using the function $P(x) = \frac{x}{x+5}$, where x represents the number of practice hours per week. The coach calculates that with 10 practice hours per week, the probability of winning is $P(10) = \frac{2}{3} \approx 0.667$. However, the team can only realistically commit to 10 hours per week due to academic schedules. Interpret what this result means for the team's season, discussing both the benefit of their practice commitment and any limitations of relying on this model to make decisions about their competitive prospects.

Model response: With 10 practice hours per week, the model predicts a 67% win probability, meaning the team should expect to win roughly 2 out of every 3 matches. This represents a meaningful competitive advantage since the probability exceeds 50%. However, the model has important limitations: it assumes practice hours are the only factor affecting wins, ignoring opponent strength, player talent variation, and game-day conditions. Additionally, the function shows diminishing returns—increasing to 15 hours would only raise the probability to 75%, so the team may face a practical ceiling on improvement. The coach should use this result as one input among others (such as scouting opponents and analyzing team weaknesses) rather than relying solely on practice volume to predict season success.

Rubric: 1 point: Interprets the probability result correctly in context (≈67% win rate), quantifies the benefit (winning about 2 of 3 matches), and identifies at least two limitations of the model (e.g., other variables ignored, diminishing returns, external factors) with discussion of implementation constraints. 0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 3 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must test each claim against the factored model, using sign analysis and end behavior, and decide which interpretations are supported, which requires reasoning with evidence.

A minor-league baseball team models its season profit (in thousands of dollars) as a function of ticket sales x (in thousands of tickets): $P(x) = x^3 - 13x^2 + 47x - 35$, which factors as $P(x) = (x - 1)(x - 5)(x - 7)$. Drag each statement into the box that correctly classifies it as a valid or invalid interpretation of the model.

Valid interpretation of the model

- The team breaks even ($P(x) = 0$) when ticket sales are 1000, 5000, or 7000, since the factored form $(x - 1)(x - 5)(x - 7)$ equals zero exactly when one of those factors is zero. ✓
- Testing the sign of each factor shows $P(x) > 0$ (profit) when $1 < x < 5$ or $x > 7$, but $P(x) < 0$ (a loss) when $5 < x < 7$ — so profit does not simply increase as more tickets are sold; there is a losing range even at moderate attendance. ✓
- The constant term -35 in the expanded form is the value $P(0)$, meaning if zero tickets were sold the model predicts a loss of 35 thousand dollars, consistent with $(0 - 1)(0 - 5)(0 - 7) = -35$. ✓

Invalid or unsupported interpretation

- Since the leading coefficient of the expanded form $x^3 - 13x^2 + 47x - 35$ is 1, profit grows without bound as ticket sales increase, so the team's maximum profit occurs at exactly 7000 tickets sold. ✓
- Because the roots of $P(x)$ are 1, 5, and 7, the team's maximum profit equals the product $1 \times 5 \times 7 = 35$ thousand dollars, occurring when $x = 1 + 5 + 7 = 13$ thousand tickets are sold. ✓

FIND MORE LIKE THIS

Create questions › Math 3 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Test Bank question

MATH 3 · CLAIM 2 · PROBLEM SOLVING

2D Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flow charts, or formulas)

Assessed at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students identify which quantities are relevant to the stated goal, a recognition task that needs no calculation or planning.

A coach is planning a training program for a basketball team. The team needs to track player performance over 12 weeks. The coach wants to measure improvement and set goals. Which of the following represent important quantities and their relationships that should be mapped out for this problem? Select all that apply.

- [ ] The color of each player's jersey and its effect on shooting accuracy
- [ ] The total cost of basketballs divided by the number of players on the team
- [x] The number of free throws made per player per week and how this changes over the 12-week period
- [x] The number of minutes played per player per game as it relates to total points scored over 12 weeks
- [x] Each player's average points scored per game and the relationship between practice hours and points scored
- [ ] The alphabetical order of players' last names

FIND MORE LIKE THIS

Create questions › Math 3 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must combine revenue and cost functions and interpret what each term represents, mapping how several quantities relate to profit.

A high school lacrosse team's revenue model depends on ticket sales and concession sales. The total revenue function is $R(x) = 45x + 12x^2 - 0.5x^3$, where x represents the number of games played in a season. The team's total costs are represented by $C(x) = 200 + 8x$. To understand their profit dynamics, the team needs to identify key quantities and how they relate to each other. Which of the following correctly identify important quantities and their relationships in this profit system?

- [x] The profit function is $P(x) = R(x) - C(x) = 45x + 12x^2 - 0.5x^3 - 200 - 8x$, which simplifies to $P(x) = 37x + 12x^2 - 0.5x^3 - 200$, showing how the different revenue and cost components combine to determine overall profitability.
- [x] The constant term 200 in the cost function represents fixed costs (like facility rental) that don't change with the number of games, while the term $8x$ represents variable costs that increase linearly with each game played.
- [ ] The relationship between the number of games (x) and profit is linear because both revenue and cost functions involve the variable x.
- [ ] The $-0.5x^3$ term in revenue is a fixed cost that must be subtracted first before calculating variable costs.
- [x] The term $12x^2$ in the revenue function represents a quadratic relationship where revenue increases at an increasing rate, but this relationship will eventually slow due to the $-0.5x^3$ term, which models market saturation or capacity constraints.
- [ ] The coefficient 45 in the revenue function is independent of all other terms and can be analyzed separately without considering how it interacts with the $12x^2$ and $-0.5x^3$ terms.

FIND MORE LIKE THIS

Create questions › Math 3 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must identify the key quantities, organize them in a table, generalize the relationship as a series, and use it to justify a long-run conclusion.

A patient takes a 100 mg dose of a medicine every 12 hours. By the time of the next dose, 30% of the medicine in the body remains. The safe limit is 150 mg in the body at any time.
(a) Make a table showing the amount of medicine in the body just after each of the first five doses.
(b) Write an expression for the amount just after the nth dose.
(c) Will the amount ever exceed the safe limit if the patient keeps taking the medicine? Justify your answer.

Model response: (a) Dose 1: 100; dose 2: $100 + 0.3(100) = 130$; dose 3: $100 + 0.3(130) = 139$; dose 4: 141.7; dose 5: 142.51 mg.

(b) $A_n = 100 + 100(0.3) + 100(0.3)^2 + \cdots + 100(0.3)^{n-1} = \dfrac{100(1 - 0.3^n)}{1 - 0.3}$.

(c) No. As n grows, 0.3^n approaches 0, so A_n approaches $\frac{100}{0.7} \approx 142.9$ mg and stays below that value. Since $142.9 < 150$, the amount never exceeds the safe limit.

Rubric: 1 point: Correct table, a correct expression (recursive or closed form), and a justified conclusion that the amount levels off near 142.9 mg and stays below 150 mg.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 3 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

CLAIM 3

Claim 3 · Communicating Reasoning

Students can clearly and precisely construct viable arguments to support their own reasoning and to critique the reasoning of others. In the Test Bank, Claims 2, 3 and 4 are built in the performance task (PT) step: choose PT, then Area 3 · Claim 3. Each question card is marked with

its claim and target (for example "Claim 3 · Tgt A"), so generate a set at the DOK you want and keep the cards for the target you need.

Create questions › Math 3 › PT › Area 3 · Claim 3 › Standard group › Options: DOK › Generate

MATH 3 · CLAIM 3 · COMMUNICATING REASONING

3A Test propositions or conjectures with specific examples

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students rewrite the average expression and test specific values to find a counterexample, using examples to evaluate a conjecture.

A basketball coach models a player's scoring output using the polynomial function $S(g) = 2g^2 - 8g + 15$, where $S(g)$ represents total points scored and g is the number of games played. The coach conjectures that the player's scoring will always be at least 7 points per game when averaged over the season. To test this conjecture, we need to verify whether $\frac{S(g)}{g} \geq 7$ holds true for different values of g.

Part A: By rewriting the expression $\frac{S(g)}{g} = \frac{2g^2-8g+15}{g}$ in simplified form, which of the following best represents the average points per game?

Choose one answer.

- ○ $2g - 8g + 15$
- ○ $g - 4 + \frac{15}{g}$
- ○ $2g^2 - 8 + 15$
- ○ $2g - 8 + \frac{15}{g}$ ✓

Part B: Testing the coach's conjecture that average scoring is always at least 7 points per game, which statement about specific values best supports that the conjecture is **false**?

Choose one answer.

- ○ When $g = 1$: $2(1) - 8 + \frac{15}{1} = 2 - 8 + 15 = 9$ points per game, which is greater than 7, so the conjecture holds.
- ○ When $g = 10$: $2(10) - 8 + \frac{15}{10} = 20 - 8 + 1.5 = 13.5$ points per game, which is greater than 7, so the conjecture holds.
- ○ When $g = 3$: $2(3) - 8 + \frac{15}{3} = 6 - 8 + 5 = 3$ points per game, which is less than 7, but this is only one counterexample and does not disprove the overall pattern.

When $g = 5$: $2(5) - 8 + \frac{15}{5} = 10 - 8 + 3 = 5$ points per game, which is less than 7, so the conjecture fails. ✓

FIND MORE LIKE THIS

Create questions › Math 3 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students test several values, rewrite the rational expression to explain the trend, and judge whether the model is reasonable, building an argument from evidence.

A sports analyst proposes that a basketball player's scoring output can be modeled by the rational function $S(g) = \frac{24g+180}{g+12}$, where $S(g)$ represents average points per game and g represents the number of games played in a season. Test this conjecture by evaluating the function at specific games ($g = 5, 20, 50$) and interpreting what the behavior of this expression reveals about whether the model is reasonable for predicting a player's scoring trajectory. Explain your reasoning by identifying which part of the rational expression dominates at different values of g and what this means about the player's performance pattern.

Model response: At $g = 5$: $S(5) = \frac{24(5)+180}{5+12} = \frac{300}{17} \approx 17.6$ ppg. At $g = 20$: $S(20) = \frac{24(20)+180}{20+12} = \frac{660}{32} \approx 20.6$ ppg. At $g = 50$: $S(50) = \frac{24(50)+180}{50+12} = \frac{1380}{62} \approx 22.3$ ppg. By rewriting the expression as $S(g) = \frac{24g+180}{g+12} = 24 - \frac{108}{g+12}$ (using polynomial division), we see that as g increases, the fraction $\frac{108}{g+12}$ approaches zero, making $S(g)$ approach the horizontal asymptote of 24 ppg. This behavior is realistic: it shows the player's scoring gradually improves and stabilizes around 24 ppg, suggesting the model captures a learning/adaptation effect early in the season with diminishing improvement. The conjecture is reasonable because the asymptotic behavior matches realistic athlete performance patterns—initial growth that levels off.

Rubric: 1 point: Student evaluates at multiple points and notes increasing trend approaching a limit, but may not fully rewrite the expression or make complete connections to realistic patterns.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 3 › PT › Area 3 · Claim 3 › Standard group › DOK 3 › Generate

Test Bank question

MATH 3 · CLAIM 3 · COMMUNICATING REASONING

3B Construct chains of reasoning that will justify or refute propositions

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 DOK 4 DOK 4 is assessed only in the performance task.

DOK 2 · Skills & concepts

Why DOK 2: Students set up and solve an equation to decide whether a value is ever reached, then choose the reasoning that justifies the claim, a short chain of logic.

A basketball player's scoring average follows the function $S(n) = \frac{420+18n}{n}$, where n is the number of games played and $S(n)$ is the average points per game. A coach claims that as the player participates in more games throughout the season, the scoring average will always approach 18 points per game but never actually reach it.

Part A: Is the coach's claim mathematically valid? Evaluate whether the scoring average can equal exactly 18 points per game for some finite value of n.

Choose one answer.

- ✓ Yes, the coach's claim is valid. The equation $\frac{420+18n}{n} = 18$ has no solution for any finite positive value of n.
- No, the coach's claim is invalid because the average is already below 18 in the first game.
- No, the coach's claim is invalid. The scoring average equals exactly 18 when $n = 420$.
- Yes, the coach's claim is valid, but only because the player will never play infinitely many games.

Part B: Which mathematical reasoning best justifies your answer to Part A?

Choose one answer.

- ✓ When we solve $\frac{420+18n}{n} = 18$, we can multiply both sides by n to get $420 + 18n = 18n$, which simplifies to $420 = 0$. This is a contradiction, so no finite solution exists.
- The horizontal asymptote of the function is $y = 18$, and horizontal asymptotes are never actually reached by the function for any real input value.
- The numerator $420 + 18n$ grows faster than the denominator n, so the fraction always increases and approaches infinity.

- Substituting $n = 1$ gives $\frac{438}{1} = 438$, which is much greater than 18, so the average cannot equal 18.

FIND MORE LIKE THIS

Create questions › Math 3 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must decide which steps form a rigorous justification, including a sign argument on an interval, which requires evaluating a complete chain of reasoning.

A sports statistician models a team's cumulative point-differential rating using the expression $E(x) = x^4 - 16x^2$, where x is the team's average scoring margin per game. The statistician claims: 'Because $E(x) = x^2(x - 4)(x + 4)$, the expression equals zero only when $x = -4$, $x = 0$, or $x = 4$, and $E(x)$ is negative for every x strictly between -4 and 4 except at $x = 0$.' Select all statements that are valid steps in a rigorous justification of this claim.

- [x] Setting $E(x) = x^2(x - 4)(x + 4) = 0$ requires $x^2 = 0$ or $x - 4 = 0$ or $x + 4 = 0$, so the only solutions are $x = 0$, $x = 4$, and $x = -4$.
- [x] For any x with $-4 < x < 4$ and $x \neq 0$, the factor $(x - 4)$ is negative and $(x + 4)$ is positive, so their product is negative; since $x^2 > 0$ for these values, $E(x)$ must be negative there.
- [ ] Since $x^2 \geq 0$ for every real number, $E(x)$ can never equal zero for any value of x.
- [x] $x^4 - 16x^2$ can be rewritten by factoring out the common factor x^2 to get $x^2(x^2 - 16)$, and $x^2 - 16$ factors further as $(x - 4)(x + 4)$ using the difference of squares, giving $E(x) = x^2(x - 4)(x + 4)$.
- [ ] Because the leading exponent in $x^4 - 16x^2$ is even, $E(x)$ must be nonnegative for every real value of x.
- [ ] Expanding $x^2(x - 4)(x + 4)$ gives $(x^2 - 16)^2$, so $E(x)$ is a perfect square and can never be negative.

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Test Bank question

DOK 4 · Extended thinking

Why DOK 4: Students carry out an extended investigation: they prove an identity, apply it to generate cases, test a general claim against a counterexample, and revise the method.

Investigation: Generating Pythagorean triples.
(a) Prove that $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ for all real numbers x and y.
(b) Explain why, when x and y are positive integers with $x > y$, the numbers $x^2 - y^2$, $2xy$, and $x^2 + y^2$ always form a Pythagorean triple. Use the identity to generate the triples for $(x, y) = (2, 1)$, $(3, 2)$, and $(4, 1)$.
(c) A classmate claims the identity produces every Pythagorean triple. Test this claim using the triple $9, 12, 15$. Can $x^2 + y^2 = 15$ for positive integers? What does this show about the claim, and how could the formula be modified so that it does produce $9, 12, 15$?

Model response: (a) Left side: $x^4 + 2x^2y^2 + y^4$. Right side: $x^4 - 2x^2y^2 + y^4 + 4x^2y^2 = x^4 + 2x^2y^2 + y^4$. The two sides are equal, so the identity holds.
(b) If $x > y > 0$ are integers, then $x^2 - y^2$, $2xy$, and $x^2 + y^2$ are positive integers, and by (a) the square of the third equals the sum of the squares of the first two, so they form a right triangle's side lengths. $(2, 1)$: $3, 4, 5$. $(3, 2)$: $5, 12, 13$. $(4, 1)$: $15, 8, 17$.
(c) The hypotenuse 15 would need $x^2 + y^2 = 15$. Checking $x = 1, 2, 3$ gives $15 - x^2 = 14, 11, 6$, none of which is a perfect square, so no positive integers work. The claim is false. However, $9, 12, 15 = 3(3, 4, 5)$, so multiplying all three expressions by a positive integer k, giving $k(x^2 - y^2)$, $2kxy, k(x^2 + y^2) with k = 3, x = 2, y = 1$, produces it.

Rubric: 1 point: All parts addressed with one minor error or a missing justification.
0 points: Anything less, including a response that is only partly correct.

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Create questions › Math 3 › PT › Area 3 · Claim 3 › Standard group › DOK 4 › Generate

Written for this guide

MATH 3 · CLAIM 3 · COMMUNICATING REASONING

3C State logical assumptions being used

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students identify which facts the factoring argument depends on, including that a sum of squares has no real zeros, by connecting each step to the assumption it uses.

A sports analyst models the difference between two teams' squared season-scoring totals with the expression $S = x^4 - 81$, where x represents a scaled performance rating. The analyst factors it as $S = (x^2 - 9)(x^2 + 9) = (x - 3)(x + 3)(x^2 + 9)$ and concludes that the only real values of x making $S = 0$ are $x = 3$ and $x = -3$. Which logical assumptions are being used in this reasoning? Select all that apply.

- [x] That $x^4 - 81$ can be viewed as a difference of two squares, $(x^2)^2 - (9)^2$, so the difference-of-squares pattern $a^2 - b^2 = (a - b)(a + b)$ applies with $a = x^2$ and $b = 9$.
- [ ] That the variable x must always represent a positive score, since it appears in a sports context.
- [x] That $x^2 + 9 = 0$ has no real solutions, so it contributes no additional real zeros beyond $x = 3$ and $x = -3$.
- [x] That $x^2 - 9$ itself fits the difference-of-squares pattern $a^2 - b^2 = (a - b)(a + b)$ with $a = x$ and $b = 3$, allowing further factoring into $(x - 3)(x + 3)$.
- [ ] That factoring an expression is only valid when all exponents in the original expression are odd.
- [ ] That $x^2 + 9$ can be factored over the real numbers into two linear factors.

FIND MORE LIKE THIS

Create questions › Math 3 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must uncover a hidden assumption behind a broad conclusion drawn from a rational model and explain the consequence if it fails, reasoning beyond the math itself.

A basketball coach models a player's free throw success rate using the function $P(n) = \frac{100n}{n+50}$, where $P(n)$ is the percentage of successful free throws after n practice attempts. The coach claims that as the player practices more attempts (as $n \to \infty$), the success rate approaches 100%. The coach then uses

this model to conclude that with unlimited practice, any player can achieve near-perfect free throw accuracy, and therefore a player's natural talent is less important than practice volume.

Part A: Which of the following identifies a critical logical assumption embedded in the coach's mathematical argument about the limit behavior of $P(n)$?

Choose one answer.

- ○ The maximum possible success rate is 100 percent.
- ○ The number of practice attempts n must be a positive integer.
- ✓ ○ The function $P(n) = \frac{100n}{n+50}$ accurately captures all factors affecting free throw performance, including physical fatigue, psychological pressure, and deteriorating technique over extended practice sessions.
- ○ The player must take at least 50 practice attempts before the model becomes valid.

Part B: Which statement best explains why this assumption is necessary for the coach's broader conclusion about talent versus practice, and what logical consequence follows if the assumption is violated?

Choose one answer.

- ✓ ○ If the mathematical limit exists but the model omits significant real-world factors (like fatigue or psychological factors), then the theoretical limit of 100% may be unattainable in practice. This means the coach's conclusion that talent matters less than practice volume could be false—a player might plateau below 100% due to factors outside the model, suggesting natural limitations do matter.
- ○ The assumption ensures the model is continuous, which is required for all mathematical limits to exist and be meaningful.
- ○ The assumption is not actually necessary because the limit $\lim_{n\to\infty} P(n) = 100$ is true regardless of what the model represents.
- ○ Without this assumption, we cannot determine whether n should approach infinity or some other value.

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Test Bank question

MATH 3 · CLAIM 3 · COMMUNICATING REASONING

3D Use the technique of breaking an argument into cases

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students recognize which statements correctly use an even/odd case split and why the cases cover all integers, applying a given case structure.

A coach claims that for any integer number of total points n scored by a team over a season, the value $n^3 - n$ is always divisible by 6. A student rewrites the expression using its structure as $n^3 - n = (n-1)n(n+1)$ and proves the claim by breaking the argument into the cases 'n is even' and 'n is odd.' Select all statements that correctly describe valid reasoning used in this case-based proof.

- [x] If n is even, n itself supplies a factor of 2; if n is odd, then both $n-1$ and $n+1$ are even, so one of them supplies a factor of 2. Either way the product is divisible by 2.
- [ ] Testing the single value $n = 0$ shows the product equals 0, which is divisible by 6, so this one case proves the claim for all integers n.
- [x] The two cases, n even and n odd, are exhaustive because every integer is either even or odd, so together the cases cover all possible values of n.
- [ ] Because $(n-1)n(n+1)$ contains three factors, divisibility by 2 alone is enough to guarantee divisibility by 6, so checking factors of 3 is unnecessary.
- [ ] It is only necessary to check the case where n is even, since odd values of n will automatically behave the same way by symmetry.
- [x] Since $(n-1)n(n+1)$ is a product of three consecutive integers, one of the three must be a multiple of 3, so the product is always divisible by 3, regardless of which case applies.

FIND MORE LIKE THIS

Create questions › Math 3 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must plan the most efficient case split, deciding which divisibility needs cases and which does not, which is strategic reasoning about the proof itself.

Use the drop-down menus to complete the statement.

A league statistician defines the season-adjustment factor for n teams as $A(n) = n^3 - n$. She wants to prove $A(n)$ is always divisible by 6 for every positive integer n, using the smallest possible number of cases. Rewriting the expression as [$(n-1)n(n+1)$ ▾] shows $A(n)$ is the product of three consecutive integers. Since any two consecutive integers automatically include one even number, divisibility by 2 requires no case split. So the most efficient case analysis needs only [3 ▾] cases, based on [the remainder when n is divided by 3 ▾], since that guarantees one of the three consecutive integers is a multiple of 3 in every case.

Drop-down 1 choices: $n(n+1)(n+2)$ | $(n-1)(n+1)$ | $(n-1)n(n+1)$ ✓ | $n^2(n-1)$

Drop-down 2 choices: 2 | 3 ✓ | 6

Drop-down 3 choices: whether n is greater than 3 | **the remainder when n is divided by 3 ✓** | the remainder when n is divided by 2 | whether n is even or odd only

FIND MORE LIKE THIS

Create questions › Math 3 › PT › Area 3 · Claim 3 › Standard group › DOK 3 › Generate

Test Bank question

MATH 3 · CLAIM 3 · COMMUNICATING REASONING

3E Distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in the argument—explain what it is

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 DOK 4 DOK 4 is assessed only in the performance task.

DOK 2 · Skills & concepts

Why DOK 2: Students check each statement about rewriting expressions and classify it as correct or flawed, applying known rules to spot errors.

A sports analyst is examining polynomial expressions that model athlete performance metrics. She writes several expressions to represent different scenarios. Drag each expression or reasoning statement into the category that correctly describes it.

Correct reasoning about structure and rewriting

- The expression $3x^2 + 6x$ can be rewritten as $3x(x + 2)$ by factoring out the GCF. ✓
- In the expression $5(x^2 + 4x) + 2$, viewing $x^2 + 4x$ as a single entity helps identify that the expression equals $5x^2 + 20x + 2$. ✓
- The expression $x^4 - 16$ can be rewritten as $(x^2 - 4)(x^2 + 4)$ by recognizing it as a difference of squares and applying the structure of that form. ✓

Flawed reasoning (logical error or unwarranted conclusion)

- The expression $2x^3 - 8x^2 + 6x$ has three terms, so it cannot be factored. ✓
- The expression $4x^3 + 12x^2 - 8x$ must equal zero because it has a common factor of $4x$. ✓

FIND MORE LIKE THIS

Create questions › Math 3 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students analyze four different arguments, decide which are valid, and name the type of error in each flawed one, critiquing reasoning with evidence.

A sports analyst studies the efficiency expression $E(x) = \dfrac{x^3 - 27}{x^2 - 9}$, where x is the number of games a player has played. Four students simplify this expression. Complete the table by identifying whether each student's reasoning is valid and, if not, the type of structural error made.

Student	Reasoning Shown	Valid?	Type of Error (if any)
A	"Cancel the x^2 term in the numerator and denominator: $\dfrac{x^3 - 27}{x^2 - 9} \to \dfrac{x - 27}{-9}$"	no ▾	canceling terms instead of common factors ▾
B	"Factor numerator as a difference of cubes and denominator as a difference of squares: $\dfrac{(x-3)(x^2+3x+9)}{(x-3)(x+3)}$, then cancel the common factor $(x-3)$ to get $\dfrac{x^2+3x+9}{x+3}$, valid for $x \neq 3, -3$"	yes ▾	valid factorization, no error ▾
C	"Just cancel the constants -27 and -9: $\dfrac{x^3 - 27}{x^2 - 9} \to \dfrac{x^3}{x^2} = x$"	no ▾	canceling constants without factoring ▾
D	"Factor both correctly as $(x-3)(x^2+3x+9)$ and $(x-3)(x+3)$, then substitute $x = 3$ into the simplified form $\dfrac{x^2+3x+9}{x+3}$ to check, getting $\dfrac{27}{6} = 4.5$, matching the original limit as $x \to 3$"	yes ▾	valid factorization, no error ▾

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Test Bank question

DOK 4 · Extended thinking

Why DOK 4: Students go beyond spotting the flaw: they investigate exactly when the faulty rule happens to work, derive a general condition, test it, and connect it to the correct property.

Riley claims that $\log(a+b) = \log a + \log b$ for all positive numbers a and b. As evidence, Riley shows that it works when $a = 2$ and $b = 2$: $\log 4 = \log 2 + \log 2$.

(a) Explain the flaw in Riley's reasoning, and give a pair of positive numbers for which the equation is false.

(b) Use the product property of logarithms to find the condition on a and b that makes $\log(a+b) = \log a + \log b$ true. Solve your condition for b in terms of a.

(c) Use your result to find two more pairs that make the equation true, and state for which values of a a positive b exists.

(d) Write a correct general property of logarithms that Riley may have been confusing with this one.

Model response: (a) One example cannot prove a statement for all values. For $a = 1, b = 1$: $\log 2 \approx 0.301$, but $\log 1 + \log 1 = 0$, so the claim is false.

(b) $\log a + \log b = \log(ab)$, so the equation holds exactly when $\log(a+b) = \log(ab)$, that is, when $a + b = ab$. Solving: $ab - b = a$, so $b(a-1) = a$ and $b = \dfrac{a}{a-1}$.

(c) $a = 3$ gives $b = 1.5$ (check: $\log 4.5 = \log 3 + \log 1.5$). $a = 5$ gives $b = 1.25$. A positive b exists only when $a > 1$.

(d) $\log(ab) = \log a + \log b$.

Rubric: 1 point: Three parts fully correct.

0 points: Anything less, including a response that is only partly correct.

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Written for this guide

MATH 3 · CLAIM 3 · COMMUNICATING REASONING

3F Base arguments on concrete referents such as objects, drawings, diagrams, and actions

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students must connect a physical shading model to a geometric series and use the picture, not just a formula, to explain the sum.

A square sheet of paper has an area of 1 square unit. Step 1: shade half of the sheet. Step 2: shade half of the unshaded part. Each step shades half of what is still unshaded. After 5 steps, the shaded area is $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{32}$. Which statement uses the paper model correctly to find this sum?

- ◯ The unshaded piece left after 5 steps has area $\frac{1}{32}$, so the shaded area is $1 - \frac{1}{32} = \frac{31}{32}$. ✓
- ◯ Each step shades $\frac{1}{2}$ of the sheet, so after 5 steps the shaded area is $5 \cdot \frac{1}{2} = \frac{5}{2}$.
- ◯ The last piece shaded has area $\frac{1}{32}$, so the total shaded area is $\frac{1}{32}$.
- ◯ The pieces get smaller, so the shaded area after 5 steps is less than $\frac{1}{2}$.

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Written for this guide

DOK 3 · Strategic thinking

Why DOK 3: Students must build a general argument from a diagram, using symmetry of the unit circle as evidence instead of checking one angle, which is strategic reasoning.

A student claims that $\sin(180^\circ - \theta) = \sin\theta$ for every angle θ. Use a unit circle diagram to construct an argument that justifies or refutes the claim. In your argument, describe the location of the points for θ and $180^\circ - \theta$ on the unit circle, explain how they are related, and state what your diagram shows about $\cos(180^\circ - \theta)$ as well.

Model response: On the unit circle, the angle θ ends at the point $P = (\cos\theta, \sin\theta)$. The angle $180^\circ - \theta$ is measured the same amount back from the negative x-axis, so its terminal point Q is the reflection of P across the y-axis: $Q = (-\cos\theta, \sin\theta)$. Reflection across the y-axis keeps the y-coordinate and changes the sign of the x-coordinate. Since sine is the y-coordinate, $\sin(180^\circ - \theta) = \sin\theta$, so the claim is true. The diagram also shows $\cos(180^\circ - \theta) = -\cos\theta$. (Example check: $\sin 150^\circ = \sin 30^\circ = 0.5$.)

Rubric: 1 point: A correct diagram or description showing the two terminal points as reflections across the y-axis, a clear explanation that the y-coordinates (sines) are equal, and the correct conclusion about cosine.
0 points: Anything less, including a response that is only partly correct.

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Written for this guide

MATH 3 · CLAIM 3 · COMMUNICATING REASONING

3G Determine conditions under which an argument does and does not apply

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students evaluate the argument at several values and find the case where a factor equals 1, identifying where the argument stops applying.

A coder claims: 'For every whole number n greater than or equal to 2, the expression n^3-1 factors as (n-1)(n^2+n+1). Since both factors are whole numbers greater than 1, n^3-1 is never a prime number.' Complete the table to check this claim for app-update counts n = 2, 3, 4, and 5, then decide where the claim does and does not hold.

n	n-1	n^2+n+1	n^3-1	Is n^3-1 prime?
2	1	7	7	yes ▾
3	2	13	26	no ▾
4	3	21	63	no ▾
5	4	31	124	no

FIND MORE LIKE THIS

Create questions › Math 3 › PT › Area 3 · Claim 3 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must decide exactly when a factoring method yields integer coefficients and why a sum of squares does not factor, generalizing the conditions for the argument.

A game designer is studying the expression $n^4 - 81$, where n is the number of levels unlocked. A student argues: 'Since $n^4 - 81$ is a difference of squares, it factors as $(n^2 - 9)(n^2 + 9)$, and any expression of the form $n^4 - c$ can be factored this way using $(n^2 - \sqrt{c})(n^2 + \sqrt{c})$.' Decide whether each statement about this argument is true or false.

	True	False
$(n^2 - 9)(n^2 + 9)$ is a correct difference-of-squares factorization of $n^4 - 81$.	☑	☐
The complete factorization of $n^4 - 81$ over the integers is $(n - 3)(n + 3)(n^2 + 9)$, since $n^2 - 9$ is itself a difference of squares.	☑	☐
Applying the same method to $n^4 - 80$ gives a factorization $(n^2 - \sqrt{80})(n^2 + \sqrt{80})$ with all integer coefficients.	☐	☑
The pattern $(n^2 - \sqrt{c})(n^2 + \sqrt{c})$ works algebraically for any $c \geq 0$, but it only produces integer coefficients when c is a perfect square.	☑	☐
The factor $n^2 + 9$ can be broken into two real linear factors, just like $n^2 - 9$ can.	☐	☑

FIND MORE LIKE THIS

Create questions › Math 3 › PT › Area 3 · Claim 3 › Standard group › DOK 3 › Generate

Test Bank question

CLAIM 4

Claim 4 · Modeling & Data Analysis

Students can analyze complex, real-world scenarios and can construct and use mathematical models to interpret and solve problems. In the Test Bank, Claims 2, 3 and 4 are built in the performance task (PT) step: choose PT, then Area 2 · Claims 2 + 4. Each question card is marked with its claim and target (for example "Claim 4 · Tgt A"), so generate a set at the DOK you want and keep the cards for the target you need.

Create questions › Math 3 › PT › Area 2 · Claims 2 + 4 › Standard group › Options: DOK › Generate

MATH 3 · CLAIM 4 · MODELING & DATA ANALYSIS

4A Apply mathematics to solve problems from everyday life (Modeling)

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students build the average cost expression from the total cost model and interpret how each term behaves, connecting the model to the situation in two steps.

A school is ordering new band uniforms. The cost to manufacture x uniforms is given by $C(x) = 500 + 8x + 0.02x^2$, where cost is in dollars. Here, 500 is the fixed setup cost, $8x$ is the per-uniform labor cost, and $0.02x^2$ is extra material cost from bulk ordering. The team divides the whole expression by x to find the average cost per uniform. Which expression correctly shows the average cost, and what happens to it as more uniforms are ordered?

- ○ Average cost $= \frac{500+8x}{0.02x^2}$; the average cost stays dominated by material costs no matter how many uniforms are ordered.
- ○ Average cost $= \frac{500}{x} + 8 + 0.02x$; it first decreases as fixed cost spreads out, then increases as material costs grow. ✓
- ○ Average cost $= \frac{500}{x} + 8 + 0.02$; the average cost settles near 8 dollars per uniform as orders grow large.
- ○ Average cost $= 500 + 8 + 0.02x$; the average cost increases in a straight line as more uniforms are ordered.

FIND MORE LIKE THIS

Create questions › Math 3 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must create a model from a physical situation, restrict its domain, and plan a systematic search to meet a requirement and optimize, which needs strategic thinking.

A company makes open-top boxes from rectangular sheets of cardboard that measure 20 cm by 30 cm. A square with side length x cm is cut from each corner, and the sides are folded up.
(a) Write a function $V(x)$ for the volume of the box and state a reasonable domain.
(b) The company wants boxes that hold at least 1000 cubic centimeters, and it will only cut whole-centimeter squares. Which cut sizes meet this requirement?
(c) Which of these cut sizes gives the greatest volume? Justify your answer.

Model response: (a) $V(x) = x(30 - 2x)(20 - 2x)$, with $0 < x < 10$ because the 20 cm side must stay positive.
(b) $V(1) = 504$, $V(2) = 832$, $V(3) = 3(24)(14) = 1008$, $V(4) = 4(22)(12) = 1056$, $V(5) = 5(20)(10) = 1000$, $V(6) = 864$, and the volumes keep decreasing up to $x = 9$. The cuts that work are 3 cm, 4 cm, and 5 cm.
(c) A 4 cm cut gives the greatest volume, 1056 cubic centimeters, which is larger than the volumes for 3 cm and 5 cm.

Rubric: 1 point: Correct volume function and domain, the correct set of cut sizes {3, 4, 5} supported by computed volumes, and the correct choice of 4 cm with justification.
0 points: Anything less, including a response that is only partly correct.

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Create questions › Math 3 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Written for this guide

MATH 3 · CLAIM 4 · MODELING & DATA ANALYSIS

4B Construct chains of reasoning to justify mathematical models

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 DOK 4 DOK 4 is assessed only in the performance task.

DOK 2 · Skills & concepts

Why DOK 2: Students compare the shape of the data with the behavior of different function families to justify which model fits, interpreting features rather than recalling them.

A coach is modeling the relationship between a basketball player's free throw attempts per practice and her free throw percentage over a season. The coach collects data showing that as the number of attempts increases from 10 to 50 per practice, the free throw percentage increases from 60% to 82%, then levels off around 85% as attempts approach 100 per practice. Which statements justify why a quadratic model would NOT be appropriate for this situation, and which justify why a different model might be better?

- [ ] Linear models are never used in sports, so a quadratic model must be the correct choice.
- [x] A rational function or exponential decay model better captures the assumption that performance improvements follow a learning curve where initial gains are larger but progress slows as the player approaches her skill ceiling.
- [ ] A quadratic model could show the leveling off pattern in the data because parabolas have both increasing and decreasing sections.
- [x] The data shows growth that slows down and approaches a limit, which indicates a horizontal asymptote—a characteristic of exponential decay or rational functions, not quadratic functions.
- [x] A quadratic model would eventually predict decreasing percentages at high practice levels, but the data shows the percentage stabilizes near 85%, contradicting what a parabola would predict.
- [ ] The coach should use a quadratic model because the relationship involves two variables: attempts and percentage.

FIND MORE LIKE THIS

Create questions › Math 3 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must test four models against all the data and explain why the square root structure fits best, building a justification from several pieces of evidence.

A gardener hangs a plant pot from a chain and studies how the chain length L (in meters) affects the time T (in seconds) for one full swing, shown in the table above. Four models are proposed:

Model 1: $T = \frac{2}{3}L$
Model 2: $T = 2L^{1/2}$
Model 3: $T = 0.03L^2$
Model 4: $T = 2(1.15)^L$

Which model correctly fits ALL four data points, and why does it make the best structural sense compared to the others?

Hanging Plant Swing: Chain Length vs. Swing Time

Chain Length L (meters)	Swing Time T (seconds)
L = 1	2
L = 4	4
L = 9	6
L = 16	8

- ○ Model 3, because squaring L eventually produces numbers close to the larger T values, so a quadratic function best matches the overall trend
- ○ Model 1, because T seems to increase by the same fixed amount each time L increases by 3, matching the constant additive change of a linear function
- ○ Model 4, because T seems to grow faster than a straight line as L increases, which matches the fast-growing pattern of an exponential function
- ○ Model 2, because $T \div L^{1/2}$ equals 2 for every point, and only a square-root relationship turns the unevenly spaced L-values into these evenly spaced T-values ✓

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Test Bank question

DOK 4 · Extended thinking

Why DOK 4: Students conduct an extended modeling task: they reject one model with evidence, transform data to discover a structure, build and test a new model, and justify its long-run behavior.

A cup of tea is left in a room that is $20°$C. Its temperature is measured every 10 minutes.
Time t (minutes): 0, 10, 20, 30, 40
Temperature (°C): 90, 62, 45, 35, 29
(a) A student proposes the linear model $T = 90 - 2.8t$. Use the data and the situation to explain why this model is not appropriate.
(b) Compute $T - 20$ for each data point and use the results to justify a model of the form $T(t) = 20 + C \cdot b^{t/10}$.
(c) Find C and b from the data, and test your model against the remaining data points.
(d) Use your model to predict the temperature after 60 minutes and after a very long time. Explain why these predictions make sense in the situation.

Model response: (a) The linear model fits the first two points but predicts $34°$C at 20 minutes (actual 45) and $-22°$C at 40 minutes, below room temperature, which is impossible. The data cool quickly at first and then more slowly.
(b) $T - 20$: 70, 42, 25, 15, 9. Successive ratios are about 0.6 ($42/70 = 0.6$, $25/42 \approx 0.60$, $15/25 = 0.6$, $9/15 = 0.6$), so the difference from room temperature decreases by a constant factor every 10 minutes, which is exponential decay toward 20.
(c) $C = 70$ (at $t = 0$) and $b = 0.6$, so $T(t) = 20 + 70(0.6)^{t/10}$. Predictions: $t = 20$: 45.2; $t = 30$: 35.1; $t = 40$: 29.1, all within $0.2°$C of the data.
(d) $T(60) = 20 + 70(0.6)^6 \approx 23.3°$C. As t grows, $(0.6)^{t/10}$ approaches 0, so T approaches $20°$C. This makes sense because the tea cools toward room temperature but never goes below it.

Rubric: 1 point: Correct model and predictions with one weak justification.
0 points: Anything less, including a response that is only partly correct.

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MATH 3 · CLAIM 4 · MODELING & DATA ANALYSIS

4C State logical assumptions being used

Assessed at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall **Why DOK 1:** Students recognize two basic assumptions built into the model, the limiting value and a nonnegative input, directly from its form and context.

Use the drop-down menus to complete the statement about the model.

A coach models a basketball player's free-throw success rate using the rational function $f(x) = \frac{50x+100}{x+3}$, where x represents the number of practice sessions. The model assumes that [the success rate approaches a limiting value as practice sessions increase ▾], and it also assumes that [$x \geq 0$ since the number of practice sessions cannot be negative ▾].

Drop-down 1 choices: the success rate increases without bound as practice sessions increase indefinitely

the success rate is negative for some values of x

the success rate approaches a limiting value as practice sessions increase ✓

Drop-down 2 choices: negative numbers of practice sessions are physically meaningful

the denominator $(x + 3)$ can equal zero during actual practice

$x \geq 0$ since the number of practice sessions cannot be negative ✓

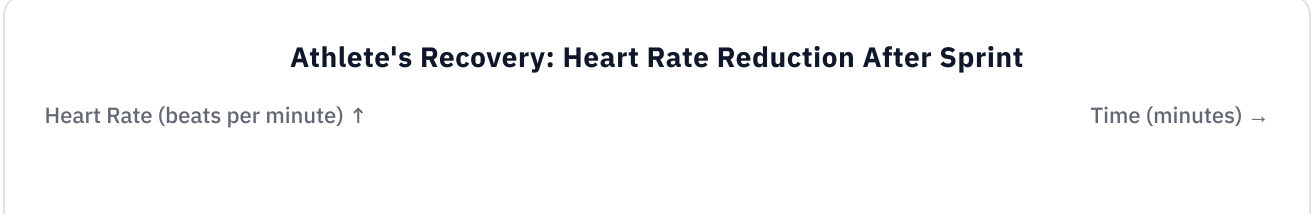
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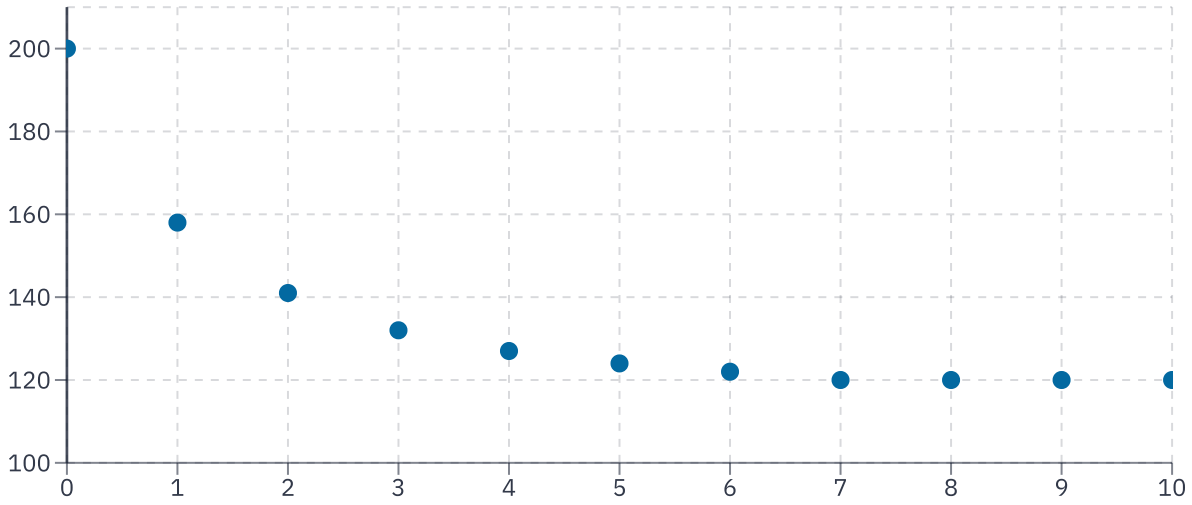
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Test Bank question

DOK 2 · Skills & concepts **Why DOK 2:** Students compare the model's built-in assumption with the plotted data and explain why that assumption limits accuracy, interpreting a graph.

A sports scientist models an athlete's heart rate recovery after a sprint using the function $h(t) = 80 + 120 \cdot \left(\frac{1}{2}\right)^{t/2}$, where t is time in minutes and $h(t)$ is heart rate in beats per minute. The graph shows actual measured data points. Which statement identifies a key assumption the scientist made in choosing this exponential decay model, and correctly explains why this assumption may limit the model's real-world accuracy?





- ✓ The model assumes heart rate decreases by a constant percentage each minute. This limits accuracy because the graph shows heart rate eventually levels off at about 120 bpm rather than continuing to decrease toward 80 bpm indefinitely.
- The model assumes the exponent uses the rational number $\frac{1}{2}$ as the base. This limits accuracy because exponential models should always use natural base e instead.
- The model assumes that time is measured in minutes rather than seconds. This limits accuracy because the recovery process actually occurs much faster than the graph suggests.
- The model assumes the athlete's initial heart rate is exactly 200 bpm. This limits accuracy because different athletes may have different maximum heart rates depending on fitness level.

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must analyze how three stated assumptions work together to shape the model and reason about when one would break down.

A sports analyst models the relationship between a basketball player's three-point shooting percentage and their average minutes played per game using the exponential function $P(m) = 85 - 45e^{-0.08m}$, where P is shooting percentage and m is minutes played. The analyst assumes that (1) increased playing time allows players to reach their "true" shooting ability, (2) there is a maximum biological/skill ceiling around 85%, and (3) the rate of improvement in shooting percentage decreases as minutes increase. Which statement best demonstrates understanding of the logical foundations and implications of these modeling assumptions?

- ○ The assumptions are reasonable because exponential functions always model sports data accurately, and the 85% ceiling represents the average NBA three-point percentage.
- ○ Assumptions (1) and (2) work together to justify the model's structure, but assumption (3) requires that improvement follows a decaying pattern—this breaks down if a player's shooting percentage actually declines after extended minutes due to fatigue or psychological factors not captured by the model. ✓
- ○ The model is valid as long as the player's actual shooting percentage never exceeds 85%, which assumption (2) guarantees will never happen.
- ○ Assumption (1) means the model only works for players with more than 20 minutes of playing time, since that is when shooting ability stabilizes.

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Test Bank question

MATH 3 · CLAIM 4 · MODELING & DATA ANALYSIS

4D Interpret results in the context of a situation

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 ~~DOK 4~~

DOK 2 · Skills & concepts

Why DOK 2: Students determine the long-run behavior of a rational model and then judge whether that behavior is reasonable in the real context, a two-step interpretation.

A basketball coach models the relationship between a player's free-throw shooting percentage and the number of practice hours per week using the rational function $f(x) = \frac{95x}{x+3}$, where x is the number of practice hours and $f(x)$ is the shooting percentage. The coach uses this model to predict performance for players practicing between 0 and 15 hours per week.

Part A: According to the model, what does the behavior of $f(x)$ as x approaches infinity tell us about the player's shooting percentage with increasingly more practice hours?

Choose one answer.

- ✓ The shooting percentage approaches 95%, suggesting that no matter how much a player practices, their shooting percentage will asymptotically approach but never exceed 95%.
- The shooting percentage increases without bound, so unlimited practice will eventually guarantee 100% or better shooting accuracy.
- The shooting percentage oscillates between 0% and 95% depending on the number of practice hours.
- The shooting percentage decreases toward zero because the denominator grows faster than the numerator.

Part B: Which observation best supports why this model's asymptotic behavior is reasonable in the real-world context of basketball free-throw shooting?

Choose one answer.

- The model is based on averaging the shooting percentages of all players on the team, so it naturally levels off at 95%.
- ✓ There is a physical and physiological limit to human performance; even elite free-throw shooters cannot achieve 100% accuracy, and additional practice eventually yields diminishing returns in improvement.

- ◯ Free-throw shooting percentage is determined by factors other than practice, such as player fatigue during games, making the model invalid.
- ◯ Basketball players can theoretically improve indefinitely with more practice, so the model should show unbounded growth.

FIND MORE LIKE THIS

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must verify a result, interpret it in context, critique a conclusion drawn from it, and explain the model's limits, which requires reasoning from several pieces of information.

A town's population is modeled by $P(t) = 18{,}000(0.97)^t$, where t is years since 2020. A planner solves $P(t) = 9{,}000$, gets $t \approx 22.8$, and writes: 'The population halves every 22.8 years. So after another 22.8 years, about 45.6 years after 2020, the town will have no people left.'
(a) Check whether $t \approx 22.8$ is correct and explain what it means.
(b) Evaluate the planner's conclusion. What does the model actually predict for about 45.6 years after 2020?
(c) Describe one reason the model's prediction far into the future may not be reliable.

Model response: (a) $0.97^t = 0.5$ gives $t = \frac{\log 0.5}{\log 0.97} \approx 22.8$. It means the population is predicted to fall to half of its 2020 value, 9,000 people, about 22.8 years after 2020 (in about 2043).
(b) The conclusion is incorrect. Halving again does not reach zero; it gives half of 9,000. $P(45.6) \approx 18{,}000(0.25) = 4{,}500$ people. An exponential decay model never reaches 0; it only gets closer to 0.
(c) For example, the 3% yearly decrease is unlikely to stay constant for 45 years because of births, people moving in, or new jobs, so long-range predictions are extrapolations beyond the data.

Rubric: 1 point: Confirms 22.8 and interprets it as a halving time, explains that the model predicts about 4,500 (not 0) people and that exponential decay never reaches 0, and gives a reasonable limitation.
0 points: Anything less, including a response that is only partly correct.

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MATH 3 · CLAIM 4 · MODELING & DATA ANALYSIS

4E Analyze adequacy and make improvements to existing models

Assessed at: ~~DOK 1~~ DOK 2 DOK 3 DOK 4 DOK 4 is assessed only in the performance task.

DOK 2 · Skills & concepts

Why DOK 2: Students revise a model by fitting a square root function to two given conditions, setting up and solving a small system to improve the model.

A coach models the relationship between a basketball player's free throw percentage and the number of practice sessions using the linear model $P = 2.5s + 55$, where P is the free throw percentage and s is the number of practice sessions.

After collecting data from 10 players, the coach observes that:
- For players with fewer than 5 practice sessions, the model predicts percentages that are too high
- For players with more than 15 practice sessions, the model predicts percentages that are too high and exceeds 100%
- The actual data shows diminishing returns: improvements slow down as players practice more

The coach wants to modify the model to better capture the diminishing returns effect. Instead of using a linear model, the coach decides to use a square root model of the form $P = a\sqrt{s} + b$.

The coach determines that when $s = 4$, the model should predict $P = 65\%$, and when $s = 9$, the model should predict $P = 75\%$.

Find the value of a in the improved square root model. Round to the nearest tenth.

Correct answer: **10**

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must analyze where a cubic model gives unrealistic results, explain why, and propose and justify a specific improvement, which requires strategic thinking.

A sports economist models a college basketball arena's game-day ticket revenue $R(x)$ (in thousands of dollars) as a function of ticket price x (in dollars) using the polynomial $R(x) = -2x^3 + 20x^2 - 18x$. The economist claims this model reasonably describes revenue for every ticket price $x \geq 0$. (a) Rewrite $R(x)$ in factored form by first factoring out the greatest common factor and then factoring the remaining quadratic. (b) Use the factored form to identify all ticket prices where the model predicts zero revenue, and explain what happens to the sign of $R(x)$ for prices between the two positive zeros versus prices between 0 and the smaller positive zero. (c) Explain why the model's behavior for very low ticket prices is unrealistic, and propose a specific improvement (such as restricting the domain) that fixes this flaw while preserving the model's usefulness for setting prices.

Model response: Factoring: $R(x) = -2x(x^2 - 10x + 9) = -2x(x - 1)(x - 9)$. The zeros are $x = 0, 1, 9$. Testing a value between 0 and 1 (e.g., $x = 0.5$) gives $R(0.5) = -2(0.5)(-0.5)(-8.5) = -4.25$, so revenue is negative on $(0, 1)$. Testing a value between 1 and 9 (e.g., $x = 5$) gives $R(5) = -2(5)(4)(-4) = 160$, so revenue is positive on $(1, 9)$. This is unrealistic: at very low ticket prices (near $0 to $1), real-world revenue should be small and positive (a few dollars per ticket times many fans), not negative — revenue cannot actually be negative. This flaw occurs because the cubic model was likely fit to data only in the profitable price range and extrapolated incorrectly to low prices. A targeted improvement is to restrict the model's domain to $1 \leq x \leq 9$, the interval where $R(x) \geq 0$ matches realistic behavior, and to use a separate simple model (e.g., a linear model through the origin) for $0 \leq x \leq 1$ if predictions in that range are needed. This preserves the cubic's good fit and realistic maximum-revenue prediction in the useful range while removing the nonsensical negative-revenue output at low prices.

Rubric: 1 point: Correctly factors R(x) as -2x(x-1)(x-9), identifies zeros at 0, 1, 9, correctly analyzes sign behavior on both intervals, clearly explains why negative revenue at low prices is unrealistic, and proposes a specific, justified domain restriction or alternative fix.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 3 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Test Bank question

DOK 4 · Extended thinking

Why DOK 4: Students carry out an extended analysis across several conditions: they compute residuals, detect a pattern, build and test a new model, and compare long-range predictions.

A town's population is recorded every 5 years, where t is years since 2000.
t: 0, 5, 10, 15, 20
Population: 12,000; 13,600; 14,880; 15,904; 16,723
A planner uses the model $P(t) = 12{,}000(1.03)^t$.
(a) Compute the model's predictions for each year in the table and the residuals (actual minus predicted). Describe the pattern in the residuals and what it says about the model.
(b) Find the change in population over each 5-year interval. What pattern do you see, and what does it suggest about the long-run population?
(c) Propose an improved model of the form $P(t) = L - C(b)^{t/5}$. Use the data to find L, C, and b, and test your model on the remaining data.
(d) Compare the two models' predictions for $t = 30$ and explain which is more reasonable to use for planning.

Model response: (a) Predictions: 12,000; 13,911; 16,127; 18,696; 21,673. Residuals: 0; -311; $-1{,}247$; $-2{,}792$; $-4{,}950$. The residuals are all negative and growing, so the exponential model increasingly overestimates; growth is slowing, not compounding.
(b) Changes: 1,600; 1,280; 1,024; 819. Each change is about 0.8 times the previous one, so the increases shrink by a constant factor and the population is leveling off toward a limit.
(c) Summing the remaining changes as a geometric series, the population approaches $12{,}000 + \frac{1{,}600}{1-0.8} = 20{,}000$, so $L = 20{,}000$. Then $C = 20{,}000 - 12{,}000 = 8{,}000$ and $b = 0.8$: $P(t) = 20{,}000 - 8{,}000(0.8)^{t/5}$. Checks: $t = 10$: 14,880; $t = 15$: 15,904; $t = 20$: 16,723, matching the data.
(d) The improved model predicts about 17,903 at $t = 30$; the original predicts about 29,127. The improved model fits all the data and reflects slowing growth, so it is more reasonable for planning, though the planner should keep updating it as new data arrive.

Rubric: 1 point: All parts addressed with one error or one weak justification.
0 points: Anything less, including a response that is only partly correct.

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MATH 3 · CLAIM 4 · MODELING & DATA ANALYSIS

4F Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flow charts, or formulas)

Assessed at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students identify the independent quantity in a table, recalling what an input variable is in a familiar situation.

A high school basketball team tracks the relationship between the number of three-point shots attempted and the number made during their games. The coach creates a table to analyze this data:

Game	Three-Pointers Attempted	Three-Pointers Made
1	12	5
2	18	7
3	15	6
4	24	9

Which variable should be identified as the independent variable when mapping the relationship between these quantities?

- ○ The game number, because it changes throughout the season
- ○ Three-pointers attempted, because this is the quantity the team can directly control ✓
- ○ Both variables equally, because they both appear in the table
- ○ Three-pointers made, because this is what the team wants to maximize

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Create questions › Math 3 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must define variables, write the revenue relationship and two constraints, and organize them in a table or diagram, mapping several connected quantities.

A high school basketball team is planning a fundraiser where they sell two types of items: team t-shirts for $12 each and hoodies for $28 each. The team wants to raise at least $840 and estimates they can sell at most 50 items total. Create a diagram or table that maps the relationship between the number of t-shirts sold, the number of hoodies sold, and the total revenue. Clearly label your variables and identify which quantities are independent and which are dependent. Explain how your representation helps you understand the constraints of this situation.

Model response: Let t = number of t-shirts sold (independent variable) and h = number of hoodies sold (independent variable). Total revenue R (dependent variable) = $12t + 28h$. Constraints: $t + h \leq 50$ and $12t + 28h \geq 840$. A table or diagram should show: (1) the two independent variables t and h as inputs, (2) the dependent variable R as output with the formula $R = 12t + 28h$ clearly labeled, and (3) the two constraints listed separately. For example, a sample table might show: if $t = 30$ and $h = 20$, then total items = 50 and $R = 360 + 560 = 920$ dollars (meets both constraints). The representation clarifies that revenue depends on both sales quantities and helps visualize which combinations of t and h satisfy both the item limit and revenue goal.

Rubric: 1 point: Student clearly identifies both independent variables (t and h) and dependent variable (R), writes the revenue formula correctly, lists both constraints, and either creates a table/diagram with labeled quantities or provides a written explanation of how the representation supports understanding the problem.

0 points: Anything less, including a response that is only partly correct.

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Create questions › Math 3 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must analyze how six quantities influence each other and identify feedback loops and constraints, reasoning about a whole system of relationships.

A high school soccer program is modeling attendance and revenue for the upcoming season. The athletic direct or identifies the following: ticket price per game (p dollars), number of games played (g), average attendance per game (a), total season revenue (R dollars), team winning percentage (w), and marketing budget (m dollars). The direct or notices that attendance depends on both winning percentage and marketing spend, winning percentage depends on player training hours and opponent strength, and revenue depends on both ticket price and attendance. Which of the following correctly identify critical feedback loops or constraints in this system that would significantly impact long-term sustainability? Select all that apply.

- [ ] Raising ticket price (p) will always increase total revenue (R) regardless of how attendance (a) responds to the price increase.
- [x] A constraint exists where if winning percentage becomes too low, attendance drops significantly, reducing revenue available for marketing; this limits the program's ability to recover competitiveness without external funding. ✓
- [x] Marketing effectiveness (the relationship between m and a) likely diminishes as winning percentage (w) decreases, meaning the program cannot simply "buy" attendance when the team performs poorly—this represents a critical interaction constraint. ✓
- [ ] The number of games played (g) is an independent variable that has no relationship to any other quantity in the system.
- [ ] Attendance per game (a) is solely determined by ticket price (p), making it independent of winning percentage and marketing.
- [x] Increased marketing budget leads to higher attendance, which increases revenue, allowing for more player training resources, which improves winning percentage, which further increases attendance—creating a positive feedback loop. ✓

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Test Bank question

MATH 3 · CLAIM 4 · MODELING & DATA ANALYSIS

4G Identify, analyze, and synthesize relevant external resources to pose or solve problems

Assessed at: ~~DOK 1~~ ~~DOK 2~~ DOK 3 DOK 4 Assessed only in the performance task, at DOK 3 and 4.

DOK 3 · Strategic thinking

Why DOK 3: Students judge two external sources by sample size, precision, and units, and decide how they could be combined, evaluating resources with evidence.

A student is building a linear model that predicts a sprinter's 100-meter race time (in seconds) from weekly training distance (in miles). The student finds two external data sources: Source A is a report from the national track federation, based on 500 athletes, with times measured to the nearest 0.01 second and distances measured to the nearest 0.1 mile. Source B is a fan blog post based on 12 athletes, with times reported only as "fast," "medium," or "slow" and distances rounded to the nearest 10 miles. Decide whether each statement about using these sources is True or False.

	True	False
Source A is more appropriate for the model because its larger sample size and precise, consistent units allow for reliable quantitative analysis.	☑	☐
Source B's categorical labels ("fast," "medium," "slow") can be directly averaged with Source A's numerical times without redefining units, since both describe speed.	☐	☑
Before combining data from both sources, the student should convert all measurements to the same units and check that both sources define "training distance" and "race time" the same way.	☑	☐
Because Source B has a much smaller sample size and less precise measurements, conclusions drawn from it should be treated as less reliable than those from Source A.	☑	☐
Reporting the final model's predicted race time to the nearest 0.0001 second is appropriate, since more decimal places always make a prediction more scientifically valid.	☐	☑

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Create questions › Math 3 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 3 › Generate

Test Bank question

DOK 4 · Extended thinking

Why DOK 4: Students must locate and evaluate several external sources, weigh their credibility and bias, and synthesize them into a plan for improving a model, an extended task.

A high school athletic director wants to model the relationship between weekly practice hours and team performance scores for the volleyball team over a season. She collects internal data showing practice hours (x) and match scores (y) for 8 weeks. However, she wants to improve her model's reliability by incorporating external data sources. Identify at least two external data sources you would recommend she consult, explain why each source is relevant and credible for this modeling purpose, and discuss any limitations or potential biases in these sources that could affect the accuracy of her linear model. Finally, explain how she should adjust her measurement precision (number of decimal places) when recording practice hours and scores based on the reliability of her combined data.

Model response: A strong response identifies sources such as: (1) published NCAA or high school athletic association benchmarking reports on practice-performance correlations, credible because they represent large populations and are peer-reviewed; (2) sports science research from university kinesiology departments, credible because they use controlled methodology but may not reflect this specific team's context; and (3) similar teams' public performance records, relevant for local comparison but limited by different coaching styles and player abilities. The response discusses limitations such as: external data may not account for variables like player injuries, roster changes, or team chemistry specific to this school; measurement bias in scoring systems may differ between matches; and practice hours alone may not capture practice quality. For measurement precision, the director should use whole numbers or one decimal place for practice hours (limited by scheduling precision) and integer scores (based on standard scoring systems), avoiding false precision that external data cannot support. The response should note that combining sources helps validate patterns but requires careful statistical interpretation to avoid overfitting.

Rubric: 1 point: Student identifies and locates at least two relevant external sources, discusses data quality, and attempts to integrate sources into modeling with some discussion of limitations.
0 points: Anything less, including a response that is only partly correct.

FIND MORE LIKE THIS

Create questions › Math 3 › PT › Area 2 · Claims 2 + 4 › Standard group › DOK 4 › Generate

Test Bank question

Sources

- Smarter Balanced Assessment Consortium, 2015–16 Summative Technical Report: claim statements, and the Appendix 2.A test blueprints (pp. 43–48), which list the DOK levels assessed for every claim and target. https://www.cde.ca.gov/ta/tg/ca/documents/sb16sbtechrpt.pdf
- Target wording and standards: Smarter Balanced Mathematics Content Specifications and the CCSS for Mathematics, as stored in the AchieveMetrics Test Bank.

- DOK level definitions: Smarter Balanced Content Specifications (Webb Depth of Knowledge), summarised on the "How to use" page.
- Example questions: the AchieveMetrics Test Bank, reviewed for this guide.

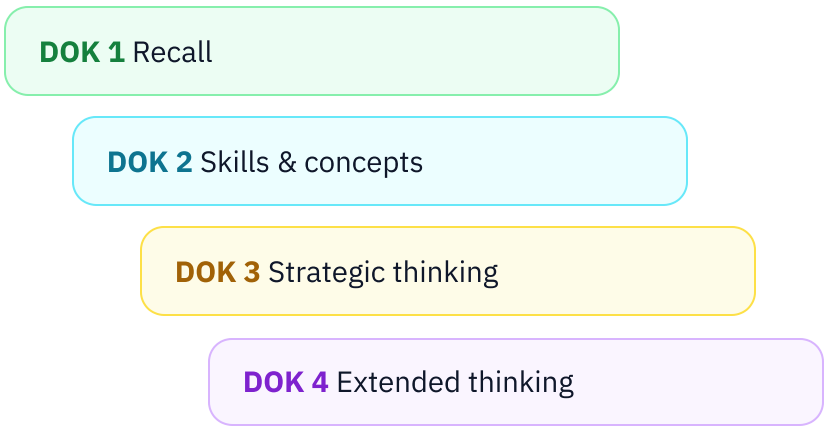
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DOK PROGRESSION GUIDE · NGSS SCIENCE

Grade 8 Science

Every NGSS performance expectation in the middle school (grades 6–8) PEs, tested in grade 8, with a Test Bank question at DOK 1, DOK 2 and DOK 3, and the clicks to find more.



For grade 8 science teachers. Organized by domain, core idea (DCI) and performance expectation (PE), the way the Test Bank files science.

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How to use this booklet

Depth of Knowledge (DOK) describes the kind of thinking a question asks for, not how hard it is. For each performance expectation (PE), this booklet shows one question at DOK 1, DOK 2 and DOK 3, so you can see the climb from recalling an idea to using evidence and reasoning with it, and then pick questions at the level your students need next.

The four DOK levels

DOK 1 · Recall — Recall a fact, term or property, or carry out a routine one-step procedure. Read a value straight from a table or graph.

DOK 2 · Skills & concepts — Decide how to approach it and use two or more steps: compare, classify, interpret data, or move between representations.

DOK 3 · Strategic thinking — Reason and plan: justify an answer, critique an argument, use evidence, or solve a problem with no routine path.

DOK 4 · Extended thinking — Carry out an extended investigation that connects several ideas, conditions or sources. The Test Bank tags science questions DOK 1 to 3, so this booklet shows those three levels.

Reading a PE page

1. The heading names the disciplinary core idea (DCI), the performance expectation (PE) code and its wording.
2. The DOK ladder shows the levels this guide gives an example for. Every PE has a DOK 1, DOK 2 and DOK 3 example.
3. One example question at each level, lowest first, with the answer shown. Read them top to bottom to see how the thinking climbs.
4. "Why DOK n" explains in one sentence what makes the question that level, so you can spot the same thing in your own questions.
5. "Find more like this" lists the exact Test Bank clicks that generate more questions for the same PE at the same level.

The state science test item specifications do not assign DOK levels to PEs, so the levels here come from the Test Bank's own DOK tags. Every example was then checked by hand against the DOK definitions above. Where no Test Bank question truly fit a level, we wrote one; those are marked "Written for this guide."

Finding these questions in the Test Bank

Every example page ends with the exact clicks. Science is filed by course, subject, core idea and PE. The courses are Grade 8 Life, Physical and Earth Science.

One PE at one DOK level

Create questions › Course › Subject › Disciplinary core idea (DCI) › Performance expectation (PE) › Practice and crosscutting concept (optional) › Options: DOK 1, 2 or 3 › Generate

Pick a practice and crosscutting concept to narrow the questions further, or leave them open for any.

Engineering Design (ETS1)

Engineering Design is not tied to one course.

Create questions › Course: All › MS Engineering Design › ETS1 › PE › Options: DOK › Generate

Questions you have saved

Saved questions are filed the same way in your Item Bank.

More › Item Bank › Course › Discrete or task › Subject › Core idea (DCI) › Performance expectation (PE) › DOK

Tip: to move a class up the ladder, generate the same PE at the next DOK level. To check that an idea is secure before going further, generate a set at DOK 1.

All performance expectations at a glance

Every PE has an example question at DOK 1, DOK 2 and DOK 3 in this booklet.

Life Science

PE		DOK 1	DOK 2	DOK 3	DOK 4
MS-LS1-1	Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells	●	●	●	–
MS-LS1-2	Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function	●	●	●	–
MS-LS1-3	Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells	●	●	●	–
MS-LS1-4	Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively	●	●	●	–
MS-LS1-5	Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms	●	●	●	–
MS-LS1-6	Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms	●	●	●	–
MS-LS1-7	Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism	●	●	●	–
MS-LS1-8	Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories	●	●	●	–
MS-LS2-1	Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem	●	●	●	–
MS-LS2-2	Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems	●	●	●	–
MS-LS2-3	Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem	●	●	●	–
MS-LS2-4	Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations	●	●	●	–
MS-LS2-5	Evaluate competing design solutions for maintaining biodiversity and ecosystem services	●	●	●	–
MS-LS3-1	Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism	●	●	●	–
MS-LS3-2	Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation	●	●	●	–
MS-LS4-1	Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms	●	●	●	–

PE		DOK 1	DOK 2	DOK 3	DOK 4
	throughout the history of life on Earth under the assumption that natural laws operate today as in the past				
MS-LS4-2	Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships	●	●	●	–
MS-LS4-3	Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy	●	●	●	–
MS-LS4-4	Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment	●	●	●	–
MS-LS4-5	Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms	●	●	●	–
MS-LS4-6	Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time	●	●	●	–

Physical Science

PE		DOK 1	DOK 2	DOK 3	DOK 4
MS-PS1-1	Develop models to describe the atomic composition of simple molecules and extended structures	●	●	●	–
MS-PS1-2	Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred	●	●	●	–
MS-PS1-3	Gather and make sense of information to describe that synthetic materials come from natural resources and impact society	●	●	●	–
MS-PS1-4	Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed	●	●	●	–
MS-PS1-5	Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved	●	●	●	–
MS-PS1-6	Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes	●	●	●	–
MS-PS2-1	Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects	●	●	●	–
MS-PS2-2	Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object	●	●	●	–
MS-PS2-3	Ask questions about data to determine the factors that affect the strength of electric and magnetic forces	●	●	●	–
MS-PS2-4	Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects	●	●	●	–
MS-PS2-5	Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact	●	●	●	–
MS-PS3-1	Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object	●	●	●	–
MS-PS3-2	Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system	●	●	●	–
MS-PS3-3	Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer	●	●	●	–
MS-PS3-4	Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample	●	●	●	–
MS-PS3-5	Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object	●	●	●	–

PE		DOK 1	DOK 2	DOK 3	DOK 4
MS-PS4-1	Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave	●	●	●	–
MS-PS4-2	Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials	●	●	●	–
MS-PS4-3	Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals	●	●	●	–

Earth & Space Science

PE		DOK 1	DOK 2	DOK 3	DOK 4
MS-ESS1-1	Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons	●	●	●	–
MS-ESS1-2	Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system	●	●	●	–
MS-ESS1-3	Analyze and interpret data to determine scale properties of objects in the solar system	●	●	●	–
MS-ESS1-4	Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history	●	●	●	–
MS-ESS2-1	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process	●	●	●	–
MS-ESS2-2	Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales	●	●	●	–
MS-ESS2-3	Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions	●	●	●	–
MS-ESS2-4	Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity	●	●	●	–
MS-ESS2-5	Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions	●	●	●	–
MS-ESS2-6	Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates	●	●	●	–
MS-ESS3-1	Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes	●	●	●	–
MS-ESS3-2	Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects	●	●	●	–
MS-ESS3-3	Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment	●	●	●	–
MS-ESS3-4	Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems	●	●	●	–
MS-ESS3-5	Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century	●	●	●	–

Engineering Design

PE		DOK 1	DOK 2	DOK 3	DOK 4
MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions	●	●	●	–
MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem	●	●	●	–
MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success	●	●	●	–
MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved	●	●	●	–

NGSS DOMAIN

Life Science

21 performance expectations, grouped by disciplinary core idea. In the Test Bank, choose the Grade 8 Life course, then MS Life Science.

Create questions › Grade 8 Life › MS Life Science › Core idea (DCI) › PE › Options: DOK › Generate

GRADE 8 SCIENCE · LIFE SCIENCE · LS1 FROM MOLECULES TO ORGANISMS

MS-LS1-1 Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students only need to recognize which single note is a microscope observation of cells, a direct recall of what counts as evidence of cells.

Isabel wrote these notes about a leaf she studied in science class. Select the note that is evidence that the leaf is made of cells.

- ○ The leaf came from a green plant in the schoolyard.
- ○ At 400x, the leaf showed many green, box-shaped units with walls. ✓
- ○ The leaf felt soft and bent easily between my fingers.
- ○ The leaf was about 3 cm long and 1 cm wide.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS1 › MS-LS1-1 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must decide to divide strand length by cell length for each organism and use the table, a two-step skill applied to investigation data.

Students use a microscope to investigate whether strands from three organisms contain one cell or many adjoining cells. They measure each strand and the length of a membrane-bounded unit within it. Use the measured lengths to estimate how many cells make up each observed strand. Choose the missing values from the drop-down menus.

Chain Organism	Chain Length (mm)	Length of One Cell (mm)	Cells in the Chain
Spirogyra strand	5	0.1	Blank 1
Anabaena chain	0.2	0.004	Blank 2
Oscillatoria thread	1	0.005	Blank 3

Blank 1 (Row 1 (Chain Organism: Spirogyra strand) — Cells in the Chain): 50 ▾

Blank 2 (Row 2 (Chain Organism: Anabaena chain) — Cells in the Chain): 50 ▾

Blank 3 (Row 3 (Chain Organism: Oscillatoria thread) — Cells in the Chain): 200 ▾

Drop-down 1 choices: 5 | **50 ✓** | 500

Drop-down 2 choices: 0.8 | **50 ✓** | 800

Drop-down 3 choices: 20 | **200 ✓** | 2,000

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS1 › MS-LS1-1 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students weigh size, cell count and cell types from the investigation to judge which explanations are supported, drawing a conclusion from several pieces of evidence.

A student uses a microscope to compare two organisms from a pond. Sample A is a paramecium. Sample B is a water flea, a small animal. The student measures that the water flea is about 10 times longer than the paramecium. Under the microscope, the paramecium is a single cell, while the water flea's body shows muscle cells, gut cells, and eye cells. The student wants to explain why the water flea is so much larger. Which statements are supported by this investigation? Select all that apply.

- [ ] The paramecium is too small to see structures inside it, so it cannot be considered a cell.
- [x] The water flea is larger mainly because it is built from many cells working together. ✓
- [ ] The water flea is 10 times longer, so each of its cells must be about 10 times larger.
- [x] The water flea has several types of cells, while the paramecium is one cell doing every job. ✓
- [x] Both organisms are made of cells, even though one is a single cell and the other has many. ✓
- [ ] Only the water flea is made of cells, since the paramecium is too simple to be a true cell.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS1 › MS-LS1-1 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · LIFE SCIENCE · LS1 FROM MOLECULES TO ORGANISMS

MS-LS1-2 Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students match each part of a bakery model to the cell part with the same job, which is recall of basic cell part functions.

Lucía models a plant cell as a bakery. Choose the cell part that each bakery part models.

	Cell wall	Cell membrane	Nucleus	Mitochondria
Bakery Part: Brick walls of the building — What It Does: Keep the building's shape	☑	☐	☐	☐
Bakery Part: Front door with a clerk — What It Does: Lets some people in and turns others away	☐	☑	☐	☐
Bakery Part: Head baker's recipe book — What It Does: Holds the instructions for all the work	☐	☐	☑	☐
Bakery Part: Ovens that burn fuel — What It Does: Release energy to run the bakery	☐	☐	☐	☑

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS1 › MS-LS1-2 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret mass changes in the egg model and connect them to what a membrane does, then pick the data that supports that interpretation.

Leo soaks two raw eggs in vinegar until their shells dissolve. Each egg is now held in only a thin, soft layer. He weighs the eggs, then soaks egg 1 in water and egg 2 in corn syrup for a day. Egg 1 goes from 75 g to 88 g. Egg 2 goes from 76 g to 52 g.

Part A: What does the thin layer around each egg model, and what does it do?

Choose one answer.

- ○ A cell wall that keeps water from ever leaving
- ○ A cell membrane that lets no water pass either way
- ○ A nucleus that decides how large the egg grows
- ○ A cell membrane that lets water move in or out ✓

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ○ Both eggs lost their hard shells when soaked in vinegar.
- ○ Corn syrup is much thicker and stickier than water.
- ○ Egg 1 gained 13 g in water, and egg 2 lost 24 g in syrup. ✓
- ○ Egg 2 weighed about the same as egg 1 at the start.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS1 › MS-LS1-2 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students build a claim, cite data from three jars including controls, and reason about which cell part released energy without light, a full evidence-based explanation.

Students put soaked bean seeds in a sealed jar in a dark closet. They set up a second jar with boiled seeds and a third jar with no seeds. After 48 hours, the first jar was 4.0°C warmer. The boiled-seed jar was 0.1°C warmer, and the empty jar did not change. Make a claim about whether living seed cells release energy in the dark. Support it with data, and explain which cell part is responsible.

Model response: Living seed cells do release energy in the dark. The jar with living seeds warmed by 4.0°C, but the boiled seeds warmed it only 0.1°C and the empty jar did not change. The seeds were in the dark, so their chloroplasts could not work. The mitochondria in the living seed cells released energy from the food stored in the seeds, and some of that energy warmed the jar.

Rubric: 2 points: The response includes all required elements: claim that living seed cells release energy in the dark; evidence citing the data (4.0°C for living seeds compared with 0.1°C for boiled seeds or no change in the empty jar); reasoning that mitochondria release energy from the seeds' stored food, which does not need light.
1 point: The response includes one or two of the three required elements above, but not all three. Credit for "Reasoning: mitochondria release energy from the seeds' stored food, without light" requires "Claim: living seed cells release energy even in the dark".
0 points: no correct part, or credits chloroplasts for the energy. No correct required element; the response is incorrect, too vague to earn credit, irrelevant, blank, or only copies the prompt without answering.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS1 › MS-LS1-2 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · LIFE SCIENCE · LS1 FROM MOLECULES TO ORGANISMS

MS-LS1-3 Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students name the level of organization for each example and identify the system that delivers oxygen, which is recall of terms and basic facts.

A runner is training for a school race. Choose the missing values from the drop-down menus about how her body is organized and how her body systems work together during the race.

Question	Example or Situation	Answer
Level of organization	One single muscle cell in her leg	Blank 1
Level of organization	Many muscle cells grouped together to form muscle tissue	Blank 2
Level of organization	The heart, built from muscle tissue, nerve tissue, and blood vessel tissue working together	Blank 3
System interaction	While she runs, her leg muscles use more oxygen. Her heart beats faster to move more blood to those muscles. Which system works with the muscular system to deliver the extra oxygen?	Blank 4

Blank 1 (Row 1 (Question: Level of organization) — Answer): Cell ▾

Blank 2 (Row 2 (Question: Level of organization) — Answer): Tissue ▾

Blank 3 (Row 3 (Question: Level of organization) — Answer): Organ ▾

Blank 4 (Row 4 (Question: System interaction) — Answer): Circulatory system ▾

Drop-down 1 choices: Organ | Tissue | **Cell ✓** | Organ system

Drop-down 2 choices: Organ | **Tissue ✓** | Cell | Organ system

Drop-down 3 choices: **Organ ✓** | Tissue | Cell | Organ system

Drop-down 4 choices: Nervous system | **Circulatory system ✓** | Excretory system | Digestive system

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS1 › MS-LS1-3 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students judge each statement about how the lungs, heart, blood and nerves interact during exercise, explaining relationships between systems at a basic level.

A student observes that after sprinting during soccer practice, her heart rate and breathing rate both increase. She also notices her muscles feel warm and she sweats more. Select True or False for each statement about how her body systems work together.

	True	False
The lungs take in oxygen, which the blood then carries to the muscles that are working hard.	☑	☐
Each body system works independently, so the higher heart rate has no link to the faster breathing.	☐	☑
The nervous system senses the muscles' needs and signals the heart and lungs to speed up.	☑	☐
Sweat comes from the lungs sending extra moisture through tubes to the skin.	☐	☑
Blood carries oxygen and nutrients to the muscle cells so they can keep contracting.	☑	☐

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS1 › MS-LS1-3 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students use the during and after exercise pattern as evidence and explain why both systems must respond together, a written argument linking several subsystems.

A student checked her heart rate and breathing rate before, during, and after riding her bike up a big hill. Both her heart rate and her breathing rate went up while she rode. After she stopped, both stayed high for a few minutes before slowing back down. Use this evidence to explain how the circulatory system and the respiratory system work together during and after hard exercise. Explain why both systems need to respond to the same problem in the body.

Model response: Both heart and breathing rates rise during cycling and remain high briefly during recovery. Lungs exchange oxygen and carbon dioxide with blood; the heart circulates blood to working muscles and back to lungs. Muscles use oxygen to release energy from food and produce carbon dioxide. The exercise/recovery pattern is consistent with increased gas-transfer needs and the connected pathways explain interdependence. Correlation alone does not prove the interaction.

Rubric: 2 points: Uses the exercise/recovery pattern and explains why lung gas exchange and blood transport together meet muscle needs. 1 point: Gives correct rate evidence or a partially correct interaction pathway, without both. 0 points: Gives no correct evidence-based interaction explanation.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS1 › MS-LS1-3 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · LIFE SCIENCE · LS1 FROM MOLECULES TO ORGANISMS

MS-LS1-4 Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students connect a described display behavior to a higher chance of being chosen as a mate, a direct link stated almost fully in the passage.

In an Australian forest, a male satin bowerbird builds a structure of sticks called a bower. He decorates the ground in front of it with blue objects, such as feathers and berries. Females visit several bowers before they choose a mate. How does this bower-building behavior most likely affect the male's reproduction?

- ◯ It attracts females, which raises his chance of being chosen as a mate. ✓
- ◯ He builds it because he wants more bowerbirds to live in the forest.
- ◯ It gives his eggs a warm place to hatch after the female lays them.
- ◯ It lets him store extra food so he can survive the dry season.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS1 › MS-LS1-4 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students sort each observation by whether it supports a claim about a plant structure aiding reproduction, which requires classifying evidence against the claim.

A student makes this claim: 'Hooked spines on seed-bearing burr fruits help the plant reproduce. The hooks let seeds stick to animals and travel to new places, where the seeds have less competition from the parent plant.' Look at each observation. Does it support the claim, or not? For each row, choose an answer for "Supports or does not support the claim".

	Does not support	Supports
Observation: Hooks on a burr seed grab onto a dog's fur while the dog walks through a field	☐	☑
Observation: The dog walks two miles before the burr falls off into a new field	☐	☑
Observation: The burr seed is brown, which helps it blend in with dirt	☑	☐
Observation: Young plants growing far from the parent plant get more sunlight and more nutrients from the soil	☐	☑

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS1 › MS-LS1-4 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must interpret a controlled experiment, compare two groups' results, and argue how flashing raises mating success, building an evidence-based argument.

A scientist randomly assigns 60 matched male fireflies to equal groups. She covers light organs with dark paint in one group and the same amount of clear paint in the other; handling and movement remain comparable. In one night, 12 of 30 clear-painted males displaying their species pattern mate, compared with 1 of 30 dark-painted males. What argument do these controlled results support about flashing and reproductive success?

Model response: The results support flashing improving mating opportunities: 12 of 30 visible-flashing males mated, compared with 1 of 30 males whose light was blocked. The species pattern provides a signal females can find and recognize. Equal handling and a clear-paint control strengthen the argument that visible light contributes to the difference, without establishing that it is the only influence on reproduction.

Rubric: 2 points: Uses the 12 of 30 versus 1 of 30 comparison and explains visible flashes as a mate-finding or recognition signal. 1 point: Gives either the correct comparison or the correct signal explanation. 0 points: Gives neither a correct comparison nor a correct signal explanation.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS1 › MS-LS1-4 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · LIFE SCIENCE · LS1 FROM MOLECULES TO ORGANISMS

MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students pick the one report sentence that shows growth changing with an environmental condition, simply recognizing evidence rather than analyzing it.

A team of divers grows kelp from one batch of spores on ropes at two depths in the same bay. Here are four sentences from their report. Which statement gives evidence that an environmental factor affected kelp growth?

- ○ All of the kelp on the ropes grew from one batch of spores.
- ○ The ropes hung from the same buoys in one part of the bay.
- ○ Kelp at 2 m grew 20 cm a week, but kelp at 12 m grew 5 cm. ✓
- ○ Kelp is a large seaweed that makes its own food from light.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS1 › MS-LS1-5 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must make two comparisons, same breed on different pastures and different breeds on the same pasture, to see both genes and environment matter.

A goat farm raises three groups of young goats, called kids, for 6 months. Group 1 is Boer goats, a large meat breed, on rich pasture. Group 2 is Boer goats on poor, dry pasture. Group 3 is Nigerian Dwarf goats, a small breed, on the same rich pasture as Group 1. At 6 months, the kids in Groups 1, 2, and 3 average 30 kg, 20 kg, and 12 kg. Which conclusion is best supported by these results?

- ○ Only genes affected the kids' growth, since breed made the biggest difference.
- ✓ Both breed and pasture affected growth, since each change made a difference.
- ○ Only pasture affected the kids' growth, since food is what builds a body.
- ○ Neither breed nor pasture mattered, since all the kids were young goats.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS1 › MS-LS1-5 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students test a general claim against six varied cases and decide which ones contradict it, reasoning about how environment can override parent size.

Mrs. Lin tells her class, "A bigger parent always has bigger offspring." The class collects observations to test her claim. Which observations are evidence against her claim? Select all that apply.

- [x] Seeds from a 40 cm bonsai juniper grew into trees 5 m tall in open ground. ✓
- [ ] A large Great Dane had puppies that grew much larger than beagle puppies.
- [ ] Seeds from a tall pea variety grew into tall plants in the same garden as their parent.
- [x] Seeds from a 900 kg prize pumpkin grew only 60 kg pumpkins in a shady, dry garden. ✓
- [ ] Seeds from a big sunflower grew into big sunflowers in the same sunny field.
- [x] A small cow raised on poor pasture had a calf that grew large on rich pasture. ✓

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS1 › MS-LS1-5 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · LIFE SCIENCE · LS1 FROM MOLECULES TO ORGANISMS

MS-LS1-6 Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall whether each photosynthesis input or output is matter or energy and whether it enters, leaves or is made in the plant.

Duckweed is a tiny floating plant that can cover a whole pond in a few weeks. Amara lists some things that are involved when duckweed carries out photosynthesis. For each item, choose whether it is matter or energy and what happens to it. Choose the missing values from the drop-down menus.

Item	Matter or energy?	What happens to it?
Sunlight	Blank 1	Blank 2
Carbon dioxide	Blank 3	Enters the plant
Oxygen	Blank 4	Blank 5
Sugar	Matter	Blank 6

Blank 1 (Row 1 (Item: Sunlight) — Matter or energy?): Energy ▾

Blank 2 (Row 1 (Item: Sunlight) — What happens to it?): Enters the plant ▾

Blank 3 (Row 2 (Item: Carbon dioxide) — Matter or energy?): Matter ▾

Blank 4 (Row 3 (Item: Oxygen) — Matter or energy?): Matter ▾

Blank 5 (Row 3 (Item: Oxygen) — What happens to it?): Leaves the plant ▾

Blank 6 (Row 4 (Item: Sugar) — What happens to it?): Made inside the plant ▾

Drop-down 1 choices: Matter **Energy ✓**

Drop-down 2 choices: Made inside the plant Leaves the plant **Enters the plant ✓**

Drop-down 3 choices: **Matter ✓** Energy

Drop-down 4 choices: **Matter ✓** | Energy

Drop-down 5 choices: Made inside the plant | **Leaves the plant ✓** | Enters the plant

Drop-down 6 choices: **Made inside the plant ✓** | Leaves the plant | Enters the plant

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS1 › MS-LS1-6 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret a two-group data table to conclude that carbon dioxide builds plant mass, then choose the comparison that supports it.

Anika grows two groups of oat seedlings under the same bright lights with the same water. One group grows in normal air. The other grows in a chamber where a filter removes the carbon dioxide from the air. She dries representative matched samples at the start and after two weeks to estimate each group's average dry mass.

Dry Mass of Oat Seedlings With and Without Carbon Dioxide

Group	Dry mass at start (g)	Dry mass after 2 weeks (g)
Normal air	1.0	2.4
Air with no carbon dioxide	1.0	0.8

Part A: Which conclusion is best supported by the results?

Choose one answer.

- ◯ Oat seedlings need carbon dioxide to build new dry mass. ✓
- ◯ Oat seedlings grow the same with or without carbon dioxide.
- ◯ Oat seedlings need extra light when carbon dioxide is removed.
- ◯ Oat seedlings get most of their dry mass from the water they use.

Part B: Which evidence from the data best supports your answer to Part A?

Choose one answer.

- ◯ Only the group in normal air gained dry mass; the other lost some. ✓

- ◯ Both groups started with a dry mass of exactly 1.0 gram.
- ◯ Both groups had the same bright lights and the same water.
- ◯ The group in normal air ended with a dry mass of 2.4 grams.

FIND MORE LIKE THIS

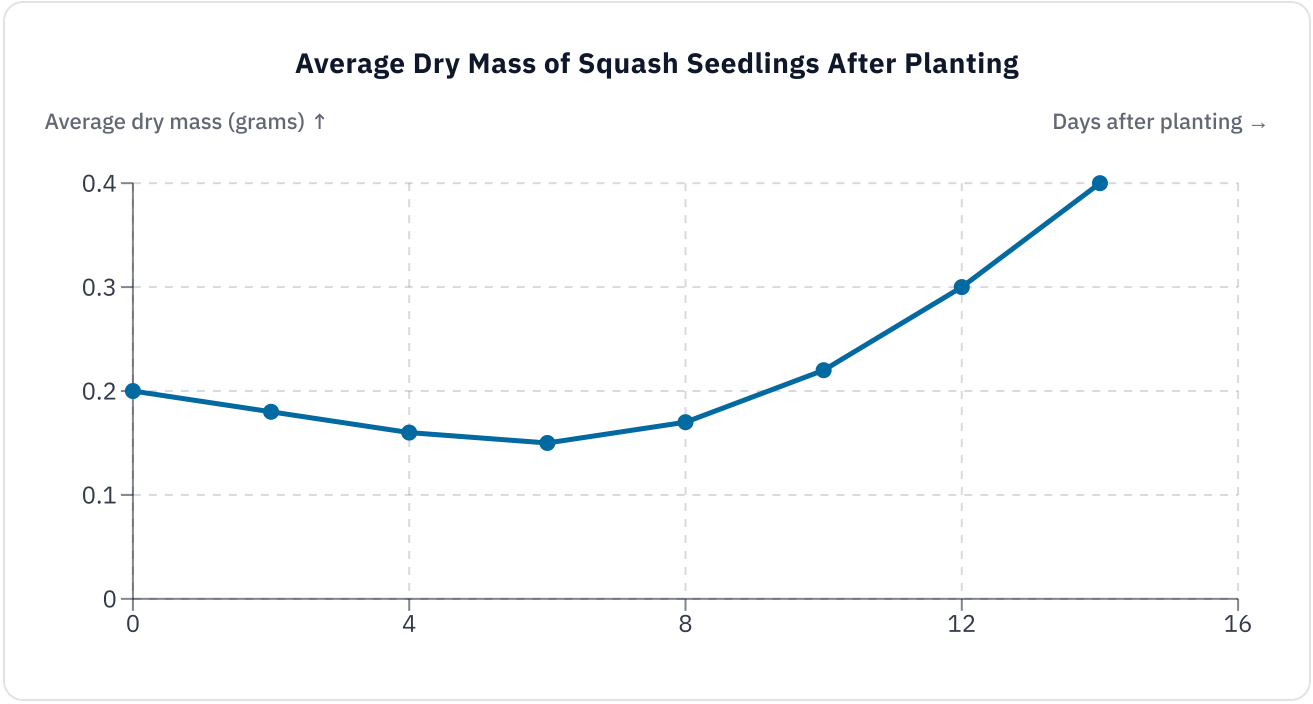
Create questions › Grade 8 Life › MS Life Science › LS1 › MS-LS1-6 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students explain why seedling mass first drops and then rises, combining stored food use and photosynthesis to account for a non-obvious pattern.

Elif plants squash seeds in pots of soil in a sunny window. Every two days, she dries and weighs a few seedlings to find their average dry mass. Which explanation best accounts for the pattern in the data?



- ○ Dry mass fell as seedlings dried out, then rose as they took up more water.
- ○ Dry mass fell while seedlings used seed food, then rose once leaves made sugar. ✓
- ○ Dry mass fell at first because seedlings do not respire until leaves open.
- ○ Dry mass fell while roots lost soil, then rose once they took in more soil.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS1 › MS-LS1-6 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · LIFE SCIENCE · LS1 FROM MOLECULES TO ORGANISMS

MS-LS1-7 Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students fill in the gas taken in, the gas given off and what muscles get from fat, recalling the basic parts of cellular respiration.

Bar-tailed godwits fly nonstop from Alaska to New Zealand, about 11,000 kilometers. They do not eat or drink for 8 or 9 days. A bird starts the trip with lots of stored fat and arrives much lighter. Choose the missing values from the drop-down menus.

Part of the model	What it is
Food molecules the bird uses in flight	Stored fat
Gas the bird takes in to break down fat	Blank 1
Gas the bird breathes out as waste	Blank 2
What the flight muscles get from the fat	Blank 3

Blank 1 (Row 2 (Part of the model: Gas the bird takes in to break down fat) — What it is):

Oxygen ▾

Blank 2 (Row 3 (Part of the model: Gas the bird breathes out as waste) — What it is):

Carbon dioxide ▾

Blank 3 (Row 4 (Part of the model: What the flight muscles get from the fat) — What it is):

Released energy ▾

Drop-down 1 choices: **Oxygen ✓** Carbon dioxide Nitrogen

Drop-down 2 choices: Oxygen **Carbon dioxide ✓** Nitrogen

Drop-down 3 choices: **Released energy ✓** Created energy Fat atoms turned into energy

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS1 › MS-LS1-7 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students classify each item as entering, leaving or being rebuilt into the bird's body, applying the matter-flow model to a new organism.

Arctic terns fly from Greenland to Antarctica each year. On the way, they stop to catch fish, then fly on. Match each item to the column that shows where it fits in a model of matter moving through a tern.

	Enters the tern's body	Leaves the tern's body	Rebuilt into the tern's body
Water vapor breathed out	☐	☑	☐
Fish molecules rebuilt into stored fat	☐	☐	☑
Carbon dioxide breathed out	☐	☑	☐
Fish molecules rebuilt into flight muscle	☐	☐	☑
Oxygen breathed in	☑	☐	☐
Fish swallowed at a stop	☑	☐	☐

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS1 › MS-LS1-7 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must reason out why body mass gain is far less than food eaten and describe two separate matter pathways, an open explanation with no single route.

A blue whale eats krill and builds blubber, but gains much less body mass than the fresh food mass it eats. Describe two food-matter pathways that a model could show to explain this difference.

Model response: Some digested krill atoms are rearranged into fat molecules in new blubber. Other food molecules undergo respiration, releasing stored energy and forming carbon dioxide and water that can leave the body; undigested matter also leaves as waste. Fresh intake and body gain alone do not measure each pathway's exact share.

Rubric: 2 points: describes krill matter being rearranged into blubber AND a pathway by which food matter leaves as respiratory products or waste. 1 point: describes one of these pathways. 0 points: describes neither pathway correctly, or claims food atoms disappear into energy.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS1 › MS-LS1-7 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · LIFE SCIENCE · LS1 FROM MOLECULES TO ORGANISMS

MS-LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students identify the basic pathway from eye receptors to brain to muscles, recalling how a stimulus leads to a response.

A volleyball player sees an approaching ball and quickly raises her arms to block. Which explanation correctly connects the visual stimulus with her response?

- ◯ Eye receptors send brain messages, and brain signals guide arm movement. ✓
- ◯ A quick block proves that the brain cannot use any previous experience.
- ◯ The eyes store the blocking skill and directly command the arm muscles.
- ◯ The arms detect the ball's light and decide to block without brain input.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS1 › MS-LS1-8 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students sort pieces of information by whether they actually link smell to memory, deciding relevance rather than just recalling facts about smell.

Hugo wants to support the claim that smells can bring back memories. Match each piece of information to the column that shows whether it supports his claim.

	Supports the claim	Does not support the claim
The nose has millions of smell receptors	☐	☑
An article says smell messages reach memory areas of the brain	☑	☐
A baker says fresh bread reminds her of her first job	☑	☐
22 of 30 classmates said a smell brought back a strong memory	☑	☐
Smells travel through the air as tiny particles	☐	☑
Dogs can smell much better than people	☐	☑

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS1 › MS-LS1-8 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate four possible tests and choose the one that isolates voice recognition from other cues, which requires planning a fair investigation.

Bao claims that his cat, Miso, recognizes Bao's voice. Miso often comes running when Bao calls her. Which test would give the best evidence for Bao's claim?

- ✓ Play recordings of Bao and of strangers calling Miso from a hidden speaker, and compare her responses.
- Ask Bao's friends whether they think Miso knows Bao's voice better than their voices.
- Have Bao call Miso while standing in plain view, and time how fast she runs to him.
- Have Bao call Miso at dinnertime every day for a week, and count how often she comes.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS1 › MS-LS1-8 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · LIFE SCIENCE · LS2 ECOSYSTEMS: INTERACTIONS, ENERGY, AND DYNAMICS

MS-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students read that the population fell and name the resource that was scarce, recalling a fact directly from the short scenario.

Use the drop-down menus to complete the statement.

A scientist studied a rabbit population in a forest over 10 years. During a drought, grass became scarce, and the rabbit count fell from 300 to 110. When the grass was scarce, the rabbit population [decreased ▾]. This pattern supports reduced [food availability ▾] as a possible contributor to the population change.

Drop-down 1 choices: stayed the same | **decreased ✓** | increased steadily

Drop-down 2 choices: predation | competition with other species | **food availability ✓**

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS2 › MS-LS2-1 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret a trend across three winters and connect snow depth to food access to explain calf survival, a cause and effect from data.

Elk calf survival in a mountain valley was 90% in a winter with 30 cm of snow, 70% with 80 cm, and 55% with 120 cm. Elk dig through snow to reach grass. Select the claim best supported by these data.

- ◯ Deeper snow made food harder to reach, so fewer calves survived. ✓
- ◯ Fewer calves survived because the adult elk ate all the snow.
- ◯ Deeper snow made the calves warmer, so more of them survived.
- ◯ Snow depth had no effect on how many calves survived.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS2 › MS-LS2-1 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students analyze a multi-year table, rule out fish supply, and argue that nesting space limited the colony, drawing a conclusion from competing evidence.

Western gulls nest on the ground on a small island and feed on fish at sea. The island was covered in a thick plant called ice plant, and gulls nested only in the open patches. In 2021, volunteers cleared ice plant from half the island. Make a claim about what limited the gull colony. Support it with evidence from the data and explain your reasoning.

Open Ground, Gull Nests, and Fish Near an Island

Year	Open Nesting Ground (square meters)	Gull Nests	Fish Near Island (catch per net)
2019	2,000	180	50
2020	2,100	185	30
2022	6,000	510	45
2023	6,100	530	28

Model response: Open nesting ground is a supported limitation: roughly 2,000 square meters and 180 nests became roughly 6,000 square meters and 510 to 530 nests after clearing. Nests follow space more closely than the changing fish catches, supporting nesting space as a contributor without proving food never matters.

Rubric: 2 points: gives a nesting-space claim with the before-and-after area/nest comparison and explains why it is supported relative to fish catches. 1 point: gives a correct claim with partial evidence or reasoning. 0 points: gives no supported claim.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS2 › MS-LS2-1 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · LIFE SCIENCE · LS2 ECOSYSTEMS: INTERACTIONS, ENERGY, AND DYNAMICS

MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students label each pair as predation, competition or mutualism, which is recall of the definitions of these interaction types.

A scientist studied three ocean places. She watched how animals act with each other. Classify each row. Pick the type of relationship for each pair: predation, competition, or mutualism.

	predation	mutualism	competition
Coral reef: clownfish gain shelter and anemones gain nutrients	☐	☑	☐
Kelp forest: otters hunt and eat urchins	☑	☐	☐
Place: Rocky Shore — Animals: Barnacles and mussels fighting for space on rocks	☐	☐	☑

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS2 › MS-LS2-2 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students apply the same competition pattern to two different ecosystems and predict each outcome, comparing cases rather than recalling a definition.

Use the drop-down menus to complete the statement.

As the Arctic warms, red foxes are moving north onto the tundra. They take over dens and hunt the same prey as arctic foxes. In Pacific forests, barred owls have spread west into the home of spotted owls, and they hunt the same prey. As red foxes spread, arctic foxes most likely [decrease ▾]. As barred owls spread, spotted owls most likely [decrease ▾]. Both cases show the pattern of [competition ▾].

Drop-down 1 choices: stay the same | increase | **decrease ✓**

Drop-down 2 choices: stay the same | increase | **decrease ✓**

Drop-down 3 choices: predation | **competition ✓** | mutualism

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS2 › MS-LS2-2 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students map each organism in the marsh example onto a rocky shore and reason through a chain of effects to predict a new outcome.

In a salt marsh, blue crabs eat snails, and the snails graze on marsh grass. Where people caught most of the crabs, the snails increased and the grass died back. On a rocky shore, oystercatcher birds eat limpets, and limpets scrape algae off rocks. Select the prediction for the rocky shore that follows the same pattern.

- ◯ If oystercatchers are scared away, limpets increase and less algae is left. ✓
- ◯ If oystercatchers are scared away, limpets decrease and algae spread over the rocks.
- ◯ If oystercatchers are scared away, limpets and algae both increase together.
- ◯ If oystercatchers are scared away, nothing changes, since birds do not eat algae.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS2 › MS-LS2-2 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · LIFE SCIENCE · LS2 ECOSYSTEMS: INTERACTIONS, ENERGY, AND DYNAMICS

MS-LS2-3 Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall that eating moves both matter and stored energy from food into the consumer, a single basic fact.

A giraffe eats acacia leaves on the savanna. Which statement correctly describes what the giraffe takes in when it eats?

- ◯ It takes in matter and the energy stored in the leaves. ✓
- ◯ It takes in only sunlight that is stored in the leaves.
- ◯ It takes in only water, since leaves are mostly water.
- ◯ It takes in heat that the acacia tree made from soil.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS2 › MS-LS2-3 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students judge several statements about a food chain model, distinguishing how matter cycles from how energy flows, which requires comparing two ideas.

A model of a grassland ecosystem shows grass being eaten by grasshoppers, grasshoppers eaten by mice, and mice eaten by hawks. When the mice and hawks die, decomposers such as fungi and bacteria break down their bodies. A student is developing this model to show how matter cycles and energy flows through the ecosystem. Which statements about this model are scientifically accurate? Select all that apply.

- [x] Decomposers break down dead organisms and waste, returning matter to the soil so producers like grass can reuse it.
- [x] At each step from grass to grasshopper to mouse to hawk, less energy is available than at the step before it.
- [x] Energy flows through the ecosystem and is eventually lost as heat, so it does not cycle back to the grass the way matter does.
- [ ] The arrows in the food web represent only which organism eats which, not the movement of matter and energy.
- [x] Without decomposers, the matter in dead mice and hawks would stay locked up and unavailable to producers.
- [ ] Energy is recycled through the ecosystem in the same way matter is, moving repeatedly from hawks back to grass.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS2 › MS-LS2-3 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students write an explanation that traces matter reuse through decomposers and argues why sunlight is still required, combining two model ideas in their own words.

A sealed-jar model contains a plant, bacteria and fungi that decompose dead material, pill bugs that eat dead material, and soil. Sunlight enters and heat leaves. Explain how matter is reused and why continued food production requires sunlight.

Model response: Bacteria and fungi release nutrients and gases from dead material into soil and air, and the plant reuses that matter. Pill bugs eat dead material. The plant stores sunlight energy in food, and energy eventually leaves as heat, so continued food production requires incoming light.

Rubric: 2 points: explains matter release by decomposers and plant reuse, and explains sunlight entering for food production with heat leaving. 1 point: correctly explains either pathway. 0 points: explains neither.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS2 › MS-LS2-3 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · LIFE SCIENCE · LS2 ECOSYSTEMS: INTERACTIONS, ENERGY, AND DYNAMICS

MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students identify the cold snap as a nonliving change and state that the population dropped, recalling a category and an obvious effect.

A cold snap froze a Florida lagoon for several days. Many snook, a fish that cannot survive cold water, died. Describe what kind of change affected the snook, living or nonliving, and explain how it affected the snook population.

Model response: The cold snap was a nonliving change, because it changed the water temperature. The snook population decreased because many snook died in the cold water.

Rubric: 2 points: identifies the cold snap as a nonliving (physical) change, AND explains that the snook population decreased because many died in the cold water. 1 point: gives only one of these. 0 points: neither.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS2 › MS-LS2-4 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must link two steps, warmer winters letting more beetles survive and more beetles killing pines, to explain an indirect effect.

Winters in a western forest have become warmer. Mountain pine beetle larvae used to die in cold winters, but now most survive. Over ten years, the beetles killed millions of pine trees. Which statement best explains how the warmer winters affected the pine trees?

- ○ Warmer winters killed the beetles, so the pines had fewer beetles to fight.
- ○ Warmer winters gave the pines more food, so the beetles had to eat more.
- ○ Warmer winters killed the pines directly, and the beetles moved in afterward.
- ✓ Warmer winters let more beetles survive, and more beetles killed more pines.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS2 › MS-LS2-4 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students combine nest data with ideas about edges and parasitism to evaluate claims about forest fragmentation, reasoning from several pieces of information.

Cowbirds lay eggs in other birds' nests and search mostly near forest edges. Their chicks compete with host chicks for food. Scientists compared similar-shaped forest patches of different sizes: 70 percent of wood thrush nests in small patches had cowbird eggs, compared with 10 percent in large patches. Select True or False for each statement.

	True	False
Cutting a large forest into small patches likely helps cowbirds find more nests.	☑	☐
Wood thrushes in small patches likely raise fewer of their own young.	☑	☐
The data show forest patch size has no link to cowbird eggs in nests.	☐	☑
Small patches have more edge compared with their size than large patches.	☑	☐

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS2 › MS-LS2-4 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · LIFE SCIENCE · LS2 ECOSYSTEMS: INTERACTIONS, ENERGY, AND DYNAMICS

MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students choose between two simple plans using the basic fact that predators control prey without poisoning other animals, a straightforward recall-based choice.

A farm has too many mice eating stored grain. Plan A puts out rat poison around the barns. Plan B puts up nest boxes for barn owls, which hunt mice at night. Which plan better protects the farm's biodiversity while controlling mice?

- ○ Plan A, because poison affects only the mice that eat it.
- ○ Plan B, because owls eat mice without poisoning other animals. ✓
- ○ Plan A, because owls would scare away every other bird.
- ○ Plan B, because owls eat grain instead of mice.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS2 › MS-LS2-5 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students compare two road crossing designs and judge each statement about their effects on stream animals, applying criteria to both solutions.

Engineers compared two ways to let a stream flow under a road. A small round pipe makes water rush through fast and drop off the end. A wide, open-bottom arch keeps the natural streambed and slow water. Trout and crayfish must move upstream to feed and breed. Select True or False for each statement.

	True	False
Fast water and a drop at the pipe's end can block fish from moving upstream.	☑	☐
The arch keeps the streambed that crayfish and insects live on.	☑	☐
The small pipe connects the stream for animals better than the arch.	☐	☑
Choosing the arch could help trout reach places to lay eggs.	☑	☐
The design under the road has no effect on stream animals.	☐	☑

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS2 › MS-LS2-5 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students check two designs against three criteria and write a justified choice using the data, evaluating competing solutions with evidence.

A county compares a concrete seawall costing 12 million dollars, reducing wave energy by 70 percent and supporting 3 kinds of fish and crabs, with an oyster reef and marsh costing 8 million dollars, reducing waves by 60 percent and supporting 25 kinds. Its criteria are at least 50 percent wave reduction and at least 20 kinds of fish and crabs within a 10-million-dollar budget. Use the data to justify your choice. Which design meets all criteria?

Model response: The oyster reef and marsh meets all criteria: 8 million is within the 10-million budget, 60 percent exceeds 50 percent, and 25 kinds exceed 20. The wall costs 12 million and supports only 3 kinds.

Rubric: 2 points: Chooses the reef and marsh and accurately uses cost, wave reduction and species evidence to show it meets all criteria. 1 point: Chooses the reef with incomplete evidence, or correctly compares one criterion. 0 points: Gives no relevant choice or comparison.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS2 › MS-LS2-5 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · LIFE SCIENCE · LS3 HEREDITY: INHERITANCE AND VARIATION OF TRAITS

MS-LS3-1 Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students fill in that a mutation changes a gene, which changes a protein, recalling the basic gene to protein to trait chain.

Use the drop-down menus to complete the statement.

A branch on a green apple tree grew red apples because of a mutation in one of its cells. Growers cut that branch and grafted it onto other trees to grow more red apples. The mutation changed a [gene ▾] in the branch, which changed a [protein ▾] that made the apples red.

Drop-down 1 choices: root | **gene ✓** | leaf

Drop-down 2 choices: flower | season | **protein ✓**

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS3 › MS-LS3-1 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret escape percentages to classify a mutation as beneficial and choose the data that supports it, linking evidence to a classification.

Scientists placed butterflies with small and large eyespots in a field with birds. Large eyespots come from a mutation in a wing-pattern gene. Of butterflies attacked by birds, 70 percent of those with large eyespots escaped with only torn wing edges, compared with 30 percent of those with small eyespots.

Part A: How is the large-eyespot mutation best classified in this field?

Choose one answer.

- ✓ Beneficial, since it helps more butterflies escape attacks
- Harmful, since it makes birds attack the butterflies more
- Beneficial, since the butterflies chose to grow bigger spots
- Neutral, since eyespot size does not affect escaping

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ✓ 70 percent with large spots escaped, compared with 30 percent.
- Birds hunt butterflies in open fields during the day.
- The large eyespots come from a mutation in a wing gene.
- Butterflies have eyespots on the edges of their wings.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS3 › MS-LS3-1 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students critique four claims and must recognize that a mutation's effect cannot be judged without knowing the environment, reasoning about what the model can support.

A student models a fictional Zebrook chromosome gene. Gene version A → protein A → orange pigment; a mutation produces version B → protein B → blue pigment. The model includes no survival data. Which claim correctly interprets the gene-to-trait change and its possible effects?

- ○ Claim 1: The mutation changed the instructions in the gene, which changed the protein produced, which resulted in blue pigment in fur cells instead of orange pigment. This is a beneficial mutation because blue fur is brighter.
- ○ Claim 2: The mutation changed the instructions in the gene, which changed the protein produced, which resulted in blue pigment in fur cells instead of orange pigment. Whether this mutation is beneficial, harmful, or neutral depends on the organism's environment. ✓
- ○ Claim 3: The mutation is harmful because all mutations cause damage to an organism's genes and make it weaker over time.
- ○ Claim 4: The organism chose to mutate its gene in order to produce a new protein that would give it blue fur to survive better in its habitat.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS3 › MS-LS3-1 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · LIFE SCIENCE · LS3 HEREDITY: INHERITANCE AND VARIATION OF TRAITS

MS-LS3-2 Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall the number of parents and whether offspring are identical for three familiar ways plants reproduce.

Plants can make new plants in different ways. For each way, fill in the number of parents and whether the offspring are identical to a parent. Choose the missing values from the drop-down menus.

Way of Reproducing	Number of Parents	Offspring Genetic Information
Strawberry runner	Blank 1	Blank 2
Pollen from one plant fertilizes another plant's flower	Blank 3	Blank 4
Potato grown from a piece of tuber	Blank 5	Blank 6

Blank 1 (Row 1 (Way of Reproducing: Strawberry runner) — Number of Parents):

1 ▾

Blank 2 (Row 1 (Way of Reproducing: Strawberry runner) — Offspring Genetic Information):

Identical to parent ▾

Blank 3 (Row 2 (Way of Reproducing: Pollen from one plant fertilizes another plant's flower) — Number of Parents): 2 ▾

Blank 4 (Row 2 (Way of Reproducing: Pollen from one plant fertilizes another plant's flower) — Offspring Genetic Information): Varies from parents ▾

Blank 5 (Row 3 (Way of Reproducing: Potato grown from a piece of tuber) — Number of

Parents): 1 ▾

Blank 6 (Row 3 (Way of Reproducing: Potato grown from a piece of tuber) — Offspring Genetic Information): Identical to parent ▾

Drop-down 1 choices: 0 | **1 ✓** | 2

Drop-down 2 choices: **Identical to parent ✓** | Varies from parents

Drop-down 3 choices: 1 | **2 ✓** | 3

Drop-down 4 choices: Identical to parent | **Varies from parents ✓**

Drop-down 5 choices: 0 | **1 ✓** | 2

Drop-down 6 choices: **Identical to parent ✓** | Varies from parents

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS3 › MS-LS3-2 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students classify new examples by whether offspring copy one parent or combine information from two, applying the concept to unfamiliar organisms.

A model predicts copied information from one-source tissue growth and new combinations from fertilization. Match each described pathway to its genetic outcome. Assume no mutations.

	Copies one source	Combines parental information
Example: A pineapple top planted in soil grows into a plant	☑	☐
Example: Two seahorses mate, and babies are born	☐	☑
Example: A sea anemone splits into two anemones	☑	☐
Example: Bees carry pollen between two blackberry bushes, and berries with seeds form	☐	☑

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS3 › MS-LS3-2 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students analyze how yeast shift between budding and spore forming under two conditions and draw a conclusion about variation, then justify it with data.

Scientists grew yeast in rich food and in poor food. In rich food, 95 percent of cells budded and 2 percent formed sexual spores. In poor food, 20 percent budded and 70 percent formed sexual spores. Budding makes copies, and sexual spores carry new gene combinations.

Part A: Which claim is best supported?

Choose one answer.

- ○ Yeast reproduce the same way whether food is rich or poor.
- ○ Yeast make more copies of themselves when food runs low.
- ○ Yeast form spores only when food is plentiful.
- ○ Yeast shift toward making varied offspring when food runs low. ✓

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ○ Budding makes copies of the parent yeast cell.
- ○ Yeast are tiny one-celled living things.
- ○ Spore forming rose from 2 to 70 percent in poor food. ✓
- ○ Scientists grew the yeast in two kinds of food.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS3 › MS-LS3-2 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · LIFE SCIENCE · LS4 BIOLOGICAL EVOLUTION: UNITY AND DIVERSITY

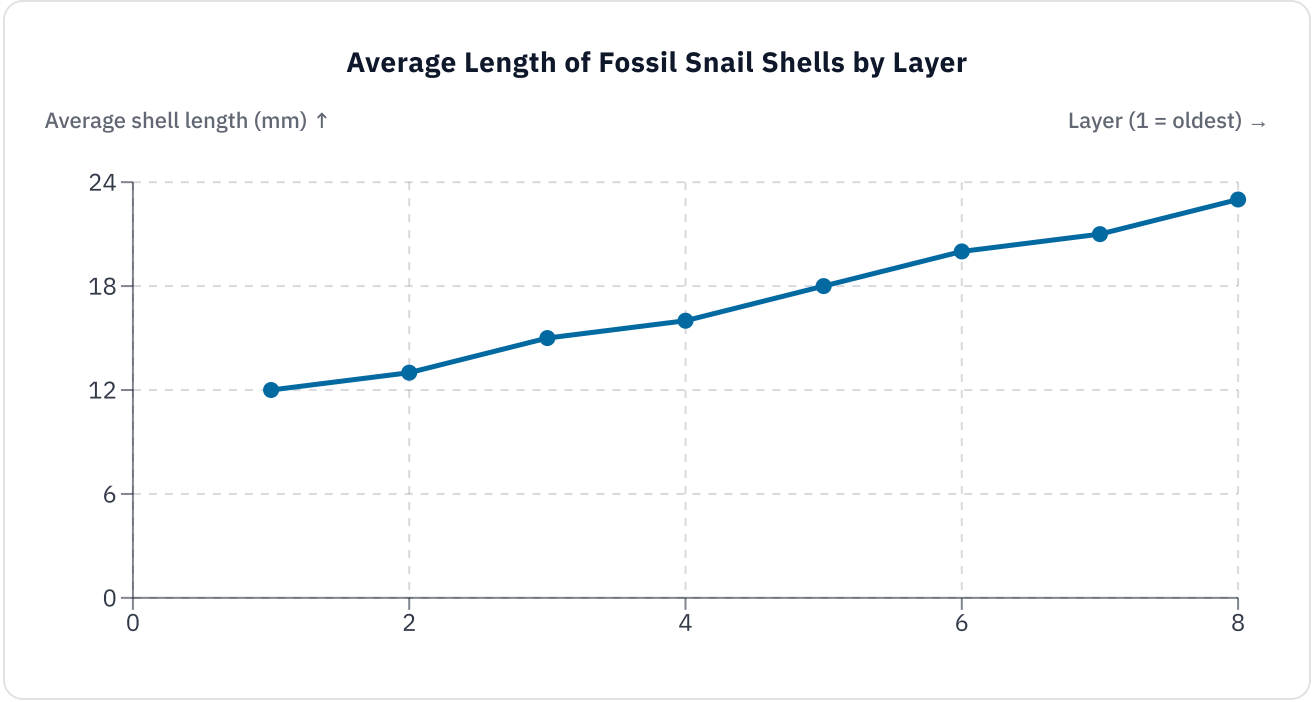
MS-LS4-1 Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students read the trend straight off the graph, knowing only that layer 1 is the oldest.

Scientists measured fossil snail shells in eight undisturbed layers of an old lake bed. Layer 1 is the oldest. What pattern does the graph show?



- ○ Shell length stayed the same in every layer.
- ○ Shells got shorter in younger layers.
- ○ Shells got longer in younger layers. ✓
- ○ The longest shells are in the oldest layer.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS4 › MS-LS4-1 › DOK 1 › Generate

DOK 2 · Skills & concepts

Why DOK 2: Students interpret the order of fossils in three layers to judge statements about when features appeared and how body forms changed.

In rock layers in China, the lower layers hold small two-legged dinosaurs covered in feathers. The middle layers hold feathered animals with wings and claws on their wings. The upper layers hold birds with beaks and no teeth. Select True or False for each statement.

	True	False
Feathers appear in these layers before toothless beaks do.	☑	☐
The middle-layer animals share features with animals above and below them.	☑	☐
Birds with toothless beaks lived before the feathered dinosaurs.	☐	☑
The animals changed because they wanted to fly.	☐	☑
The pattern shows body forms changing over long periods of time.	☑	☐

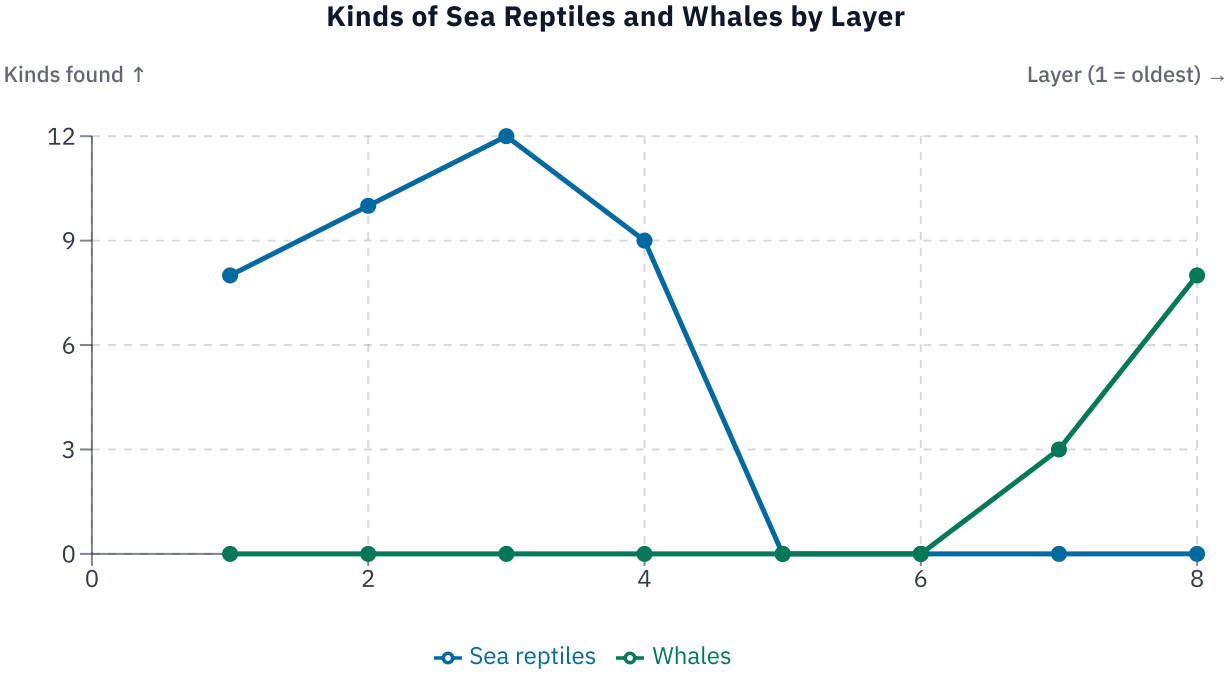
FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS4 › MS-LS4-1 › DOK 2 › Generate

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate a friend's claim against a two-line fossil graph, spotting the gap between groups to decide whether the claim holds.

Kofi counted the kinds of sea reptiles and the kinds of whales in eight layers of a coastal region. Layer 1 is the oldest. His friend claims that whales replaced the sea reptiles right away. Which statement best evaluates this claim using the graph?



- ○ The claim is supported, because whales appear in the same layers as the sea reptiles.
- ○ The claim is not supported, because no whales appear until two layers after the reptiles vanish. ✓
- ○ The claim is supported, because the sea reptiles turned into whales at Layer 5.
- ○ The claim is not supported, because whales lived before the sea reptiles did.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS4 › MS-LS4-1 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · LIFE SCIENCE · LS4 BIOLOGICAL EVOLUTION: UNITY AND DIVERSITY

MS-LS4-2 Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall that shared body structures, not diet or habitat, are anatomical evidence of common ancestry.

Which observations would be good anatomical evidence that two animals share a fairly recent common ancestor? Select all that apply.

- [x] Their teeth come in the same kinds and the same order.
- [ ] They are both brown with small white spots on the back.
- [x] They have the same bones arranged the same way in their legs.
- [ ] They both eat the same kinds of small fish.
- [ ] They both live in the same lake and hunt at night.
- [x] They share the same unusual skull feature near the ear.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS4 › MS-LS4-2 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students sort each fossil observation as strong or weak evidence of relationship to cats, deciding which features reflect shared ancestry.

Scientists compared a new fossil with living cats. Match each observation to the column that shows how strongly it suggests the fossil is a close relative of cats.

	Strong evidence	Weak evidence
Its skull has the same ear region as a cat's	☑	☐
It was found in a forest	☐	☑
Its claws fit into sheaths, like a cat's	☑	☐
Its teeth have the same slicing shape as a cat's	☑	☐
It hunted small animals	☐	☑
It was about the size of a house cat	☐	☑

FIND MORE LIKE THIS

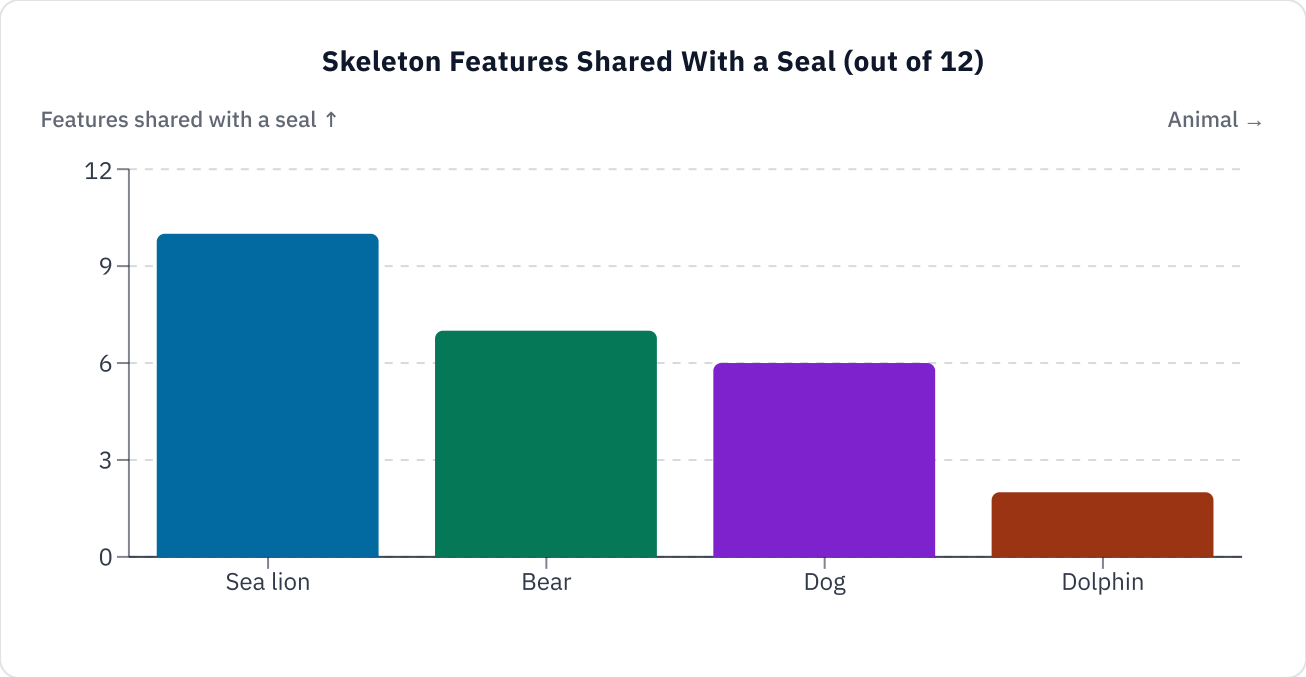
Create questions › Grade 8 Life › MS Life Science › LS4 › MS-LS4-2 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students use shared skeleton counts to evaluate a claim based on lifestyle, reasoning that similar habits do not mean close relationship.

Seals swim in the ocean, as dolphins do. Scientists counted how many of 12 skeleton features each animal shares with a seal. Leo claims that seals are most closely related to dolphins, since both swim. Which statement best evaluates his claim?



- ○ It is strong, because dolphins share more features with seals than dogs do.
- ○ It is strong, because seals and dolphins both have flippers and swim in the sea.
- ○ It is weak, because seals do not really swim the way dolphins do.
- ○ It is weak, because bears and dogs share more features with seals than dolphins do. ✓

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS4 › MS-LS4-2 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · LIFE SCIENCE · LS4 BIOLOGICAL EVOLUTION: UNITY AND DIVERSITY

MS-LS4-3 Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall that similar early embryos point to a common ancestor and pick the fact that states that similarity.

A class looks at early embryo pictures of a fish, a chicken, and a human, all at a similar early stage. Each embryo has a short tail and a row of gill-like folds near where the neck will form. As the animals grow, the fish keeps its tail and gills, but the chicken and human lose the gill folds and grow very different bodies.

Part A: What do the shared tail and gill-like folds most likely show?

Choose one answer.

- ○ The three animals are really one species
- ○ Embryos of different animals never look alike
- ○ The three animals share a common ancestor ✓
- ○ Human embryos breathe underwater with gills

Part B: Which fact best supports your answer to Part A?

Choose one answer.

- ○ The class looked at pictures of three embryos.
- ○ The embryos share early parts, though adults differ. ✓
- ○ The chicken grows wings, and the human grows arms.
- ○ The fish is the only adult with a tail and gills.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS4 › MS-LS4-3 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students apply the embryo idea to a new case, shared larvae in different adults, and judge which statements the evidence supports.

Brine shrimp, krill, and copepods are small sea animals that look quite different as adults. All three hatch as the same kind of larva: a tiny body with one eye and three pairs of legs. Select True or False for each statement.

	True	False
The three animals share a larva with the same basic body plan.	☑	☐
The shared larva suggests the three animals share an ancestor.	☑	☐
The adults keep one eye and three pairs of legs.	☐	☑
The larvae show a link that is harder to see in the adults.	☑	☐
Similar larvae prove the three are the same species.	☐	☑

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS4 › MS-LS4-3 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must weigh embryo evidence against misleading adult body shape and explain both the relationship and why the shapes look alike.

Use the drop-down menus to complete the statement.

Adult dolphins look like sharks, but dolphin embryos grow hair follicles and hind limb buds like pig embryos. This suggests dolphins are more closely related to [pigs ▾], and that their shark-like shape came from [living in water ▾].

Drop-down 1 choices: fish | **pigs ✓** | sharks

Drop-down 2 choices: a shared fish ancestor | being the same species | **living in water ✓**

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS4 › MS-LS4-3 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · LIFE SCIENCE · LS4 BIOLOGICAL EVOLUTION: UNITY AND DIVERSITY

MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students identify which cactus variety is more likely to survive, recalling that a protective trait improves survival.

Barrel cactus plants vary in how many spines they have. In a desert, animals like to eat the soft inside of the cactus for water. Which statement correctly describes which plants are more likely to survive?

- ○ Spine number has nothing to do with which plants are eaten.
- ○ Animals teach cactus plants to grow extra spines.
- ○ Cactus plants with fewer spines grow more spines when bitten.
- ○ Cactus plants with more spines are less likely to be eaten. ✓

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS4 › MS-LS4-4 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students judge statements about beetle color, deciding how existing variation and environment together explain which color becomes common in each habitat.

A population of beetles lives on forest floors with both dark soil and light sand patches. Dark beetles are easier to spot by birds on light sand, while light beetles are easier to spot on dark soil. Over many generations, scientists observe that dark beetles become more common in areas with dark soil, and light beetles become more common in areas with light sand. For each statement, decide if it is True or False based on how genetic variation and survival relate to this environment.

	True	False
The dark beetle color variation gives individuals a survival advantage specifically in the dark soil environment because they are harder for birds to see there.	☑	☐
Individual beetles changed their color from light to dark because they needed to survive better on dark soil.	☐	☑
The light beetle color variation causes beetles to have a better chance of surviving and reproducing in light sand areas due to camouflage from predators.	☑	☐
Both dark and light color variations are equally likely to survive and reproduce in any environment, so the environment does not matter.	☐	☑
The genetic variation in beetle color exists in the population before birds start hunting, and the environment determines which variation gives a survival advantage.	☑	☐

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS4 › MS-LS4-4 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students predict a change in a new situation and explain it with variation, mate choice and missing predators, building a multi-part explanation.

Male guppies in a stream full of predator fish are mostly dull. A scientist plans to move some of these guppies, including a few bright males, to a stream with no predators. Female guppies prefer bright males. Predict how male color will change in the new stream over many generations, and explain why, using the ideas of variation and reproduction.

Model response: I predict bright males will become more common in the new stream. The moved guppies vary, since a few males are bright. With no predators, bright males are not eaten more, and females choose them as mates, so bright males will have more young. Their young inherit bright color, so over many generations, bright color will spread.

Rubric: 2 points: The response includes all required elements: predicts bright males will become more common, uses variation (a few bright males are present), AND explains that bright males will have more young because females prefer them and predators are absent.
1 point: The response includes one or two of the three required elements above, but not all three.
0 points: none. No correct required element; the response is incorrect, too vague to earn credit, irrelevant, blank, or only copies the prompt without answering.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS4 › MS-LS4-4 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · LIFE SCIENCE · LS4 BIOLOGICAL EVOLUTION: UNITY AND DIVERSITY

MS-LS4-5 Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recognize the description of artificial selection, recalling that choosing parents over generations makes a trait more common.

Turkeys raised on farms today are much larger than wild turkeys. For decades, farmers chose the biggest birds to be parents. Which statement correctly describes how this changed turkeys?

- ○ Large size appeared in all turkeys in one generation of breeding.
- ○ Scientists put a growth gene from another animal into turkeys.
- ✓ Choosing big parents made large size more common in each generation.
- ○ Eating more food made farm turkeys pass large size to their chicks.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS4 › MS-LS4-5 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students compare two sources and classify each method, contrasting selective breeding with direct gene editing.

Source A describes dog breeding: people select parents with desired traits over generations. Source B describes a laboratory method that edits DNA directly before an animal develops. Compare the methods using the source information.

Source A describes [artificial selection ▾], driven by [people choosing reproductive parents ▾]. Source B differs because it [directly edits genetic information ▾].

Drop-down 1 choices: natural selection | spontaneous mutation | **artificial selection ✓**

Drop-down 2 choices: habitats directing a desired mutation | individuals acquiring traits by need | **people choosing reproductive parents ✓**

Drop-down 3 choices: copies the same breeding procedure | **directly edits genetic information ✓** | selects existing reproductive parents

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS4 › MS-LS4-5 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate two sources for completeness and bias, then justify which gives a fuller picture of a bred trait's benefits and costs.

A student found two sources about merino sheep. A wool company ad says wrinkly merinos are "perfect in every way." A farm research report says wrinkly skin gives more wool but leads to more fly problems in skin folds.

Part A: Which source gives the more complete picture?

Choose one answer.

- ○ Both sources equally
- ○ The wool company ad
- ○ Neither source
- ○ The farm research report ✓

Part B: Which reason best supports your answer to Part A?

Choose one answer.

- ○ It says the sheep are perfect, which sounds certain.
- ○ It reports both a benefit and a cost of the bred trait. ✓
- ○ It is shorter and easier to read than the ad.
- ○ It was written by a company that sells wool products.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS4 › MS-LS4-5 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · LIFE SCIENCE · LS4 BIOLOGICAL EVOLUTION: UNITY AND DIVERSITY

MS-LS4-6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students do a routine percent calculation for each year, a one-step procedure repeated across rows.

A city put out the same rat poison for five years. Each year, workers caught 200 rats and tested whether each one could survive the poison. Find the percent of rats that could survive the poison each year. Choose the missing values from the drop-down menus.

Year	Rats Tested	Rats That Survived the Poison	Percent That Survived
Year 1	200	10	Blank 1
Year 3	200	50	Blank 2
Year 5	200	120	Blank 3

Blank 1 (Row 1 (Year: Year 1) — Percent That Survived): 5 ▾

Blank 2 (Row 2 (Year: Year 3) — Percent That Survived): 25 ▾

Blank 3 (Row 3 (Year: Year 5) — Percent That Survived): 60 ▾

Drop-down 1 choices: 4 | **5 ✓** | 6

Drop-down 2 choices: 20 | **25 ✓** | 30

Drop-down 3 choices: 48 | **60 ✓** | 72

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS4 › MS-LS4-6 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students calculate changes in percentages and use the model to classify statements as supported or not, combining math with a selection explanation.

In a classroom model, rabbit fur color is inherited. Foxes catch light gray rabbits more often on brown soil. Light gray rabbits fall from 65% in generation 1 to 20% in generation 5. Classify each statement.

	Supported by the model	Not supported by the model
Light gray share fell by 45 percentage points.	☑	☐
Dark brown share rose from 35% to 80%.	☑	☐
Light gray share fell by 65 percentage points.	☐	☑
Individual light rabbits changed their inherited color after seeing foxes.	☐	☑
Dark rabbits left more offspring that inherited their color.	☑	☐
Dark brown share fell from 80% to 35%.	☐	☑

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS4 › MS-LS4-6 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students analyze a trend, extend it to predict a future value, and reject overreaching conclusions, using math to support reasoning about selection.

Wild sheep on a Scottish island have dark or light coats. Scientists found that light-coated lambs survive winters slightly better. The share of sheep with dark coats was 70% in 1990, 60% in 2005, and 50% in 2020. Which conclusions are supported? Select all that apply.

- [x] The trait fell gradually rather than all at once.
- [x] If the trend goes on, about 40% may be dark by 2035.
- [ ] Each sheep's coat got lighter as the sheep grew older.
- [x] Dark coats fell by 20 percentage points in 30 years.
- [ ] Light coats will make up 100% of the sheep by 2035.
- [ ] Light-coated sheep became less common over the 30 years.

FIND MORE LIKE THIS

Create questions › Grade 8 Life › MS Life Science › LS4 › MS-LS4-6 › DOK 3 › Generate

Test Bank question

NGSS DOMAIN

Physical Science

19 performance expectations, grouped by disciplinary core idea. In the Test Bank, choose the Grade 8 Physical course, then MS Physical Science.

Create questions › Grade 8 Physical › MS Physical Science › Core idea (DCI) › PE › Options: DOK › Generate

GRADE 8 SCIENCE · PHYSICAL SCIENCE · PS1 MATTER AND ITS INTERACTIONS

MS-PS1-1 Develop models to describe the atomic composition of simple molecules and extended structures

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students read a formula and a ball-and-stick model directly to recall what a simple molecule is and what the subscript counts, a one-step recognition task.

A student uses a ball-and-stick model to represent a molecule of ammonia (NH_3). The model shows one nitrogen atom bonded to three hydrogen atoms. Which statements correctly describe what this model shows? Select all that apply.

- [ ] The 3 in NH_3 means an ammonia molecule is three times as large as a hydrogen atom.
- [x] Ammonia is a simple molecule, a small separate unit rather than a pattern that repeats through a whole solid. ✓
- [x] Every ammonia molecule in a pure sample has the same atoms: one nitrogen and three hydrogens. ✓
- [x] The formula NH_3 means one ammonia molecule has one nitrogen atom and three hydrogen atoms. ✓
- [ ] Each nitrogen atom in the model has the strong smell that ammonia gas has.
- [ ] Ammonia must be a liquid because the atoms in the model are touching each other.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS1 › MS-PS1-1 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must combine two steps, multiplying atoms per molecule by the number of molecules, then classify each group, rather than recall a single fact.

A student builds models of these groups of molecules and sorts them by total atoms.

	Fewer than 7 atoms in all	7 or more atoms in all
2 molecules of H_2O	☑	☐
1 molecule of CH_4	☑	☐
2 molecules of C_2H_6O	☐	☑
1 molecule of O_2	☑	☐
3 molecules of CO_2	☐	☑
4 molecules of N_2	☐	☑

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS1 › MS-PS1-1 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students infer what each particle model must look like and then choose the property evidence that justifies the difference, linking structure to behavior with reasoning.

A student looks at two white solids. Solid A is table salt. Solid B is dry ice (solid carbon dioxide). She makes a particle model of each one.

Part A: Which statement describes a key difference between the two models?

Choose one answer.

- ○ Both are separate molecules, because every solid is made of molecules.
- ○ A is separate molecules; B is one repeating pattern of atoms.
- ○ A has larger molecules than B, so A is harder.
- ○ B is separate CO_2 molecules; A is one repeating pattern of atoms. ✓

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ○ B turns to gas at -78 °C, but A stays solid until 801 °C. ✓
- ○ B has 3 atoms in its formula, but A has only 2.
- ○ A forms cube-shaped crystals, but B forms white chunks.
- ○ A is white, but B is white with a mist around it.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS1 › MS-PS1-1 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · PHYSICAL SCIENCE · PS1 MATTER AND ITS INTERACTIONS

MS-PS1-2 Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall basic rules, such as melting and dissolving do not make new substances, and apply them to familiar kitchen examples without analyzing data.

A class compares a silver spoon with its tarnish coating, butter before and after melting, bread before and after toasting, and sugar before and after dissolving in water. Tests compare properties under the same conditions. Select True or False for each statement.

	True	False
The coating on the spoon is a new substance because its measured material density differs from silver under the same conditions.	☑	☐
The melted butter is a new substance, because it changed from solid to liquid.	☐	☑
The toast contains new substances because it has a different odor from the bread.	☑	☐
The sugar is gone for good, because it dissolved in the tea.	☐	☑

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS1 › MS-PS1-2 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret a property table, comparing density and melting behavior before and after heating, to decide whether a new substance formed.

A student heats a copper wire in air. A black coating forms. She scrapes off the coating and tests it. Did a chemical reaction occur?

Properties of Copper and of the Black Coating

Property	Copper wire	Black coating
Color	Shiny reddish	Black
Density (g/cm³)	8.96	6.3
Melting behavior	Original copper behavior	Different measured behavior

- ○ No; the coating is still copper, just darker.
- ○ Yes; the isolated coating has different material density and melting behavior. ✓
- ○ No; the coating formed on the wire, so it must be copper.
- ○ Yes; the wire got hot when it was heated.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS1 › MS-PS1-2 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students weigh several properties to draw a conclusion and must also critique weak evidence (color, mass), so they reason from multiple pieces of information.

A student mixes two clear, colorless solutions. Solution A is silver nitrate dissolved in water. Solution B is table salt (sodium chloride) dissolved in water. A white solid forms right away and settles to the bottom. The student filters out the solid, dries it and tests it. Her data: Silver nitrate (before mixing): white solid, dissolves in water, melts at 212 °C. Sodium chloride (before mixing): white solid, dissolves in water, melts at 801 °C. New white solid (after mixing): does not dissolve in water, melts at 455 °C, turns gray-purple in sunlight. Her partner says no reaction happened, because all three solids are white and the total mass of the beaker did not change.

Part A: Which conclusion is best supported by the data?

Choose one answer.

- ✓ A chemical reaction occurred, because the new solid has properties that neither starting substance has.
- No chemical reaction occurred, because all three solids are white.
- No chemical reaction occurred, because the total mass did not change.
- A chemical reaction occurred, because two liquids were poured together.

Part B: Which statement best explains why the partner's evidence does not show that no reaction occurred?

Choose one answer.

- ✓ Color alone cannot identify a substance, and total mass stays the same in both physical and chemical changes.
- White solids can never take part in chemical reactions.
- Total mass always increases during a chemical reaction.
- The partner did not measure how long the mixing took.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS1 › MS-PS1-2 › DOK 3 › Generate

Written for this guide

GRADE 8 SCIENCE · PHYSICAL SCIENCE · PS1 MATTER AND ITS INTERACTIONS

MS-PS1-3 Gather and make sense of information to describe that synthetic materials come from natural resources and impact society

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall basic facts stated in the note: synthetic fabric comes from petroleum, a natural resource, and chemical processing makes a new material.

A company note traces tent fabric to chemicals from petroleum changed by chemical reactions into new fibers. Tests report lightweight, flexible fabric suitable for packing and carrying. Select True or False for each statement using the note.

	True	False
Synthetic tent fabric is made from petroleum, a natural resource. Chemical processing turns it into a new material with different properties than the original petroleum.	☑	☐
The synthetic fabric was made waterproof and strong in a lab, without using anything from nature.	☐	☑
The synthetic fabric is lightweight and flexible. This matches its job: being packed and carried, then set up as a tent.	☑	☐
Making synthetic tent fabric only changes the shape and size of the petroleum. It does not change what the petroleum is made of.	☐	☑

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS1 › MS-PS1-3 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret a short report and connect a synthetic material to a societal effect, going beyond recall to explain a relationship.

Long ago, farmers fed crops with manure. Now factories make a fertilizer called ammonia. They join nitrogen from the air with hydrogen from natural gas. A farming report says large factory supplies made more crop nitrogen available and increased food production. Which societal effect does this information support?

- ◯ Farms could grow much more food to feed more people. ✓
- ◯ Crops no longer needed nitrogen.
- ◯ Fertilizer became a natural material.
- ◯ Farms stopped needing any natural resources.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS1 › MS-PS1-3 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students make a claim and justify it by weighing a benefit against a cost of a synthetic material, and more than one choice can be defended.

A city is deciding whether to use plastic lumber, made from recycled bottles, or wood for new park benches. Use at least one benefit and one cost of the plastic lumber to argue which the city should choose.

Model response: The city should choose plastic lumber. A benefit is that it does not rot or need painting, so it lasts longer, and it reuses plastic bottles. A cost is that it is made from plastic that came from crude oil, and it will not break down if it is thrown away. Because the benches will last a long time and reuse waste, the benefits outweigh the costs.

Rubric: 2 points: The response includes all required elements: a clear choice; one benefit of plastic lumber; one cost of plastic lumber, used in the argument.
1 point: The response includes one or two of the three required elements above, but not all three.
0 points: No correct required element; the response is incorrect, too vague to earn credit, irrelevant, blank, or only copies the prompt without answering.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS1 › MS-PS1-3 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · PHYSICAL SCIENCE · PS1 MATTER AND ITS INTERACTIONS

MS-PS1-4 Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students reproduce the standard particle description of melting (vibrating in place, then sliding past each other), which is recall of a learned model.

A metal worker heats a solid piece of tin until it melts. Use a particle model to describe how the tin particles change from solid to liquid.

Model response: In the solid tin, the particles vibrate in fixed positions. As thermal energy is added, the particles vibrate faster. At the melting point, they have enough energy to break out of their fixed positions and slide past each other, so the tin becomes a liquid.

Rubric: 2 points: describes solid tin particles vibrating in fixed positions AND liquid particles sliding past each other after gaining energy. 1 point: one of these. 0 points: neither.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS1 › MS-PS1-4 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students apply the particle model to a shrinking balloon and connect it to an observation, explaining a cause and effect relationship at a basic level.

A student places a sealed balloon of air in a freezer at -18 °C. After 30 minutes it has shrunk. She puts it in a room at 25 °C, and after 15 minutes it returns to its original size.

Part A: What happens to the air particles when thermal energy is removed?

Choose one answer.

- ○ They become smaller and contract.
- ○ They stop moving completely because the air is cold.
- ○ They move more slowly and stay closer together on average. ✓
- ○ They are replaced by smaller particles.

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ○ Warming the balloon made it grow back to its original size. ✓
- ○ The rubber of the balloon shrank in the cold.
- ○ The freezer removed all the air from the balloon.
- ○ Cold air is heavier, so it pressed the balloon in.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS1 › MS-PS1-4 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must build a particle model to explain a surprising result, ice expanding while losing energy, which requires reasoning beyond the routine model.

A student places a sealed plastic water bottle, completely full with liquid water and no air gaps, into a freezer overnight. In the morning, the bottle is bulging outward and looks like it might crack, and the water inside is now solid ice. Develop a particle model to explain what is happening to the water particles as thermal energy is removed, and use that model to explain why the bottle bulges outward even though the substance is losing energy and getting colder. Explain your reasoning.

Model response: As the bottle sits in the freezer, thermal energy flows out of the water into the colder freezer air. This causes the water particles to slow down (lose average kinetic energy), which is measured as a drop in temperature. As the particles slow down, the attractive forces between them are able to pull them into a fixed, orderly arrangement, forming a solid (ice). While the particles vibrate in place rather than sliding past each other as they did in the liquid, water is an unusual substance in that its solid form actually takes up slightly more space than its liquid form because the rigid arrangement of particles in ice holds them slightly farther apart on average than in liquid water. Since the particles themselves do not change size, this increase in volume is due to the change in spacing/arrangement of the particles as they freeze, and since the bottle is sealed and full, the expanding ice pushes outward on the rigid walls, causing the bulge.

Rubric: 2 points: The response explains cooling/freezing with lower average kinetic energy and molecules around fixed positions, and explains the bulge as the same molecules occupying greater volume in ice's arrangement rather than enlarging.
1 point: The response correctly explains either cooling/freezing behavior or the arrangement-based volume increase, but not both.
0 points: The response includes neither required explanation, is irrelevant, or is blank.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS1 › MS-PS1-4 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · PHYSICAL SCIENCE · PS1 MATTER AND ITS INTERACTIONS

MS-PS1-5 Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students do a routine count of oxygen atoms on each side of a given equation, a one-procedure task with a single right answer.

Air pollution from coal plants can form sulfur trioxide by the reaction $2SO_2 + O_2 \rightarrow 2SO_3$. How many oxygen atoms are on each side of the reaction?

- ○ 3
- ○ 2
- ○ 4
- ○ 6 ✓

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS1 › MS-PS1-5 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students apply the atom model to a sealed-flask reaction and judge several statements about atoms and mass, connecting atom conservation to mass conservation.

A student burns sulfur in a sealed flask. Sulfur (S) joins oxygen (O_2) to form sulfur dioxide (SO_2). Which statements are correct? Select all that apply.

- [ ] The SO_2 has less mass than the sulfur and oxygen.
- [x] The total mass in the flask stays the same.
- [ ] New oxygen atoms are made in the flame.
- [x] The sulfur atom is still present after the reaction.
- [x] The two oxygen atoms are now part of SO_2.
- [ ] The sulfur atom is destroyed by the flame.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS1 › MS-PS1-5 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students combine a mass ratio, a starting amount and conservation of mass to reason about leftover reactant and total mass, a non-routine multi-step problem.

Charcoal briquettes are mostly carbon. A lab group burns 6 g of charcoal carbon in a sealed jar with 20 g of oxygen. Carbon and oxygen join in a 3 to 8 ratio by mass to make carbon dioxide. Select True or False for each statement.

	True	False
6 g of carbon joins with 16 g of oxygen.	☑	☐
22 g of carbon dioxide forms.	☑	☐
4 g of oxygen is left over.	☑	☐
The total mass in the jar changes to 22 g.	☐	☑

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS1 › MS-PS1-5 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · PHYSICAL SCIENCE · PS1 MATTER AND ITS INTERACTIONS

MS-PS1-6 Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students identify which single statement is temperature evidence of a released-energy reaction, a direct recognition task.

A student wrote four sentences about her hand warmer test. Which statement gives evidence the reaction releases thermal energy?

- ○ The packet contains iron powder and salt.
- ✓ The packet warmed from 20 °C to 55 °C in 5 minutes.
- ○ The packet is small enough to fit in a glove.
- ○ The packet costs less than one dollar.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS1 › MS-PS1-6 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret a data table and apply two design criteria at once (at least 2 hours, least iron) to choose a design.

A student recorded how long different hand warmers stayed above 40 °C. Which warmer lasts at least 2 hours while using the least iron powder?

Hand Warmer Test Results

Warmer	Iron powder (g)	Hours above 40 °C
1	15	1.5
2	20	2.2
3	25	2.8
4	30	3.5

- ○ Warmer 4
- ○ Warmer 2 ✓
- ○ Warmer 3
- ○ Warmer 1

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS1 › MS-PS1-6 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate design claims against test data and a safety criterion, recognizing that the biggest temperature drop is not automatically the best design.

A design team tested a cold pack for sports injuries. They mixed a chemical with water inside a sealed pouch and measured temperature over time. Trial 1 used 10 g of the chemical and the temperature dropped from 24°C to 14°C in 2 minutes. Trial 2 used 20 g of the chemical and the temperature dropped from 24°C to 4°C in 2 minutes, but the pack became too stiff and cold to safely hold against skin. Decide whether each statement is True or False based on this test data.

	True	False
The chemical reaction in the cold pack absorbs thermal energy from the surrounding water and pouch.	☑	☐
The cold pack works by transferring 'coldness' from the chemicals into the injured area.	☐	☑
Because Trial 2 dropped in temperature more, 20 g of chemical is automatically the better design choice for the cold pack.	☐	☑
Test data on amount of substance and resulting temperature can be used to decide whether the pack meets safe-use criteria, not just how large the temperature drop is.	☑	☐
Since there were no flames or light produced, no thermal energy was released or absorbed in this reaction.	☐	☑

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS1 › MS-PS1-6 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · PHYSICAL SCIENCE · PS2 MOTION AND STABILITY: FORCES AND INTERACTIONS

MS-PS2-1 Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall Newton's third law, that paired forces are equal and opposite, and recognize it in a simple catch.

A soccer goalie catches a fast ball. Which statement correctly describes the forces?

- ○ The ball pushes on the hands, but the hands do not push back.
- ○ The hands push harder because the goalie is bigger.
- ✓ The hands push on the ball as hard as the ball pushes on the hands.
- ○ The ball pushes harder because it is moving.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS2 › MS-PS2-1 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students explain a relationship: equal forces in a collision produce different changes in motion because the masses differ.

A skateboard ramp designer is testing two skateboarders of different masses colliding head-on at the bottom of a ramp. Skateboarder A has a mass of 50 kg and Skateboarder B has a mass of 80 kg. Both skateboarders are moving at the same speed when they collide. Using Newton's Third Law, explain what forces the two skateboarders exert on each other during the collision. Then explain why the skateboarders experience different changes in motion even though the forces between them are equal and opposite.

Model response: During the collision, Skateboarder A exerts a force on Skateboarder B, and Skateboarder B exerts an equal and opposite force on Skateboarder A (Newton's Third Law). Even though these two forces are equal in size and opposite in direction, the skateboarders experience different changes in motion because they have different masses. The lighter skateboarder (A, 50 kg) experiences a greater change in velocity (more acceleration or deceleration) from the same force compared to the heavier skateboarder (B, 80 kg). The effect of the equal force pair depends on the mass of each object in the system.

Rubric: 2 points: Identifies equal opposite forces and explains that the 50 kg skateboarder has the larger velocity change because of smaller mass. 1 point: Gives one correct idea or an incomplete connection between equal forces and mass-dependent motion. 0 points: Gives no correct explanation or leaves the response blank.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS2 › MS-PS2-1 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students reason about a design solution, using the third law and stopping time together to explain why one phone case protects better.

Engineers drop two phones from the same height onto a hard floor. Design 1 has a thin, stiff plastic shell. Design 2 has thick foam inside that squashes on impact. Which statement best explains why Design 2 reduces damage?

- ○ The foam is lighter, so gravity pulls on the phone less.
- ✓ The foam makes the stop take longer, so the force on the phone is smaller.
- ○ The foam stops the phone from pushing on the case at all.
- ○ The foam pushes on the phone with less force than the phone pushes on it.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS2 › MS-PS2-1 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · PHYSICAL SCIENCE · PS2 MOTION AND STABILITY: FORCES AND INTERACTIONS

MS-PS2-2 Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recognize the basic rule that a bigger push gives a bigger change in motion and point to the matching fact in the stem.

A student launches the same paper airplane twice from a rubber band launcher. The first time, the band gives a 2 N push. The second time, it gives a 6 N push. With the 6 N push, the airplane speeds up much faster.

Part A: What does this show?

Choose one answer.

- ◯ A bigger force gives a bigger change in motion. ✓
- ◯ Mass does not affect motion.
- ◯ Force does not affect motion.
- ◯ A bigger force gives a smaller change in motion.

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ◯ The same airplane sped up faster with the 6 N push. ✓
- ◯ The airplane started from rest each time.
- ◯ The airplane is made of folded paper.
- ◯ Mass was the variable that was changed.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS2 › MS-PS2-2 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students identify variables in a described investigation and use the results to explain how mass affects change in motion.

A student uses a spring scale to pull a cart across a track with negligible friction, applying a constant force of 5 N. She measures the time it takes the cart to travel 2 meters. First she pulls an empty cart (mass 2 kg) with the 5 N force and records the time. Then she loads the cart with bricks so its mass is 4 kg and pulls it again with the same 5 N force, recording the time. She repeats each trial three times and finds that the empty cart consistently reaches the 2-meter mark faster than the loaded cart. Every pull begins from rest. Identify the independent variable, the dependent variable, and one variable she controlled in this investigation. Then explain, using her results, how mass affects the change in motion produced by a given net force. Explain your reasoning.

Model response: The independent variable is the mass of the cart (2 kg vs. 4 kg). The dependent variable is the time it takes the cart to travel the 2-meter distance (which relates to its change in motion/acceleration). A controlled variable is the applied force (5 N) and the distance traveled (2 m), which were kept the same in both trials. Since the empty (less massive) cart took less time to travel the same distance under the same force, it had a greater acceleration than the more massive cart. This shows that when the same net force is applied, a larger mass results in a smaller change in motion (smaller acceleration), while a smaller mass results in a larger change in motion.

Rubric: 2 points: Identifies mass, measured travel time and a valid control, then uses shorter travel time of the lighter cart to explain greater acceleration at the same net force. 1 point: Correctly identifies variables or gives a correct but incomplete data-based mass explanation. 0 points: Gives no correct explanation or leaves the response blank.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS2 › MS-PS2-2 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students critique an investigation plan, noticing that adding propellers also adds mass, so they must reason about hidden variables.

An engineering class tests whether adding more propellers to a model airboat makes it speed up faster across a pool. Each propeller has its own battery pack. Sort each part of their plan.

	Good for the test	Problem for the test
Test some boats in the pool and some in a pond	☐	☑
Use a different hull for each propeller number	☐	☑
Test each propeller number three times	☑	☐
Use the same hull every time	☑	☐
Run each test only once	☐	☑
Add clay to match the mass of missing propeller packs	☑	☐

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS2 › MS-PS2-2 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · PHYSICAL SCIENCE · PS2 MOTION AND STABILITY: FORCES AND INTERACTIONS

MS-PS2-3 Ask questions about data to determine the factors that affect the strength of electric and magnetic forces

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students identify the one factor that changed (the balloon's charge) and point to the observation that shows it, a direct read of the description.

A student charges a balloon by rubbing it on her hair. After 5 rubs, it picks up 4 bits of paper. After 20 rubs, it picks up 15 bits. A charge sensor confirms greater charge after 20 rubs. The gap and paper-bit mass remain unchanged.

Part A: What factor changed the strength of the electric force?

Choose one answer.

- ○ The color of the paper
- ○ The balloon’s charge ✓
- ○ The size of the balloon
- ○ The time of day

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ○ The balloon was rubbed on hair.
- ○ She used the same balloon.
- ○ Paper bits are very light.
- ○ More rubs led to more paper bits picked up. ✓

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS2 › MS-PS2-3 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students compare two magnets across two distances to interpret which is stronger and how distance affects force.

Use the drop-down menus to complete the statement.

A student compares two magnets. Magnet X lifts 30 paper clips when touching the pile. Magnet Y lifts 10. At 3 cm away, X lifts 5 and Y lifts 0. This shows that X is [stronger ▾], and that both magnets get [weaker ▾] with distance.

Drop-down 1 choices: **stronger ✓** | weaker | the same

Drop-down 2 choices: stronger | **weaker ✓** | the same

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS2 › MS-PS2-3 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must judge which data comparisons are controlled, reject a flawed comparison and draw conclusions about two factors, which takes planning and reasoning.

A class tests an electromagnet made of wire coiled around a nail. They count how many paper clips it can lift. Trial 1: 10 coils, 0.5 A of current, 1 cm from the clips, 6 clips lifted. Trial 2: 20 coils, 0.5 A, 1 cm, 12 clips. Trial 3: 20 coils, 1.0 A, 1 cm, 24 clips. Trial 4: 20 coils, 1.0 A, 3 cm, 8 clips. A classmate says, "Trials 1 and 3 prove that more current makes the electromagnet stronger." (a) Explain why Trials 1 and 3 cannot prove this. (b) Name the two trials that do test the effect of current, and state what they show. (c) Name two trials that test the effect of distance, and state what they show.

Model response: (a) Between Trials 1 and 3, both the number of coils and the current changed, so the class cannot tell which change caused more clips to be lifted. (b) Trials 2 and 3 test current: only the current changed (0.5 A to 1.0 A), and the clips lifted went from 12 to 24, so more current made a stronger magnetic force. (c) Trials 3 and 4 test distance: only the distance changed (1 cm to 3 cm), and the clips dropped from 24 to 8, so the force is weaker farther away.

Rubric: 2 points: explains that Trials 1 and 3 change two factors, AND correctly identifies Trials 2 and 3 for current and Trials 3 and 4 for distance with correct conclusions. 1 point: gives one or two of these three parts correctly. 0 points: no correct part.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS2 › MS-PS2-3 › DOK 3 › Generate

Written for this guide

GRADE 8 SCIENCE · PHYSICAL SCIENCE · PS2 MOTION AND STABILITY: FORCES AND INTERACTIONS

MS-PS2-4 Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall two basic facts about gravity, that it always attracts and that it is stronger for objects with more mass.

Which statement about the gravitational force between two objects is correct?

- ✓ It always pulls the objects toward each other, and it is stronger when the objects have more mass.
- It can push the objects apart or pull them together, depending on their masses.
- It acts only when the two objects are touching each other.
- It acts only on objects that are close to Earth's surface.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS2 › MS-PS2-4 › DOK 1 › Generate

Written for this guide

DOK 2 · Skills & concepts

Why DOK 2: Students interpret a comparison with size held constant to explain that more planet mass gives a stronger pull, and separate mass from weight.

A model planet has Earth radius and four times Earth mass. At that radius a model records a 20 kg dog weight of 784 N, compared with 196 N near Earth. Explain how this evidence supports mass-dependent attraction and distinguish dog mass from weight.

Model response: The same dog mass and same center distance are used. The larger planet mass gives the larger inward force, 784 N instead of 196 N, supporting mass-dependent attraction. The dog mass stays 20 kg; weight is the changed gravitational force.

Rubric: 2 points: Uses the fixed dog mass and equal radius to connect the larger planet mass to greater measured attraction and distinguishes unchanged dog mass from changed weight. 1 point: Gives a correct relevant element but an incomplete comparison or explanation. 0 points: Gives no correct relevant response.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS2 › MS-PS2-4 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must build an argument from several data points, using them both to refute a claim and to describe how gravitational attraction depends on mass.

Scientists hang pairs of metal spheres from thin wires so the spheres are 10 cm apart, center to center. A very sensitive instrument measures the gravitational pull between each pair, in billionths of a newton (nN). Pair A: 1 kg and 1 kg, 6.7 nN. Pair B: 2 kg and 1 kg, 13.3 nN. Pair C: 2 kg and 2 kg, 26.7 nN. Pair D: 4 kg and 2 kg, 53.4 nN. In every pair, the spheres slowly swing toward each other. A student claims, "Gravity only pulls things toward Earth. Small objects do not pull on each other." Use the data to argue whether the student's claim is correct. Then describe how the gravitational pull depends on the masses of the objects.

Model response: The claim is not correct. Every pair of small spheres pulled on each other with a measurable force, and the spheres swung toward each other, which shows gravity is an attractive force between any two objects with mass, not just with Earth. The pull depends on mass: when one mass doubled (Pair A to Pair B), the pull doubled from 6.7 to 13.3 nN, and when both masses doubled (Pair A to Pair C), it became four times as large. More mass gives a stronger pull.

Rubric: 2 points: refutes the claim using the measured nonzero, attractive forces between small spheres AND uses at least one data comparison to show the pull increases with mass. 1 point: does one of these two things. 0 points: neither.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS2 › MS-PS2-4 › DOK 3 › Generate

Written for this guide

GRADE 8 SCIENCE · PHYSICAL SCIENCE · PS2 MOTION AND STABILITY: FORCES AND INTERACTIONS

MS-PS2-5 Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recognize the basic idea that a magnetic field reaches through the table and acts on the compass without contact, which is recall of the field concept.

A student places a bar magnet under a table and holds a compass above the table surface at different locations. The compass needle rotates to point in different directions depending on where the student holds it. Select all statements that correctly explain why the compass needle moves without the magnet and compass touching each other.

- [x] The magnetic field causes the compass needle to align with the direction of the field at each location. ✓
- [ ] The compass needle only moves when it is placed directly on top of the magnet because magnetic fields cannot pass through materials.
- [x] A magnetic field exists around the bar magnet and exerts a force on the compass needle even through the table. ✓
- [x] The observation of the compass needle changing direction at different positions is evidence that a force is acting without contact between objects. ✓
- [ ] The table blocks the magnetic field, so the compass needle moves only because the student is moving it closer to the magnet.

FIND MORE LIKE THIS

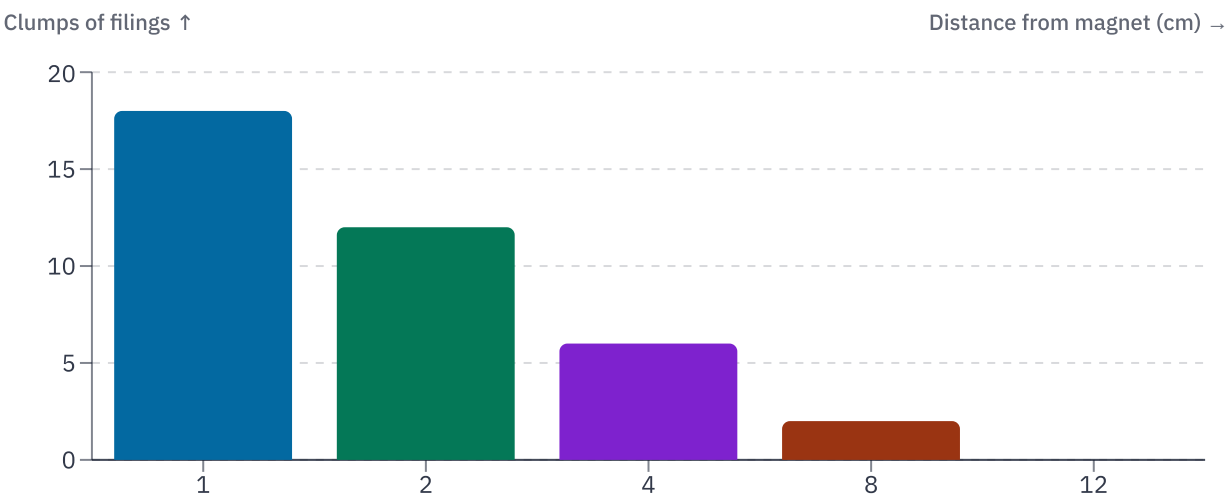
Create questions › Grade 8 Physical › MS Physical Science › PS2 › MS-PS2-5 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret a bar graph to infer that a field exists without contact and weakens with distance.

A student holds a sheet of paper with iron filings at different distances above a bar magnet. The magnet never touches the paper. She counts the clumps of filings that form. What does the graph show about the magnet's force?



- ○ The paper blocks the field at 12 cm and beyond.
- ○ No force acts, since nothing touched the filings.
- ○ The magnet pulls the filings only at 1 cm.
- ○ A field surrounds the magnet and weakens with distance. ✓

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS2 › MS-PS2-5 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students design a controlled test that rules out a classmate's alternate explanation and state what result would support the field idea.

A charged comb lifts paper bits from 2 cm away. A classmate proposes that air moved by the approaching comb causes the motion. Describe a controlled test and a result that would favor the electric-field explanation.

Model response: Move charged and uncharged combs along the same path to the same 2 cm gap, keeping the paper and surroundings unchanged. Repeat both conditions. If the paper bits move only with the charged comb before contact, the difference supports an electric field rather than the identical air movement.

Rubric: 2 points: describes a charged versus uncharged comparison with unchanged distance and movement, and explains that repeatable motion only with charge before contact supports the field explanation. 1 point: gives the controlled comparison or the supporting result, but not both. 0 points: gives neither a suitable comparison nor a supporting result.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS2 › MS-PS2-5 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · PHYSICAL SCIENCE · PS3 ENERGY

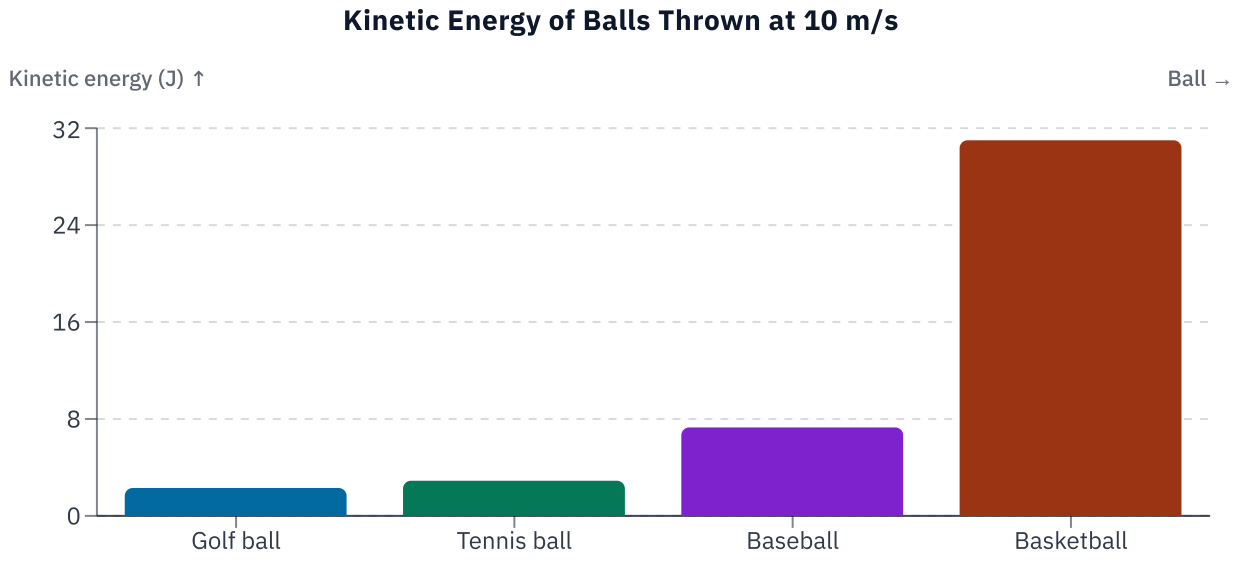
MS-PS3-1 Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students read the tallest bar on the graph and use the fact that, at equal speed, more kinetic energy means more mass.

At a sports lab, a launcher fires a golf ball, a tennis ball, a baseball and a basketball, each at 10 m/s. Based on the graph, which ball has the most mass?



- ○ Tennis ball
- ○ Basketball ✓
- ○ Baseball
- ○ Golf ball

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS3 › MS-PS3-1 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students calculate and compare kinetic energies for several balls, deciding how mass and speed changes combine, which takes more than one step.

A student rolls balls into a cup and compares each one with a reference ball: a 2 kg ball rolling at 3 m/s. Sort each ball by how its kinetic energy compares with the reference ball.

	More kinetic energy than the reference ball	Same kinetic energy as the reference ball	Less kinetic energy than the reference ball
A 4 kg ball rolling at 6 m/s	☑	☐	☐
A 1 kg ball rolling at 3 m/s	☐	☐	☑
A 2 kg ball rolling at 6 m/s	☑	☐	☐
An 8 kg ball rolling at 1.5 m/s	☐	☑	☐
A 4 kg ball rolling at 3 m/s	☑	☐	☐
A 2 kg ball rolling at 1.5 m/s	☐	☐	☑

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS3 › MS-PS3-1 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate competing relationships against the data, using more than one comparison to justify that kinetic energy depends on speed squared.

An ideal car model keeps mass and braking force constant, so stopping distance is proportional to initial kinetic energy. The table gives results at three speeds. Evaluate whether the energy data fit a direct-speed or squared-speed relationship.

Stopping Distance of the Same Car

Speed (mph)	Stopping distance (ft)
10	5
20	20
30	45

Model response: When the speed doubles from 10 mph to 20 mph, the stopping distance grows from 5 ft to 20 ft, so the kinetic energy becomes four times as large. If kinetic energy grew in step with speed, the distance would only double to 10 ft. When the speed triples to 30 mph, the distance is 45 ft, nine times as far. Four times for double and nine times for triple shows that kinetic energy grows with speed squared.

Rubric: 2 points: uses the fourfold change for doubled speed and a second comparison or direct-speed prediction to support the squared-speed relationship. 1 point: gives a correct energy ratio or identifies squared speed, but provides incomplete comparative evidence. 0 points: gives no correct relationship or relevant comparison.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS3 › MS-PS3-1 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · PHYSICAL SCIENCE · PS3 ENERGY

MS-PS3-2 Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall that objects held higher above Earth store more energy in the object-Earth system.

Use the drop-down menus to complete the statement.

A water tower holds water high above a town. The water-Earth system stores [more ▾] energy than it would if the same water were at ground level, because the water is [farther from ▾] Earth's surface.

Drop-down 1 choices: more ✓ | less | the same

Drop-down 2 choices: farther from ✓ | closer to | touching

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS3 › MS-PS3-2 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students classify attracting and repelling pairs and apply the model to decide whether stored energy rises or falls when objects move closer.

In a toy store, a student tries out several toys that use pulls and pushes. Sort each pair by how the stored energy changes when the objects move closer together.

	Stored energy decreases	Stored energy increases
A falling rock and Earth	☑	☐
Two north poles of magnets	☐	☑
An iron nail and a magnet	☑	☐
A balloon and a wall it clings to	☑	☐
Two positively charged beads	☐	☑

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS3 › MS-PS3-2 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students use data to refute a claim, explain where the cart's energy came from and extend the pattern to a new case, which is reasoning with a model.

A student fixes one magnet to the end of a track. She tapes a second magnet to a low-friction cart so the two north poles face each other. She holds the cart at different gaps from the fixed magnet, lets go and measures the cart's top speed. Gap 2 cm: 0.60 m/s. Gap 4 cm: 0.35 m/s. Gap 6 cm: 0.20 m/s. Her friend claims, "The two magnets store the same amount of energy no matter how far apart they are, because they are the same magnets." Use the data to argue whether the claim is correct. Explain where the cart's kinetic energy came from, and predict how the cart's top speed would change if it were released from an 8 cm gap.

Model response: The claim is not correct. The same cart moved fastest when released from the smallest gap (0.60 m/s at 2 cm) and slowest from the largest gap (0.20 m/s at 6 cm). A faster cart has more kinetic energy, so more energy was stored in the magnet system when the repelling magnets were held closer together. The kinetic energy came from the potential energy stored in the system of the two magnets, which changed as the magnets pushed apart. At an 8 cm gap, less energy would be stored, so the cart's top speed would be less than 0.20 m/s.

Rubric: 2 points: refutes the claim using the speed data (smaller gap, more speed, more stored energy) AND explains the kinetic energy came from energy stored in the magnet system with a correct prediction for 8 cm. 1 point: one of these. 0 points: neither.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS3 › MS-PS3-2 › DOK 3 › Generate

Written for this guide

GRADE 8 SCIENCE · PHYSICAL SCIENCE · PS3 ENERGY

MS-PS3-3 Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall basic facts about how glass, a closed door and stored water affect energy in a greenhouse, with no data to analyze.

A student designs a greenhouse to keep plants warm on cold nights. Select True or False for each statement.

	True	False
Glass walls let sunlight in during the day.	☑	☐
A closed door keeps warm air from escaping.	☑	☐
Barrels of water can store energy and release it at night.	☑	☐
Leaving the roof vents open at night keeps it warmest.	☐	☑

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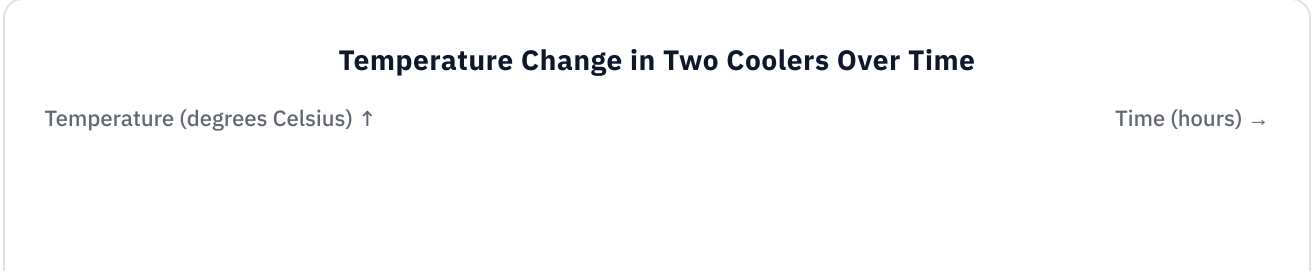
Create questions › Grade 8 Physical › MS Physical Science › PS3 › MS-PS3-3 › DOK 1 › Generate

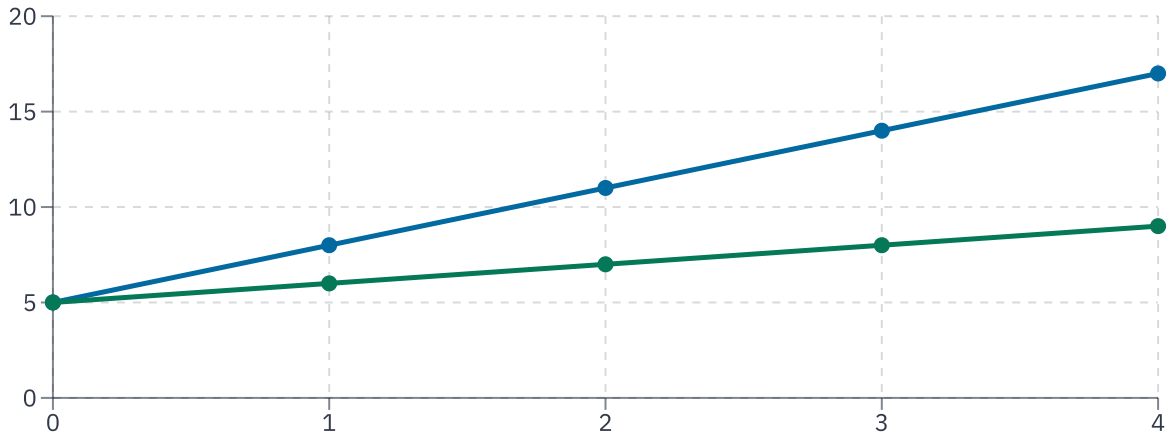
Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret a two-line graph and connect the slower temperature rise to the design feature that reduced energy transfer.

A student designed two coolers to keep sports drinks cold during a soccer tournament. Cooler A has thin plastic walls with no insulation. Cooler B has thick foam insulation and a reflective outer layer. Both coolers started at 5 degrees Celsius and were left in the sun for 4 hours. The graph shows how the temperature inside each cooler changed over time. Both contain equal amounts of the same drink. Based on the graph, which explanation best describes why Cooler B minimized thermal energy transfer more effectively than Cooler A?





- [x] Cooler B's foam insulation reduced the movement of thermal energy from the warm surroundings into the cold drinks inside.
- [ ] Cooler B's reflective outer layer produced cold energy that prevented heat from entering the cooler.
- [ ] Cooler A's thin plastic walls conducted cold from inside the cooler to the outside environment.
- [ ] Cooler B kept the drinks cold because the foam insulation moved the heat energy away from the drinks more quickly.

FIND MORE LIKE THIS

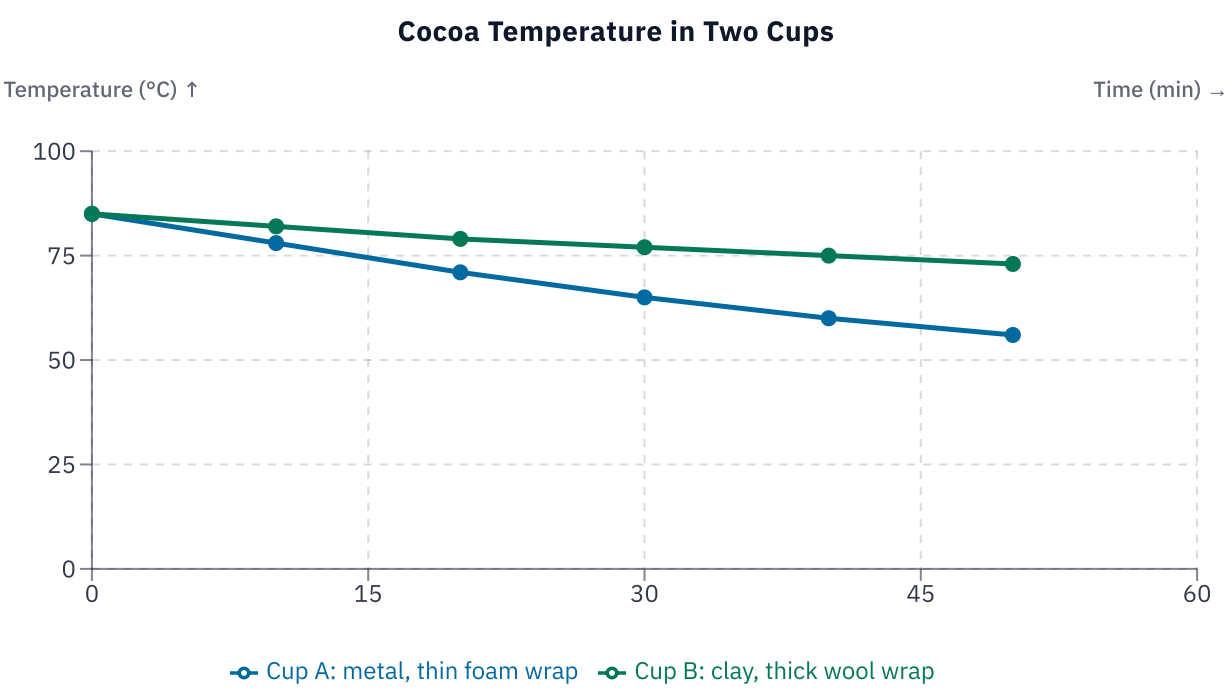
Create questions › Grade 8 Physical › MS Physical Science › PS3 › MS-PS3-3 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students judge what a test can and cannot conclude, noticing that two design features changed at once, which requires critical reasoning about evidence.

Two cup designs hold equal cocoa volumes initially at 85 °C under the same cooler conditions. A is metal with thin foam; B is clay with thick wool. Which statement is best supported by the graph?



- ○ Cup A works better because metal always stays colder.
- ○ The test proves the wool wrap alone caused the result.
- ○ Cup B's design slows energy loss better, but two things changed. ✓
- ○ Cup A stays warmer because metal makes its own heat.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS3 › MS-PS3-3 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · PHYSICAL SCIENCE · PS3 ENERGY

MS-PS3-4 Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall that a larger mass of the same material needs more energy to warm by one degree, applied to a nail and a pan.

A student compares a small iron nail and a large iron pan heated with the same energy. Select True or False for each statement.

	True	False
The nail warms more than the pan.	☑	☐
The pan needs more energy to warm by 1 °C.	☑	☐
Both warm the same because they are both iron.	☐	☑
The pan has more particles to share the energy.	☑	☐

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS3 › MS-PS3-4 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students reason proportionally, using three times the water sharing equal energy to estimate the smaller temperature rise and back it with evidence.

A hotel model compares 20 L and 60 L water samples at equal initial temperatures. Each receives equal measured heater energy in 10 minutes, with negligible losses and no phase change. The 20 L sample rises 15 °C.

Part A: About how much does the 60 L tub warm?

Choose one answer.

- ○ About 45 °C
- ○ About 30 °C
- ○ About 15 °C
- ○ About 5 °C ✓

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ○ The smaller tub's measured rise was 15 °C.
- ○ Both tubs contain water of the same composition.
- ○ Both tub trials last the same 10 minutes.
- ○ Three times the water shares equal added energy. ✓

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS3 › MS-PS3-4 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate a plan and several interpretations, deciding what makes a fair test and which conclusions the data can and cannot support.

A metal slide and wood fence feel different in sunlight. A student compares their material temperature responses using calibrated heaters and thermometers. Which statements describe a fair test or valid interpretation? Select all that apply.

- [ ] If the metal reaches 45 degrees Celsius and the wood reaches only 30 degrees Celsius after getting the same amount of energy, this proves that metal particles always move faster than wood particles at every temperature.
- [x] Use equal masses and initial temperatures with equal measured input energy, then measure each rise.
- [x] The results would show that the same amount of energy causes different temperature changes in different materials, because metal and wood respond differently to the same energy.
- [ ] Temperature and thermal energy are the same thing, so if both materials end up at the same final temperature, they must have absorbed the same amount of energy.
- [x] If the student used twice as much metal under the same lamp for the same time, that metal would need about twice as much energy to reach the same temperature change as the smaller amount did.
- [ ] To do the test fairly, the student should use more metal than wood so the metal heats up faster and the difference is easier to see.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS3 › MS-PS3-4 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · PHYSICAL SCIENCE · PS3 ENERGY

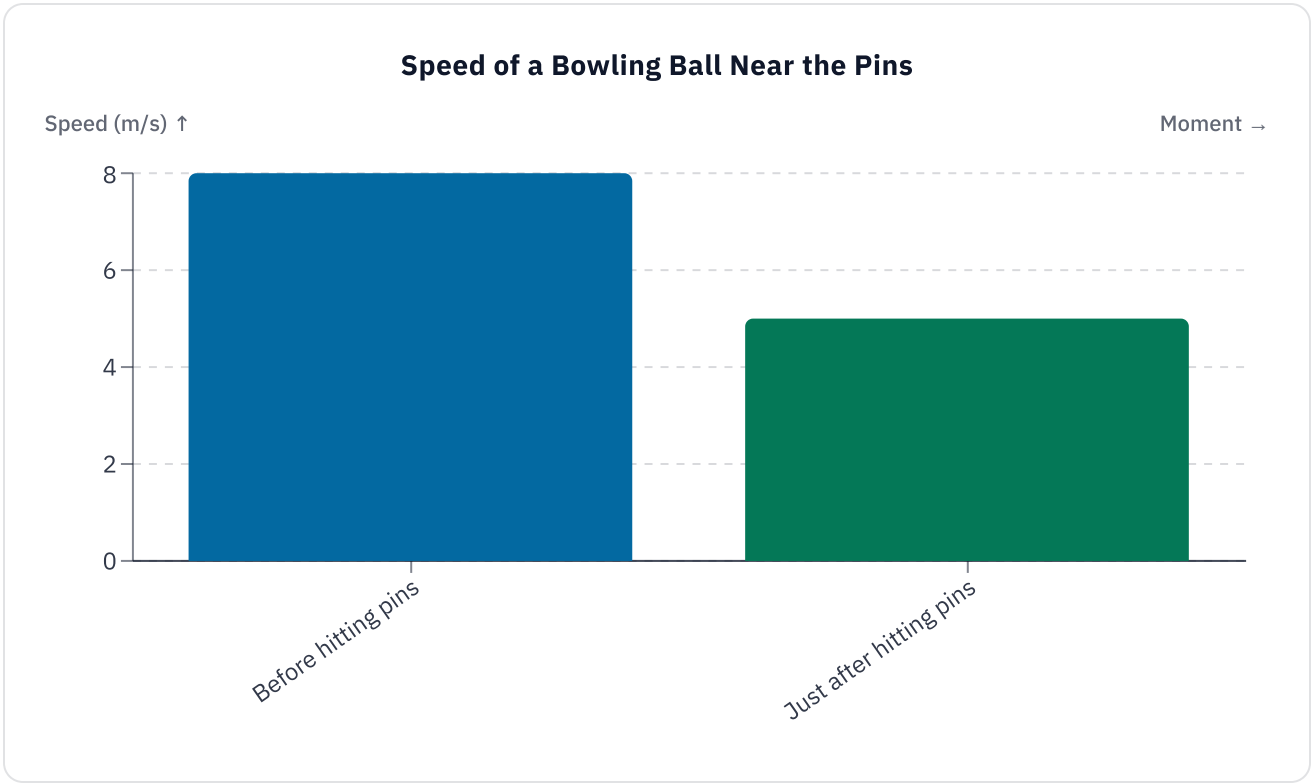
MS-PS3-5 Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students read a two-bar graph showing the ball slowed and recognize that its energy went to the pins, a direct read and recall.

A student measured the speed of a bowling ball before and after it hit the pins. Which statement is best supported by the graph?



- ○ The ball's energy stayed the same.
- ○ The ball gained energy from the hit.
- ○ Energy moved from the pins to the ball.
- ○ Energy moved from the ball to the pins. ✓

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS3 › MS-PS3-5 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students explain where kinetic energy goes when friction slows a skateboard, connecting the slowing to energy transfer.

A student rolls a skateboard across a rough concrete surface and watches it gradually come to a stop. It moves much faster at the start than at the end. Which statement best explains where its kinetic energy went?

- ◯ Friction moved it to the concrete and air as heat and sound. ✓
- ◯ It was used up when the board stopped and no longer exists.
- ◯ Friction is a force, so it destroyed the energy of the board.
- ◯ It stayed in the board even after the board stopped moving.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS3 › MS-PS3-5 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students construct an argument from several observations to refute a claim and trace the direction of energy transfer, which requires reasoning with evidence.

A student hits a nail with a hammer. She records these observations: the hammer head moved at 6 m/s just before it hit the nail and stopped right after; the nail was driven 1 cm deeper into the wood; a thermometer probe showed the nail head warmed from 21 °C to 25 °C; a loud bang was heard across the room. Her friend says, "When the hammer stops, its kinetic energy is destroyed." Construct an argument that supports or refutes the friend's claim. Use at least two of the observations, and describe the direction of the energy transfer.

Model response: The claim is wrong. The hammer's kinetic energy was not destroyed; it was transferred out of the hammer to other objects. The nail moved 1 cm into the wood, so energy went into moving the nail. The nail head warmed from 21 °C to 25 °C, so some energy became thermal energy. The loud bang shows some energy was carried away as sound. Energy moved from the hammer to the nail, the wood and the air.

Rubric: 2 points: refutes the claim AND uses at least two observations to show where the energy went, with the transfer from the hammer to other objects. 1 point: refutes the claim with one supporting observation, or uses observations without a clear direction of transfer. 0 points: supports the claim or gives no relevant evidence.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS3 › MS-PS3-5 › DOK 3 › Generate

Written for this guide

GRADE 8 SCIENCE · PHYSICAL SCIENCE · PS4 WAVES AND THEIR APPLICATIONS

MS-PS4-1 Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall the definition of frequency and match it to counting waves passing a post, a one-step identification.

A student stands on a dock and counts the waves that pass a wooden post. She counts 12 waves in 60 seconds. Which wave property is she measuring?

- ○ Amplitude
- ○ Energy
- ✓ Frequency
- ○ Wavelength

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS4 › MS-PS4-1 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students translate a word description into wave properties and use more than one step, including speed from frequency and wavelength.

At a pier, crests are 4 m apart and rise 0.5 m above calm water. Two crests pass a post each second. Classify each statement as true or false.

	True	False
The wavelength is 4 m.	☑	☐
The amplitude is 0.5 m.	☑	☐
The frequency is 2 waves per second.	☑	☐
The amplitude is 4 m.	☐	☑
The waves move at 2 m per second.	☐	☑

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS4 › MS-PS4-1 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students use a mathematical pattern in data to critique a claim, describe the relationship and make a prediction, which goes beyond reading values.

A student makes waves on a long rope by shaking one end at the same rate each time. A sensor measures the energy each wave carries. Amplitude 1 cm: 3 energy units. Amplitude 2 cm: 12 energy units. Amplitude 3 cm: 27 energy units. Her partner says, "When the amplitude doubles, the energy doubles." Use the data to evaluate the partner's claim. Describe the mathematical relationship between amplitude and energy, and predict the energy carried by a wave with an amplitude of 4 cm.

Model response: The claim is not correct. When the amplitude doubles from 1 cm to 2 cm, the energy goes from 3 to 12 units, which is four times as much, not twice. When the amplitude triples to 3 cm, the energy is 27 units, nine times as much. The energy is proportional to the amplitude squared (energy = 3 x amplitude x amplitude). For a 4 cm amplitude, the energy would be 3 x 4 x 4 = 48 units.

Rubric: 2 points: uses the data to show doubling amplitude gives four times the energy (claim incorrect), describes the squared relationship AND predicts 48 units. 1 point: gives one or two of these correctly. 0 points: none correct.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS4 › MS-PS4-1 › DOK 3 › Generate

Written for this guide

GRADE 8 SCIENCE · PHYSICAL SCIENCE · PS4 WAVES AND THEIR APPLICATIONS

MS-PS4-2 Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall that snow reflects most light and looks white because it reflects all colors, which is recall of basic facts.

A field is covered with fresh snow on a sunny day. Which statements about light and snow are correct? Select all that apply.

- [ ] Snow absorbs most of the sunlight that hits it.
- [x] Snow looks white because it reflects all colors. ✓
- [ ] Snow looks white because it makes white light.
- [x] Snow reflects most of the sunlight that hits it. ✓
- [x] Skiers wear sunglasses because reflected light is bright. ✓
- [ ] Snow transmits all sunlight down to the ground.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS4 › MS-PS4-2 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students apply the model in two steps, first what the filter transmits and then what each object can reflect, to predict colors.

A white-light flashlight shines through a red filter that transmits mostly red and absorbs most other colors. White paper reflects all colors; a blue marker mostly reflects blue. Classify each statement as true or false.

	True	False
The filter transmits mostly red light.	☑	☐
A white sheet of paper looks red in this light.	☑	☐
A blue marker looks bright blue in this light.	☐	☑
The filter absorbs most of the other colors.	☑	☐

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS4 › MS-PS4-2 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must decide what kind of evidence would disprove a claim, recognizing that reflection and warming show light not transmitted, which takes reasoning about evidence.

A student claims that clear window glass transmits all the light that hits it. Which evidence best shows that the claim is wrong?

- ○ Sunlight lights up the room behind the glass.
- ○ The glass looks clear from both sides.
- ○ A faint reflection shows in the glass, and it warms in the sun. ✓
- ○ People outside can be seen clearly through the glass.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS4 › MS-PS4-2 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · PHYSICAL SCIENCE · PS4 WAVES AND THEIR APPLICATIONS

MS-PS4-3 Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students read values straight from a table to see that digital text stayed correct while analog voice got worse with distance.

A note describes continuous analog voice information and discrete digital text values. The table reports correct words at four noisy-stadium distances. Which statement matches the evidence?

Words Received Correctly (out of 20)

Distance (m)	Walkie-talkie (analog)	Text (digital)
50	19	20
100	16	20
200	11	20
300	6	20

- ○ Neither method was affected by distance.
- ○ Both methods lost words at the same rate.
- ○ Text stayed correct; analog voice worsened with distance. ✓
- ○ The walkie-talkie stayed correct, but the text got worse.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS4 › MS-PS4-3 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students explain why the digital signal is clearer and connect the explanation to evidence about noise, a basic cause and effect relationship.

A school radio club plays the same song two ways. Method A sends it through the air as an analog signal. Method B sends it through the internet as a digital signal. Near electric machines, listeners hear crackling on Method A. Method B stays clear.

Part A: Why does the digital signal sound clearer?

Choose one answer.

- ○ It travels through air, which blocks noise.
- ○ It was invented more recently than analog.
- ○ Machines can never affect a digital wave.
- ○ Its on-off pattern can be rebuilt after noise. ✓

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ○ Noise changes the shape of a smooth analog wave. ✓
- ○ Digital signals were built to block all noise.
- ○ Digital copies of songs are stored on computers.
- ○ Analog signals match how sound moves in air.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS4 › MS-PS4-3 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students integrate a technical description with test data to support a claim and also identify a limitation, which requires combining several sources.

A town radio club sends the same recorded message through 5 relay stations in a row, once as an analog signal and once as a digital signal. Source 1 (technical note): An analog signal is a smooth wave whose shape carries the message. Any noise that changes the shape becomes part of the signal and is passed on to the next station. A digital signal is a pattern of pulses that stand for only two values, 0 and 1. Each station decides whether each pulse is a 0 or a 1, even if noise has changed it a little, and sends out fresh, clean pulses. Source 2 (test data): After 5 stations, listeners understood 58% of the words in the analog message and 100% of the words in the digital message. Use information from BOTH sources to support the claim that digital signals are a more reliable way to send information. Then describe one situation in which the digital message could still fail.

Model response: The test data show the digital message arrived 100% understandable after 5 stations, while the analog message dropped to 58%. The technical note explains why: noise changes the shape of the analog wave, and each station passes that noise on, so it builds up. A digital station only has to decide 0 or 1, so small noise is removed and clean pulses are sent each time. A digital message could still fail if the noise is so strong that a station reads a 1 as a 0, or if the signal is lost completely.

Rubric: 2 points: supports the claim with the test data AND the explanation from the technical note, and describes a reasonable failure case. 1 point: uses only one source, or uses both sources without a failure case. 0 points: no relevant support.

FIND MORE LIKE THIS

Create questions › Grade 8 Physical › MS Physical Science › PS4 › MS-PS4-3 › DOK 3 › Generate

Written for this guide

NGSS DOMAIN

Earth & Space Science

15 performance expectations, grouped by disciplinary core idea. In the Test Bank, choose the Grade 8 Earth course, then MS Earth Science.

Create questions › Grade 8 Earth › MS Earth Science › Core idea (DCI) › PE › Options: DOK › Generate

GRADE 8 SCIENCE · EARTH & SPACE SCIENCE · ESS1 EARTH'S PLACE IN THE UNIVERSE

MS-ESS1-1 Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall the percent of the Moon's visible face that is lit at each named phase, a single remembered fact per row.

A student models the Earth-Moon-Sun system to explain why the Moon's appearance changes. The Moon always has one half lit by sunlight; the phase we see depends on how much of that lit half faces Earth. Choose the missing values from the drop-down menus by giving the percent of the Moon's visible face that appears lit for each position.

Moon Position	Phase Name	Percent of Visible Face Lit
Moon between Earth and Sun	New Moon	Blank 1
Moon at 90 degrees from Sun-Earth line	First Quarter	Blank 2
Earth between Moon and Sun	Full Moon	Blank 3
Moon at opposite 90 degree point	Third Quarter	Blank 4

Blank 1 (Row 1 (Moon Position: Moon between Earth and Sun) — Percent of Visible Face Lit): 0.0 ▾

Blank 2 (Row 2 (Moon Position: Moon at 90 degrees from Sun-Earth line) — Percent of Visible Face Lit): 50.0 ▾

Blank 3 (Row 3 (Moon Position: Earth between Moon and Sun) — Percent of Visible Face Lit): 100.0 ▾

Blank 4 (Row 4 (Moon Position: Moon at opposite 90 degree point) — Percent of Visible Face Lit): 50.0 ▾

Drop-down 1 choices: 0.0 ✓ 50.0 100.0

Drop-down 2 choices: 0.0 **50.0** ✓ 100.0

Drop-down 3 choices: 0.0 50.0 **100.0** ✓

Drop-down 4 choices: 0.0 **50.0** ✓ 100.0

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS1 › MS-ESS1-1 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret an eclipse data table and connect each eclipse type to Moon phase and timing, comparing the data with a model rather than recalling one fact.

Mira's eclipse model has the Moon orbiting Earth in a plane tilted to Earth's path around the Sun. A solar eclipse needs the Moon near the Sun–Earth line between those bodies; a lunar eclipse needs Earth between the Sun and Moon. She compares this model with the 2024 data. Select True or False for each statement.

Eclipses in 2024

Date	Type of Eclipse	Moon Phase
March 25	Lunar (partial shadow)	Full moon
April 8	Total solar	New moon
September 18	Partial lunar	Full moon
October 2	Annular solar	New moon

	True	False
In the data, solar eclipses happen at new moon.	☑	☐
In the data, lunar eclipses happen at new moon.	☐	☑
The data show an eclipse every month.	☐	☑
In the data, each lunar eclipse comes about two weeks before a solar eclipse.	☑	☐

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS1 › MS-ESS1-1 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate a physical model against real data, calculating size and distance ratios to judge what the model gets right, what it gets wrong, and what it can still show.

Sofia models Earth with a basketball 24 cm wide and the Moon with a tennis ball 6.7 cm wide. She places them 30 cm apart. In real life, Earth is about 12,700 km wide, the Moon is about 3,500 km wide, and the Moon is about 384,000 km from Earth. Which statements correctly evaluate Sofia's model? Select all that apply.

- [ ] The 30 cm separation correctly scales the Earth–Moon distance.
- [ ] The ball sizes must be increased to correct the distance scale.
- [ ] The tennis ball should be half the basketball's diameter.
- [x] The Moon is placed much too close; it should be about 30 Earth-widths away. ✓
- [x] The model can still show why phases change as the Moon orbits Earth. ✓
- [x] The sizes of the two balls are about right compared with each other. ✓

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS1 › MS-ESS1-1 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · EARTH & SPACE SCIENCE · ESS1 EARTH'S PLACE IN THE UNIVERSE

MS-ESS1-2 Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall what each object orbits and that gravity is the force holding every orbit, filling in known facts.

An orbital model shows Earth moving around the Sun, the Moon moving around Earth, and the Sun moving about the Milky Way's center. The table records the centers and forces explaining those curved paths. Choose the missing values from the drop-down menus.

Object	What It Orbits	Force That Holds It in Orbit
Earth	The Sun	Blank 1
The Moon	Blank 2	Blank 3
The Sun	Blank 4	Gravity

Blank 1 (Row 1 (Object: Earth) — Force That Holds It in Orbit): Gravity ▾

Blank 2 (Row 2 (Object: The Moon) — What It Orbits): Earth ▾

Blank 3 (Row 2 (Object: The Moon) — Force That Holds It in Orbit): Gravity ▾

Blank 4 (Row 3 (Object: The Sun) — What It Orbits): The center of the Milky Way ▾

Drop-down 1 choices: Friction | Magnetism | **Gravity ✓**

Drop-down 2 choices: **Earth ✓** | The Sun only | The whole galaxy

Drop-down 3 choices: Magnetism | Friction | **Gravity ✓**

Drop-down 4 choices: The solar system centered on Earth | No center because stars have no gravity | **The center of the Milky Way ✓**

FIND MORE LIKE THIS

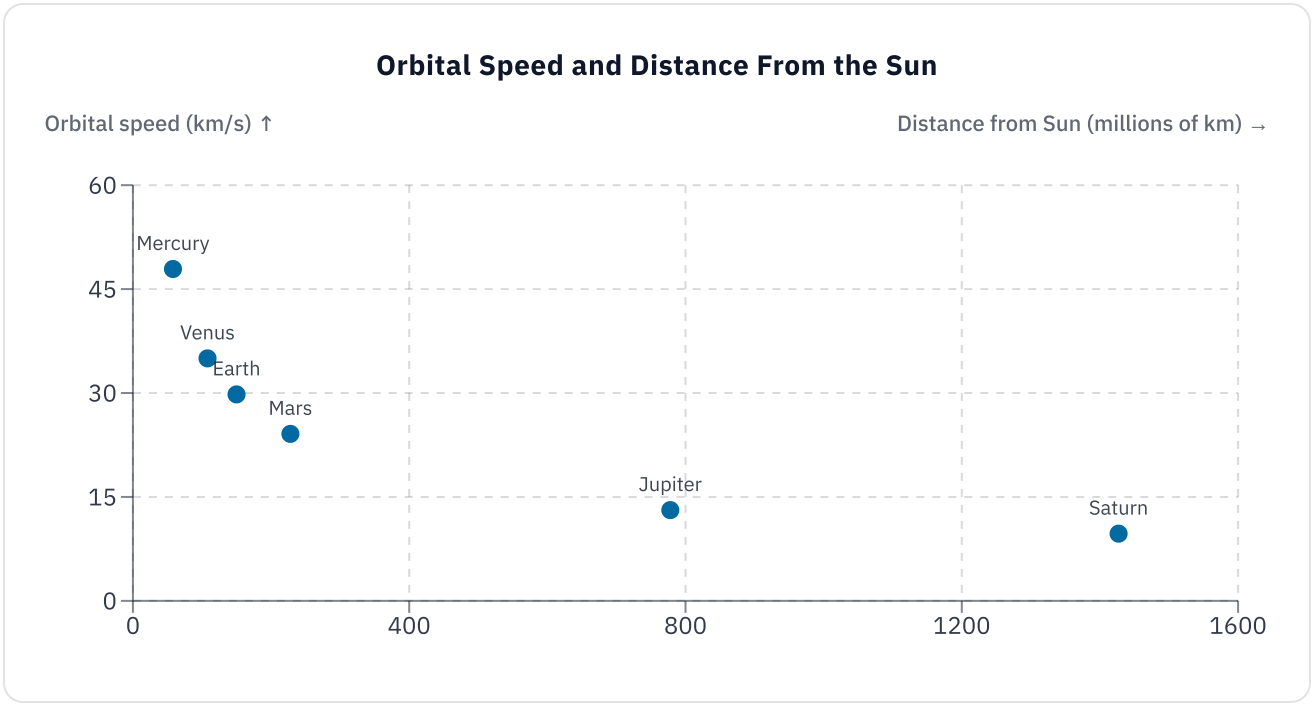
Create questions › Grade 8 Earth › MS Earth Science › ESS1 › MS-ESS1-2 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret a distance-versus-speed graph and connect the pattern to how gravity's pull changes with distance, linking data to a model.

A model represents the graph's planets on nearly circular paths curved by the Sun's attraction. Which statement best connects gravity to the distance-speed pattern?



- ○ Distant planets feel zero solar pull, so straight motion alone maintains their circles.
- ○ Distant planets feel stronger backward drag, which removes all their orbital motion.
- ○ Distant planets feel stronger inward attraction, so the model requires faster circular speeds.
- ○ Distant planets feel weaker inward attraction, matching slower circular speeds. ✓

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS1 › MS-ESS1-2 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students reason from unfamiliar data comparing a comet and Earth to explain a surprising orbital speed, then choose the evidence that justifies their explanation.

In 2014, the Rosetta spacecraft orbited Comet 67P, which is only about 4 kilometers across. About 30 kilometers from the comet's center, Rosetta moved at only about 0.15 meters per second, slower than a person walking. A spacecraft orbiting close to Earth must move at about 7,800 meters per second. A classroom model represents each orbit as forward motion continually turned inward by the central object's gravity.

Part A: What best explains why Rosetta could orbit the comet so slowly?

Choose one answer.

- ✓ The comet pulled weakly, so only a slow speed was needed to stay in orbit.
- The comet had no gravity, so Rosetta could move at any speed it wanted to.
- The comet pulled strongly, so Rosetta had to move slowly to avoid crashing.
- The Sun's gravity pushed Rosetta toward the comet, so it did not need speed.

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- The comet's large distance from Earth makes its own gravity disappear.
- The spacecraft's solar panels reduce the comet's gravitational attraction.
- The comet's low temperature makes its gravity stronger than Earth's.
- ✓ The comet's much smaller mass gives it a weak inward gravitational pull.

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS1 › MS-ESS1-2 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · EARTH & SPACE SCIENCE · ESS1 EARTH'S PLACE IN THE UNIVERSE

MS-ESS1-3 Analyze and interpret data to determine scale properties of objects in the solar system

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students read diameters straight from a table and pick the values larger than the Moon's, a direct lookup and comparison.

Spacecraft have measured the diameters of many moons in the solar system. The table shows some of these moons, along with Earth's Moon and the planet Mercury. Which moons are wider than Earth's Moon? Select all that apply.

Diameters of Large Moons and Mercury

Object	Diameter (km)
Ganymede (moon of Jupiter)	5,268
Titan (moon of Saturn)	5,150
Mercury (planet)	4,879
Io (moon of Jupiter)	3,643
Earth's Moon	3,475
Europa (moon of Jupiter)	3,122
Triton (moon of Neptune)	2,707
Charon (moon of Pluto)	1,212

- [x] Ganymede
- [ ] Europa
- [ ] Triton
- [ ] Charon
- [x] Io

- [x] Titan ✓

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS1 › MS-ESS1-3 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must work with a scale-model table, finding gaps and a size ratio, to judge several statements about scale, which takes more than one step.

A class built a scale model of the solar system on a 100-yard football field, with the Sun at the goal line. Their scale is 1 yard = 10 million km. The table shows the real sizes and the model distances they used. Select True or False for each statement.

Real Diameters and Model Distances for the Football Field Model

Object	Real Diameter (km)	Model Distance from Sun (yards)
Sun	1,392,000	0
Mercury	4,879	5.8
Venus	12,104	10.8
Earth	12,742	15.0
Mars	6,779	22.8
Jupiter	139,820	77.8

	True	False
The listed planet gaps are unequal, even though one distance scale is used.	☑	☐
At the same size scale, the Sun model would be only slightly wider than Earth.	☐	☑
The Mars-to-Jupiter gap is much larger than the Venus-to-Earth gap.	☑	☐
Equal-sized planet circles accurately represent the listed real diameters.	☐	☑
The Sun model would be about 109 times Earth's model diameter.	☑	☐

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS1 › MS-ESS1-3 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must decide to compare layers as fractions of each body's radius rather than raw sizes, then test several claims against those calculations.

Scientists use seismometers to study the insides of Earth and the Moon. The table compares the sizes of their layers. Which statement is supported by the data?

Sizes of the Layers of Earth and the Moon

Measurement	Earth (km)	Moon (km)
Radius	6,371	1,737
Average crust thickness	30	40
Core radius	3,480	350

- ◯ The core fills a much larger share of Earth's radius than of the Moon's radius. ✓
- ◯ The Moon's core is about half of the Moon's radius, just like Earth's core.
- ◯ The Moon's crust is thinner than Earth's crust because the Moon is smaller.
- ◯ Earth's crust makes up more than one-tenth of Earth's radius.

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS1 › MS-ESS1-3 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · EARTH & SPACE SCIENCE · ESS1 EARTH'S PLACE IN THE UNIVERSE

MS-ESS1-4 Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students apply the basic rule that upper layers in an undisturbed stack are younger, a single recalled principle.

Use the drop-down menus to complete the statement.

On the coast of Dorset, England, gray mudstone lies under yellow sandstone, and neither layer has been tipped over. The sandstone is [younger ▾] than the mudstone because new layers are deposited [on top of ▾] older ones.

Drop-down 1 choices: **younger ✓** | the same age | older

Drop-down 2 choices: underneath | **on top of ✓** | beside

FIND MORE LIKE THIS

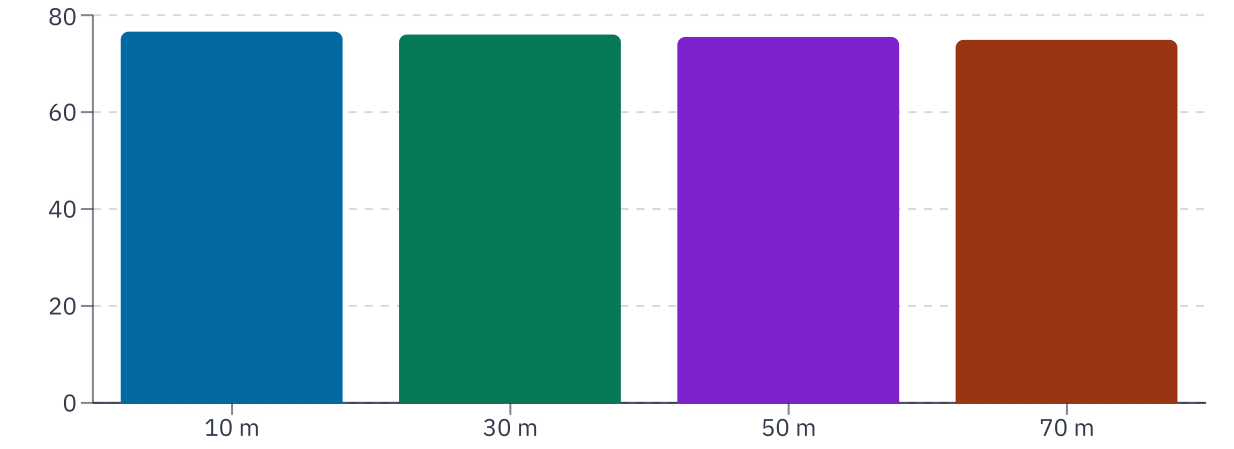
Create questions › Grade 8 Earth › MS Earth Science › ESS1 › MS-ESS1-4 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret a graph of ash-bed ages by height and connect the pattern to how layers are deposited over time.

Geologists date ash beds in flat, undisturbed layers in Dinosaur Provincial Park. The graph gives each bed's age and height. Which explanation connects the pattern with how sedimentary sequences record time?



- ◯ Higher beds are younger because material was deposited over earlier layers. ✓
- ◯ Higher beds are older because their sediment had farther to fall.
- ◯ The beds must be the same age because they contain the same rock material.
- ◯ The beds alternate in age because erosion always reverses layer order.

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS1 › MS-ESS1-4 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students combine three fossil age ranges and reason about their overlap to bracket a layer's age, drawing a conclusion from several pieces of information.

A Texas layer contains unreworked fossils of three species that all lived during deposition. A lived from 300 to 280 million years ago, B from 290 to 260, and C from 285 to 250. Use the overlap of their ranges to constrain the layer's age. Choose the missing values from the drop-down menus.

Age limit for the layer	Age (millions of years)
Oldest possible age	Blank 1
Youngest possible age	Blank 2
Length of the possible time window	Blank 3

Blank 1 (Row 1 (Age limit for the layer: Oldest possible age) — Age (millions of years)): 285 ▾

Blank 2 (Row 2 (Age limit for the layer: Youngest possible age) — Age (millions of years)): 280 ▾

Blank 3 (Row 3 (Age limit for the layer: Length of the possible time window) — Age (millions of years)): 5 ▾

Drop-down 1 choices: **285 ✓** 290 300

Drop-down 2 choices: 250 260 **280 ✓**

Drop-down 3 choices: **5 ✓** 50 565

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS1 › MS-ESS1-4 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · EARTH & SPACE SCIENCE · ESS2 EARTH'S SYSTEMS

MS-ESS2-1 Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students name the process for each arrow of the rock cycle, recalling standard vocabulary.

Kwesi drew a rock cycle diagram for his class in Ghana. Each arrow shows one rock type or material changing into another. For each arrow, choose the process it shows.

	weathering and erosion	compaction and cementation	metamorphism	melting
Arrow in the Diagram: Igneous rock → sediment	☑	☐	☐	☐
Arrow in the Diagram: Sediment → sedimentary rock	☐	☑	☐	☐
Arrow in the Diagram: Sedimentary rock → metamorphic rock	☐	☐	☑	☐
Arrow in the Diagram: Metamorphic rock → magma	☐	☐	☐	☑

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS2 › MS-ESS2-1 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students explain the relationship between cooling rate, crystal size, and where igneous rock forms, connecting cause and effect at a basic level.

A simplified model compares slower deep cooling with faster surface cooling of melt. Use the drop-down menus to connect cooling conditions, crystal sizes, and solidification.

Magma that cools slowly deep underground forms igneous rock with [large ▾] crystals, like granite. Lava that cools quickly at the surface forms igneous rock with [small ▾] crystals, like basalt. Both kinds of rock form because [melted rock loses heat and hardens ▾].

Drop-down 1 choices: **large ✓** | no | small

Drop-down 2 choices: large | **small ✓** | layered

Drop-down 3 choices: solid rock is heated and squeezed | sediment is pressed together | **melted rock loses heat and hardens ✓**

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS2 › MS-ESS2-1 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate claims about energy across the whole rock cycle, deciding which energy source drives each part and rejecting statements that reverse heat flow.

A student is building a model of how energy flows through the rock cycle. Which statements correctly describe energy in the rock cycle? Select all that apply.

- [ ] Weathering creates new energy that is stored inside rocks.
- [x] Gravity pulls sediment downhill and presses buried layers together. ✓
- [ ] The Sun's energy melts rock deep underground into magma.
- [x] Heat from Earth's interior drives plate motions that lift rock up. ✓
- [ ] Magma takes in heat from its surroundings as it cools.
- [x] Sunlight drives evaporation, which brings the rain that weathers rock. ✓

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS2 › MS-ESS2-1 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · EARTH & SPACE SCIENCE · ESS2 EARTH'S SYSTEMS

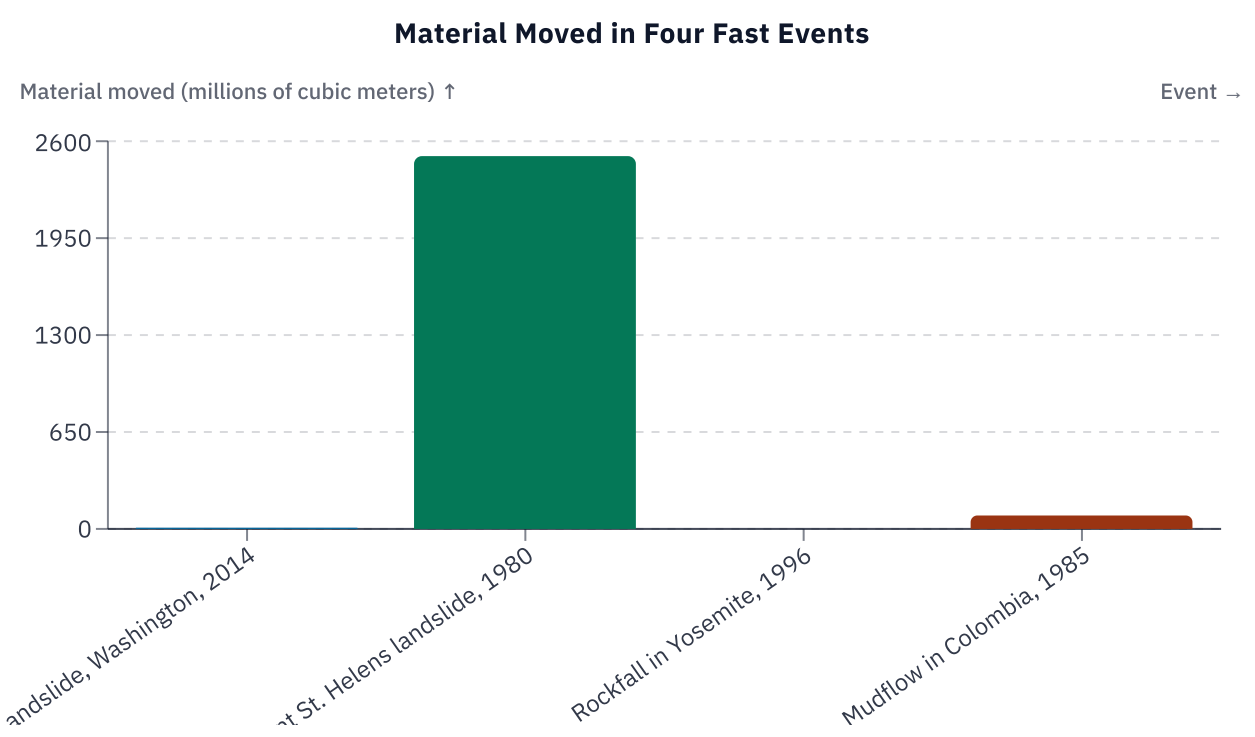
MS-ESS2-2 Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students read a bar graph to find which event moved the most material, a direct lookup.

A geologist compared how much rock and soil moved during four fast events. Which event moved the most material?



- ○ The 2014 Oso landslide in Washington
- ○ The 1985 mudflow in Colombia
- ○ The 1980 Mount St. Helens landslide ✓
- ○ The 1996 rockfall in Yosemite

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS2 › MS-ESS2-2 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students classify surface changes as fast or slow by interpreting each description, sorting by time scale.

The table lists four changes to Earth's surface. Choose whether each is fast or slow.

	fast (minutes to days)	slow (thousands of years or more)
A sinkhole 100 meters wide appears within a day in Winter Park, Florida.	☑	☐
Repeated movement of ice scrapes and deepens the Great Lakes basins over many ice ages.	☐	☑
Many layers of river sediment gradually extend the Nile Delta into the sea.	☐	☑
The 2022 Hunga Tonga eruption removes part of an island within hours.	☑	☐

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS2 › MS-ESS2-2 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students weigh an overall trend in island age and height against an exception, judging which conclusions the evidence supports and which go too far.

The Hawaiian Islands were built by volcanoes. After a volcano stops erupting, its island slowly wears down and sinks. The table shows the age and highest point of four islands. Select True or False for each statement.

Age and Height of Four Hawaiian Islands

Island	Age (million years)	Highest Point (meters)
Hawaii (Big Island)	0.4	4,205
Maui	1.3	3,055
Oahu	3.0	1,220
Kauai	5.1	1,598

	True	False
The youngest island in the table has the highest point.	☑	☐
Every older island is lower than every younger island.	☐	☑
Overall, the data fit the idea that islands wear down as they age.	☑	☐
Kauai is higher than Oahu, so Kauai must be the younger island.	☐	☑

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS2 › MS-ESS2-2 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · EARTH & SPACE SCIENCE · ESS2 EARTH'S SYSTEMS

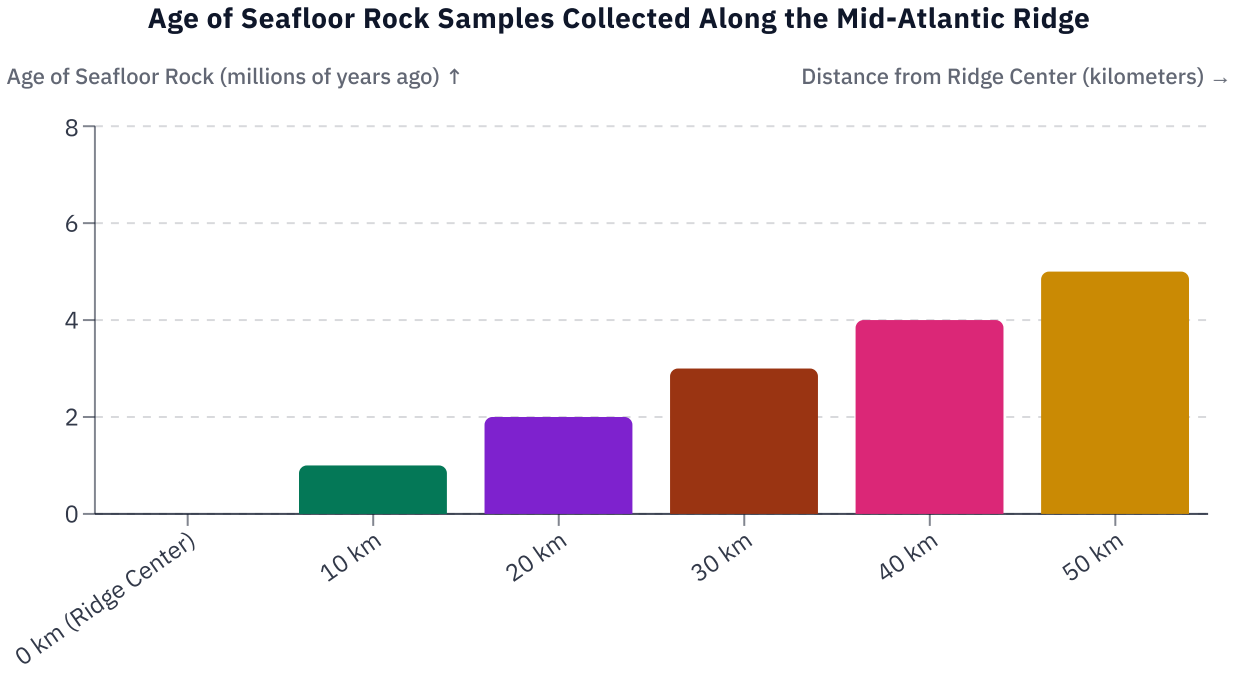
MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students identify the simple pattern in a graph, rocks getting older away from the ridge, and match it to seafloor spreading.

Scientists collected rock samples from the seafloor at different distances from the Mid-Atlantic Ridge center. The graph shows the age of each rock sample. What pattern in the data provides evidence that the seafloor is spreading apart at the Mid-Atlantic Ridge?



- The rock samples closest to the ridge center are the oldest, which shows that new seafloor is created at the ridge and moves outward.
- The rock samples get younger as you move away from the ridge center, which shows that plates move quickly enough to notice over a human lifetime.
- The rock samples all have the same age, which proves that continents have always been in their current positions.

- [x] The rock samples get progressively older as you move away from the ridge center, which shows that new seafloor is created at the ridge and moves outward.

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS2 › MS-ESS2-3 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students classify landforms and measurements by the type of plate boundary that produces them, interpreting each piece of evidence.

Some features form where plates pull apart, and others form where plates push together. Sort each feature by where it forms.

	Plates pull apart	Plates push together
An East African valley has sides moving away and new cracks filled by lava	☑	☐
Japan has an offshore trench and earthquakes deepening inland	☐	☑
An ocean plate descends under the Andes volcanic arc	☐	☑
GPS stations on opposite sides of Iceland's rift move farther apart	☑	☐
India approaches Asia and former marine rock is raised in the Himalaya	☐	☑
A ridge has youngest crust at its center and older crust on both sides	☑	☐

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS2 › MS-ESS2-3 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students calculate a spreading rate from seafloor ages, compare it with GPS data, and justify whether two different lines of evidence agree.

GPS shows that Brazil and West Africa move apart at about 3 centimeters each year. In the South Atlantic, seafloor 750 kilometers from the ridge on each side is about 50 million years old.

Part A: Do the GPS data and the seafloor data agree about how fast the South Atlantic is widening?

Choose one answer.

- ○ No, the seafloor shows the ocean widening ten times faster.
- ○ No, the seafloor shows the ocean is not widening at all.
- ○ Yes, but only because GPS and rock ages measure the same thing.
- ○ Yes, both show about 3 centimeters of widening each year. ✓

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ○ GPS using satellites proves that any geological age must equal the present measured rate.
- ○ Each side moved 750 kilometers in 50 million years, or 1.5 centimeters yearly per side. ✓
- ○ Young ridge rock alone proves a total widening rate of 30 centimeters per year.
- ○ Continents on opposite sides prove equal spreading rates regardless of sample ages.

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS2 › MS-ESS2-3 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · EARTH & SPACE SCIENCE · ESS2 EARTH'S SYSTEMS

MS-ESS2-4 Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students name the water cycle process shown by an everyday example, recalling a term.

After Leo takes a hot shower, the bathroom mirror becomes covered with tiny water droplets. Warm, moist air from the shower touched the cool glass. Which water cycle process does the foggy mirror model?

- ◯ Condensation ✓
- ◯ Evaporation
- ◯ Precipitation
- ◯ Infiltration

FIND MORE LIKE THIS

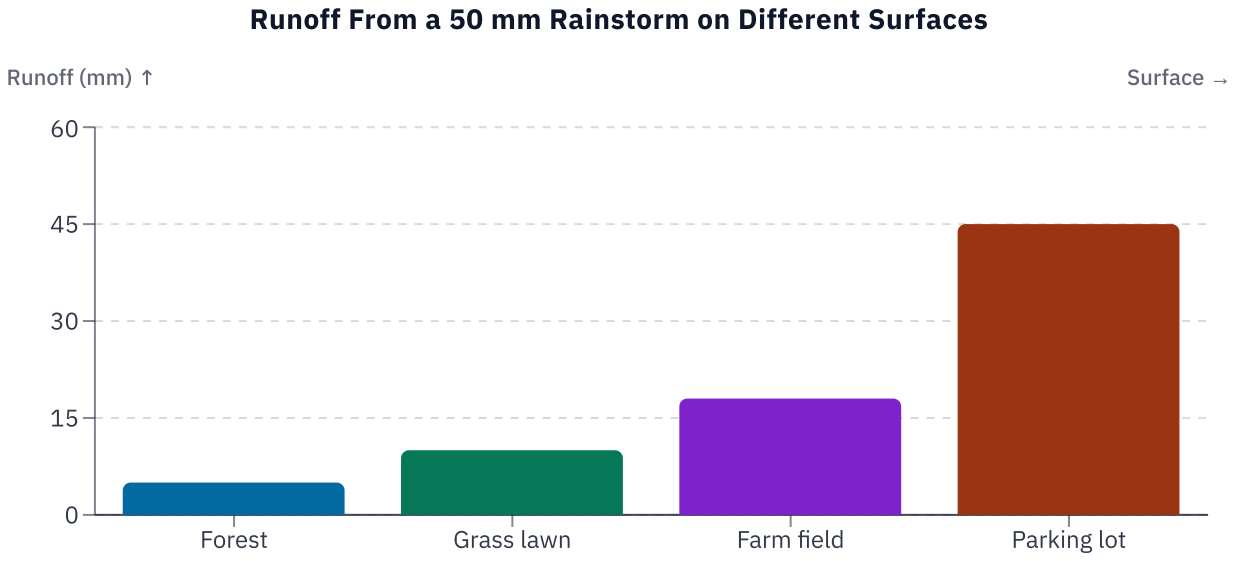
Create questions › Grade 8 Earth › MS Earth Science › ESS2 › MS-ESS2-4 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret runoff data from four surfaces and connect the pattern to how water moves through the land.

A model splits a 50-millimeter rainfall input between water remaining on or entering the surface and downhill runoff. The graph gives runoff from four surfaces. Which interpretation of the modeled paths fits the measurements?



- ○ Parking lots let the most rain soak into the soil.
- ○ Surfaces that let water soak in have less runoff. ✓
- ○ Forests have the most runoff of all the surfaces.
- ○ Every surface gets the same amount of runoff.

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS2 › MS-ESS2-4 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students draw conclusions from a real dye-tracing study, deciding which claims the evidence supports about water paths and gravity and which go beyond the data.

In summer, scientists poured harmless dye into a moulin, a deep hole in the Greenland ice sheet where a meltwater stream disappears. Two days later, the dye came out in a river flowing from under the edge of the ice, about 20 kilometers downhill. Which conclusions are supported by this evidence? Select all that apply.

- [ ] The meltwater evaporated inside the ice and rained out later.
- [x] Meltwater can travel through or under the ice sheet. ✓
- [x] Gravity moved the meltwater downhill toward the ice edge. ✓
- [ ] The meltwater flowed uphill to reach the edge of the ice.
- [ ] The dye shows the Sun's heat reaches the bottom of the ice.
- [x] Water melted on top of the ice can reach rivers and the sea. ✓

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS2 › MS-ESS2-4 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · EARTH & SPACE SCIENCE · ESS2 EARTH'S SYSTEMS

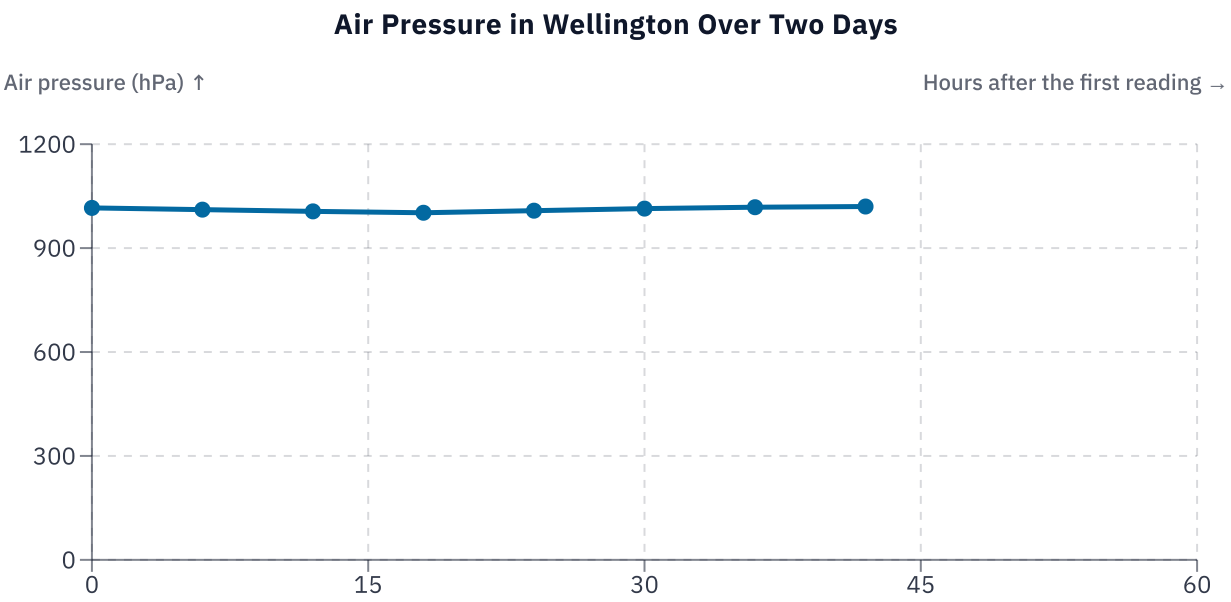
MS-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Given the rule for when a front passes, students find the lowest point on a pressure graph, a direct reading.

A student in Wellington, New Zealand, recorded the air pressure every 6 hours for two days while a cold front passed. The front passed when the pressure stopped falling and began to rise. When did the front most likely pass?



- ○ Around hour 6
- ○ Around hour 42
- ○ Around hour 30
- ○ Around hour 18 ✓

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS2 › MS-ESS2-5 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret three days of pressure and temperature data to explain which air masses moved in, linking data to causes in a short explanation.

A weather station in the mountains recorded air pressure and temperature over three days as a weather system moved through the region. On Day 1, the pressure was 1010 mb and the temperature was 15 °C with clear skies. On Day 2, the pressure dropped to 995 mb and the temperature rose to 22 °C with increasing clouds. On Day 3, the pressure was 1005 mb, the temperature dropped to 8 °C, and heavy rain fell. Use the data to explain how the motion and interaction of air masses caused these weather changes.

Model response: From Day 1 to Day 2, the pressure dropped and the temperature rose, so a warm air mass moved in, and clouds began to form. On Day 3, the temperature dropped to 8 °C and the pressure rose, so a cold, dense air mass pushed in. The cold air forced the warm, moist air upward, where it cooled and its water vapor condensed into clouds and heavy rain.

Rubric: 2 points: uses the Day 1 to Day 2 data (pressure drop and temperature rise) to identify a warm air mass moving in, and uses the Day 3 data (temperature drop, pressure rise and heavy rain) to explain that a cold air mass pushed in and lifted the warm, moist air, causing the rain. 1 point: correctly explains only one of the two air masses using the data. 0 points: does not connect the data to moving air masses.

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS2 › MS-ESS2-5 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students critique a data-collection plan, reasoning about sampling frequency, extra measurements, and fair setup to judge whether it can show that fronts cause temperature changes.

Jonah plans to test whether fronts cause temperature changes at his home. He will read an outdoor thermometer at 7 AM and 7 PM for two weeks and compare his data with news reports of when fronts passed. Select True or False for each statement about his plan.

	True	False
Adding air pressure readings would make his evidence stronger.	☑	☐
Two readings a day could miss when a front passes.	☑	☐
Comparing his data with the times fronts passed can show cause and effect.	☑	☐
Reading only at 7 AM would give him just as much evidence.	☐	☑
Hanging the thermometer next to the barbecue grill would be fine.	☐	☑

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS2 › MS-ESS2-5 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · EARTH & SPACE SCIENCE · ESS2 EARTH'S SYSTEMS

MS-ESS2-6 Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall that sinking air warms and dries, which explains why deserts lie near 30 degrees latitude.

Many of the world's large deserts, such as the Sahara in Africa, are found near 30° north or south of the equator. Air that rose near the equator sinks back down near these latitudes. Why does the sinking air help make deserts?

- ○ Sinking air carries ocean water inland, which then dries.
- ○ Sinking air pushes the Sun's light away from the ground.
- ○ Sinking air cools and forms thick clouds that block rain.
- ○ Sinking air warms and dries out, so few clouds form. ✓

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS2 › MS-ESS2-6 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students explain a chain of cause and effect, from unequal heating to a warm current to milder coastal winters, completing a two-step relationship.

Use the drop-down menus to complete the statement.

A model of ocean circulation shows the Gulf Stream carrying warm water from the tropics northeast toward Western Europe. This current is part of a circulation system driven by unequal heating, which makes tropical surface water [warmer and less dense ▾] than water near the poles. As this warm current flows past Western Europe, it [warms ▾] the air above it, so coastal regions of Western Europe have [milder ▾] winters than inland regions at the same latitude in Asia.

Drop-down 1 choices: **warmer and less dense ✓** | colder and denser | the same temperature

Drop-down 2 choices: has no effect on | **warms ✓** | cools

Drop-down 3 choices: **milder ✓** | identical | colder

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS2 › MS-ESS2-6 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students build a claim, evidence, and reasoning explanation that transfers results from a sand-and-water model to India's monsoon.

A class models a monsoon with a pan of sand (land) and a pan of water (ocean) under a heat lamp. After 20 minutes, they hold a stick of smoking incense between the pans. How does this model explain India's summer monsoon rains? Make a claim, support it with evidence from the table, and explain your reasoning.

Monsoon Model Results After 20 Minutes Under a Lamp

Observation	Result
Sand temperature	45°C
Water temperature	28°C
Direction the smoke drifted	From the water toward the sand, then upward over the sand

Model response: In summer, the land heats up more than the ocean, so moist air flows from the ocean onto the land. In the model, the sand reached 45°C while the water reached only 28°C, and the smoke drifted from the water toward the sand and then rose. Over India, the moist ocean air rises over the hot land, cools, and forms rain clouds, which bring the monsoon rains.

Rubric: 2 points: The response includes all required elements: a correct claim (land heats more than the ocean, so moist ocean air flows inland), evidence from the table (sand 45°C vs water 28°C, smoke moving from water to sand and rising), and reasoning that the moist air rises over the land, cools, and forms rain clouds.
1 point: The response includes one or two of the three required elements above, but not all three. Reasoning counts only with the correct claim. Credit for "Reasoning: warm air rises over the land, moist ocean air flows in to replace it, and as it rises it cools and drops rain" requires "Claim: land heats more than the ocean, so moist ocean air flows onto the land in summer".
0 points: No correct required element; the response is incorrect, too vague to earn credit, irrelevant, blank, or only copies the prompt without answering.

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS2 › MS-ESS2-6 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · EARTH & SPACE SCIENCE · ESS3 EARTH AND HUMAN ACTIVITY

MS-ESS3-1 Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students sort familiar resources by how they formed, recalling whether each came from evaporating water or buried living things.

Some resources formed when water evaporated and left minerals behind. Others formed from buried living things. Sort each resource by how it formed.

	Left when water evaporated	Formed from buried living things
Borax in Death Valley, California	☑	☐
Potash in Saskatchewan	☑	☐
Lignite coal in Germany	☐	☑
Natural gas in Groningen, Netherlands	☐	☑
Peat in Irish bogs	☐	☑
Gypsum at White Sands, New Mexico	☑	☐

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS3 › MS-ESS3-1 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students explain in their own words how plate boundaries and volcanoes put usable heat near the surface in only some places, connecting a process to a resource pattern.

Many of the world's geothermal power plants are in Iceland, New Zealand, and Kenya. All three sit along plate boundaries with active volcanoes. Explain why geothermal energy is easy to use in these places but not in most other places.

Model response: These places are on plate boundaries with volcanoes, so magma and hot rock are close to the surface. The heat warms underground water into hot water and steam near the surface, which power plants can reach easily. In most other places the hot rock is too deep to reach.

Rubric: 2 points: explains that magma or hot rock is close to the surface near plate boundaries and volcanoes AND that this heat makes hot water or steam near the surface that can be used. 1 point: gives only one of these. 0 points: neither.

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS3 › MS-ESS3-1 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students apply what they know about how oil forms and gets trapped to new site descriptions, reasoning about which conditions make oil likely.

An energy company wants to drill where oil is most likely to be found. Geologists describe several sites. Which sites are most likely to hold oil? Select all that apply.

- [ ] A thick glacier sitting on old, hard metamorphic rock
- [ ] A field of young lava flows from a volcano
- [x] Sandstone layers arched into a dome under a tight cap rock
- [x] Layers of marine mud that were buried deep enough to be heated
- [ ] A mountain made entirely of granite that cooled from magma
- [x] A deep basin with thick layers of shale holding sea fossils

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS3 › MS-ESS3-1 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · EARTH & SPACE SCIENCE · ESS3 EARTH AND HUMAN ACTIVITY

MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recognize the basic use of earthquake location patterns: knowing where quakes are common helps people prepare.

A scientist looked at earthquake records from the last 50 years along the San Andreas Fault in California. Some sections of the fault had many earthquakes. Other sections had very few. How can this pattern help keep people safe?

- ◯ It shows which fault sections have more earthquakes, so builders and planners can focus safety efforts there. ✓
- ◯ It proves that new technology can stop earthquakes from happening along the fault.
- ◯ It shows earthquakes happen randomly, so no one can guess where the next one will happen.
- ◯ It lets scientists know the exact day and time the next earthquake will hit each section.

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS3 › MS-ESS3-2 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students use a long-term data pattern to make a forecast and explain it, interpreting data rather than recalling a fact.

A California city keeps records of earthquakes over the past 100 years. The data show that most earthquakes in the region occur along a narrow zone that follows a known fault line, and almost no earthquakes occur in areas more than 20 miles away from that fault line. Based on this pattern, is a future earthquake more likely to occur near the fault line or far from it? Use the pattern in the data to explain your answer.

Model response: A future earthquake is more likely to occur near the fault line. The 100 years of data show a clear pattern: most earthquakes clustered along the zone that follows the fault, and almost none happened more than 20 miles away. A pattern that lasted that long is good evidence for where earthquakes are likely to happen next.

Rubric: 2 points: States that a future earthquake is more likely near the fault line and uses the pattern in the data (most earthquakes over 100 years clustered along the fault, almost none more than 20 miles away) to support the forecast. 1 point: States that the fault line is more likely but does not use the pattern in the data, or describes the pattern without making a clear forecast. 0 points: States that earthquakes are equally likely anywhere or more likely far from the fault, or gives no valid response.

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS3 › MS-ESS3-2 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students analyze a disaster timeline to decide which improvement would most reduce future deaths, then justify that choice with evidence.

In March 2019, Cyclone Idai struck Mozambique. The table shows the timeline. Over 600 people died in Mozambique, many from flooding far inland.

Timeline of Cyclone Idai in Mozambique, 2019

Date	What Happened
March 11	Forecasters predicted landfall near the city of Beira
March 14	The cyclone struck Beira with strong winds and storm surge
March 15–20	Heavy rain upstream made rivers rise; huge areas inland flooded

> Part A: Which improvement would most likely reduce deaths in a future cyclone like Idai?

Choose one answer.

- ○ Building a wall around the city of Beira to stop the winds
- ○ Forecasting the cyclone's landfall city more days in advance
- ○ Stopping all weather forecasts once a cyclone reaches land
- ○ Better river flood warnings and evacuations for inland areas ✓

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ○ Cyclone Idai struck Mozambique in the month of March in 2019.
- ○ Forecasters correctly predicted landfall near Beira three days early.
- ○ Much of the deadly flooding came inland in the days after landfall. ✓
- ○ The cyclone struck Beira with strong winds and a storm surge.

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS3 › MS-ESS3-2 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · EARTH & SPACE SCIENCE · ESS3 EARTH AND HUMAN ACTIVITY

MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students match each human impact to a known fix, connecting a problem directly to its standard solution.

A class matches each human impact with a way to reduce it. Choose the best solution for each impact.

	Build a rain garden to soak up runoff	Add dot patterns that make glass visible	Use shielded, dim amber lights
Human Impact: Runoff from a parking lot carries oil into a creek	☑	☐	☐
Human Impact: Birds fly into a school's glass walkway	☐	☑	☐
Human Impact: Beach lights confuse sea turtle hatchlings	☐	☐	☑
Human Impact: Rain washes lawn fertilizer into a pond	☑	☐	☐
Human Impact: Bright streetlights draw moths away from a wetland	☐	☐	☑

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS3 › MS-ESS3-3 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students compare monitoring results from two towns to conclude whether a salt-reduction plan worked, interpreting a comparison and choosing supporting evidence.

Two towns in Ohio sit along the same stream. Last winter, Town A sprayed brine on roads before storms and used 30% less rock salt than the winter before. Town B did not change. Salt levels in the stream fell below Town A but stayed about the same below Town B.

Part A: What is the best conclusion?

Choose one answer.

- ◯ Town A's brine plan likely reduced salt reaching the stream. ✓
- ◯ Town B's roads were safer because it used more salt.
- ◯ Brine adds more salt to streams than rock salt does.
- ◯ The winter was warmer than usual, so both towns used less salt overall.

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ◯ Salt fell below Town A but not below Town B, which did not change. ✓
- ◯ Town A used rock salt on its roads during the winter before.
- ◯ Brine is salt dissolved in water and sprayed before storms.
- ◯ Both towns sit along the same stream in the state of Ohio.

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS3 › MS-ESS3-3 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate monitoring data from a treated lake and a control lake, reasoning about what the control rules out and which conclusions go too far.

A town added a buffer of native plants around Lake A to reduce algae. Lake B, nearby and similar, got no buffer. Scientists measured algae in both lakes before and after. Which conclusions do the data support? Select all that apply.

Algae in Two Lakes Before and After a Buffer Was Added to Lake A

Lake	Algae Before (units)	Algae After (units)
Lake A (buffer added)	80	40
Lake B (no buffer)	78	75

- [x] Lake B helps show the drop in Lake A was not just a change in weather.
- [ ] Lake B's algae dropped more than Lake A's did.
- [x] Algae dropped by half in the lake with the buffer.
- [ ] The data show a buffer would not help Lake B.
- [ ] The buffer removed all the algae from Lake A.
- [x] Algae barely changed in the lake without a buffer.

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS3 › MS-ESS3-3 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · EARTH & SPACE SCIENCE · ESS3 EARTH AND HUMAN ACTIVITY

MS-ESS3-4 Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students apply the simple idea that total use equals people times use per person, so doubling the population doubles demand.

Use the drop-down menus to complete the statement.

A country's total freshwater use depends on both the number of people living there and how much water each person uses. If a country's population doubles while water use per person stays the same, the total freshwater use will [double ▾]. This change will likely have a [negative ▾] effect on Earth's systems, such as groundwater supplies and river ecosystems.

Drop-down 1 choices: stay the same | **double ✓** | go up by four times

Drop-down 2 choices: positive | **negative ✓** | no

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS3 › MS-ESS3-4 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students decide which findings actually support a cause-and-effect claim about beef demand and forest loss, separating relevant evidence from true but unrelated facts.

A student claims that growing demand for beef is causing forest loss in the Amazon. Match each finding to the correct column.

	Supports the claim	Does not support the claim
Beef exports from the region grew over the same years	☑	☐
Satellite images show pasture replacing forest in the same areas	☑	☐
The Amazon River is the largest river by volume	☐	☑
Many kinds of monkeys live in the Amazon rainforest	☐	☑
Cattle numbers in the region rose as forest area fell	☑	☐

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS3 › MS-ESS3-4 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must calculate totals and separate the effect of population from the effect of use per person, then build an argument that critiques a proposed fix.

Riverside Town gets all of its water from wells that pump groundwater. The table shows town records for 2000 and 2020. A council member says, "Our groundwater is dropping mainly because more people moved here, so the best fix is to stop building new homes." Construct an argument that evaluates the council member's claim. Use calculations from the table as evidence, and explain which change has the larger effect on the groundwater.

Water Records for Riverside Town

Measurement	2000	2020
Population	20,000	25,000
Average water use per person (liters per day)	150	240
Depth to water in town wells (meters)	12	30

Model response: The claim is only partly correct. Total water use went from 20,000 × 150 = 3,000,000 liters a day to 25,000 × 240 = 6,000,000 liters a day, so it doubled, which explains why the wells now have to reach 30 m instead of 12 m. Population rose by only 25% (20,000 to 25,000), but use per person rose by 60% (150 to 240). If only population had grown, use would be 25,000 × 150 = 3,750,000 liters; if only use per person had grown, it would be 20,000 × 240 = 4,800,000 liters. So the rise in use per person had the larger effect. Stopping new homes would not fix most of the problem; the town also needs to cut how much water each person uses.

Rubric: 2 points: The response includes all required elements: a claim that the council member is only partly right (or wrong) because use per person is the larger cause, evidence from calculations (total use doubled from 3,000,000 to 6,000,000 liters a day; population up 25% vs. use per person up 60%, or equivalent separate calculations), and reasoning that more total pumping lowers the groundwater, so reducing use per person matters more than limiting population alone.
1 point: The response includes one or two of the three required elements above, but not all three.
0 points: No correct required element; the response agrees that population is the main cause without evidence, is too vague, or is blank.

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS3 › MS-ESS3-4 › DOK 3 › Generate

Written for this guide

GRADE 8 SCIENCE · EARTH & SPACE SCIENCE · ESS3 EARTH AND HUMAN ACTIVITY

MS-ESS3-5 Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students pick the one question that asks about a cause of the CO2 and temperature rise, recognizing a relevant science question.

A student looks at the data in the table. Since 1900, Earth's temperature has gone up by about 1.1°C, and carbon dioxide (CO_2) in the air has gone up from 295 to 414 parts per million. Both rise quickly after 1960. Which question would help the student learn what is causing these changes?

Carbon Dioxide and Global Temperature Change, 1900 to 2020

Year	CO_2 in the Air (ppm)	Temperature Change Since 1900 (°C)
1900	295	0
1920	303	0.1
1940	310	0.2
1960	317	0.05
1980	339	0.3
2000	369	0.5
2020	414	1.1

- ○ Does the hole in the ozone layer explain why CO_2 and temperature both rose?
- ○ What human activities add CO_2 to the air, and how does CO_2 trap heat? ✓
- ○ Did this past winter feel colder than winters ten years ago in my town?
- ○ Do volcanoes alone explain all of the temperature rise shown in the data?

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS3 › MS-ESS3-5 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must connect melting ice, darker ocean, and absorbed sunlight to choose the question that could explain faster Arctic warming, linking a cause to an observation.

Over the past 40 years, the Arctic has warmed about three times faster than the world as a whole. Which question would best help explain why?

- ○ Does the Sun shine for more hours each day in the Arctic in winter?
- ○ Do more people live in the Arctic now than lived there in 1980?
- ○ Are polar bears moving to new areas as the Arctic gets warmer?
- ○ Does melting ice uncover dark ocean that absorbs more sunlight? ✓

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS3 › MS-ESS3-5 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students design two questions, name the data each needs, and explain how comparing human and natural factors would reveal the main cause of warming.

Write two questions that together could help find out whether people or natural factors caused most of the warming since 1900. For each question, name the data you would need. Then explain how comparing the answers would help.

Model response: Question 1: How much CO_2 has burning coal, oil, and gas added since 1900? I would need yearly records of fossil fuel burned and CO_2 in the air. Question 2: Did the Sun's energy or volcanic eruptions change in a way that matches the warming? I would need satellite data on the Sun's energy and records of eruptions. Comparing the answers would show which factor lines up with the warming, so I could tell whether people or nature caused most of it.

Rubric: 2 points: The response includes all required elements: gives a question and data about a human factor (such as fossil fuels or forest clearing), gives a question and data about a natural factor (such as the Sun or volcanoes), and explains that comparing them shows which factor matches the warming.
1 point: The response includes one or two of the three required elements above, but not all three.
0 points: none. No correct required element; the response is incorrect, too vague to earn credit, irrelevant, blank, or only copies the prompt without answering.

FIND MORE LIKE THIS

Create questions › Grade 8 Earth › MS Earth Science › ESS3 › MS-ESS3-5 › DOK 3 › Generate

Test Bank question

NGSS CORE IDEA ETS1

Engineering Design

4 performance expectations, grouped by disciplinary core idea. Engineering Design questions show when Course is set to All.

Create questions › Course: All › MS Engineering Design › Core idea (DCI) › PE › Options: DOK › Generate

GRADE 8 SCIENCE · ENGINEERING DESIGN · ETS1 ENGINEERING DESIGN

MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students only need to recall the meaning of the term constraint; no analysis of the design problem is required.

A class is designing a model footbridge for a stream crossing. The bridge must hold at least 20 kg and span 1 m. It must cost no more than $30.

In engineering design, what is the name for a limit, such as the $30 budget, that every solution must stay within?

- ◯ A constraint ✓
- ◯ A prototype
- ◯ A hypothesis
- ◯ A variable

FIND MORE LIKE THIS

Create questions › Course: All › MS Engineering Design › ETS1 › MS-ETS1-1 › DOK 1 › Generate

Written for this guide

DOK 2 · Skills & concepts

Why DOK 2: Students must compare each question with the stated criteria and constraints and classify which ones clarify the problem, which takes more than recall.

Sofia plans a small sunlight-powered charger with safe walking access. A charger must supply at least 5 Wh during a 2-hour matched sunlight test. Cost is at most $25 and panel area at most 0.5 m². The device must not block a walking route or create unsafe exposed connections.

Which questions define or clarify measurable design needs and constraints? Select all that apply.

- [x] What energy test under matched sunlight would check the 5 Wh requirement?
- [x] How should walkway access and exposed connections limit the placement plan?
- [ ] Which charger looks brightest without measuring energy supplied during the 2-hour test?
- [x] How can a charger supply 5 Wh in 2 hours within $25 and 0.5 m² while keeping walkways and connections safe?
- [ ] How can the largest panel be called successful even if it exceeds 0.5 m² and blocks the route?

FIND MORE LIKE THIS

Create questions › Course: All › MS Engineering Design › ETS1 › MS-ETS1-1 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must plan a precise problem definition on their own, choose measurable criteria and limits, and justify one with science, with more than one valid answer.

Rain runs off a school parking lot, floods the walkway to the playground, and carries soil into a nearby creek. A student group wrote this problem statement: "Design something to stop the flooding."

Rewrite the problem statement so it could lead to a successful solution. Include at least two measurable criteria and at least two constraints, and make sure at least one requirement protects people or the creek. Then use a science idea to explain why one of your requirements is needed.

Model response: Sample answer: Design a system that stores at least 40 L of runoff from a matched test storm and lets no more than 20 L reach the walkway, while costing at most $50, keeping the walkway usable, and keeping soil out of the creek. The soil requirement is needed because fast-moving water has more energy and can pick up and carry sediment, which would cloud the creek and harm living things there.

Rubric: One point for two measurable criteria, one point for two constraints including an effect on people or the environment, and one point for a science-based justification of a requirement.

FIND MORE LIKE THIS

Create questions › Course: All › MS Engineering Design › ETS1 › MS-ETS1-1 › DOK 3 › Generate

Written for this guide

GRADE 8 SCIENCE · ENGINEERING DESIGN · ETS1 ENGINEERING DESIGN

MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students read one column of a table and compare each value with a single stated limit, a one-step task.

A team is designing an insulated lunch box. The box must keep food from warming more than 5 °C in 3 hours, and it must cost no more than $20. The table shows test results for four designs.

Which design does NOT meet the cost constraint?

Test Results for Each Lunch Box Design

Design	Temperature rise in 3 hours (°C)	Cost (dollars)
Design A	7	15
Design B	4	18
Design C	3	24
Design D	6	12

- ◯ Design C ✓
- ◯ Design A
- ◯ Design B
- ◯ Design D

FIND MORE LIKE THIS

Create questions › Course: All › MS Engineering Design › ETS1 › MS-ETS1-2 › DOK 1 › Generate

Written for this guide

DOK 2 · Skills & concepts

Why DOK 2: Students must check every design against two requirements at once and eliminate the ones that fail either, a multi-step comparison of table data.

A class is designing a water filter. It must clean at least 253 mL per minute and cost no more than $26. The table shows test results.

Which design meets both requirements?

Test Results for Each Design

Design	Water cleaned per minute (mL)	Cost (dollars)
Design A	246	22
Design B	304	10
Design C	168	20
Design D	176	22

- ◯ Design B ✓
- ◯ Design C
- ◯ Design A
- ◯ Design D

FIND MORE LIKE THIS

Create questions › Course: All › MS Engineering Design › ETS1 › MS-ETS1-2 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must build a written argument for one design, cite data for every criterion and constraint, and explain the systematic method that rules out the competitors.

Tyler evaluates turbine solutions. The team needs electrical output from a stable tower. Wind input and generator load are the same in all trials. Required electrical output is at least 5 W. Required tower tilt is at most 5 degrees. Cost is at most $48. Use the lowest-cost design that meets every requirement.

Tested design solutions:

Argue for the preferred design. Compare evidence with every criterion and constraint, then explain the systematic method that makes this solution preferable to its competitors.

Electrical Output, Tower Tilt, and Cost by Design

Design	electrical output (W)	tower tilt (degrees)	Cost (USD)
S	8	3	38
T	10	4	43
P	2	3	33
Q	11	2	53
R	8	7	36

Model response: Design S meets all criteria and costs $38, less than the other qualifying design at $43. Design S has 8 W for electrical output and 3 degrees for tower tilt. Its cost is $38. Check both performance criteria and the budget first, then choose the lowest cost among fully qualifying designs.

Rubric: One point each for the preferred qualifying design, its performance and cost evidence, and the systematic evaluation method.

FIND MORE LIKE THIS

Create questions › Course: All › MS Engineering Design › ETS1 › MS-ETS1-2 › DOK 3 › Generate

Test Bank question

GRADE 8 SCIENCE · ENGINEERING DESIGN · ETS1 ENGINEERING DESIGN

MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students read values straight from one column of the table and pick the largest, which is retrieving information rather than analyzing it.

A team building a model wind turbine tested blade sets and bases separately. Wind speed and load were the same in every test. The goals are more electrical power and less tower tilt. The table shows the component test results.

Which blade set produced the most electrical power?

Component Test Results

Source design	Blade set	Electrical power (W)	Base	Tower tilt (degrees)
P	Curved blade set	8	Small base	12
Q	Flat blade set	3	Wide base	4
R	Narrow blade set	5	Medium base	9

- ◯ Curved blade set ✓
- ◯ Flat blade set
- ◯ Narrow blade set
- ◯ Wide base

FIND MORE LIKE THIS

Create questions › Course: All › MS Engineering Design › ETS1 › MS-ETS1-3 › DOK 1 › Generate

Written for this guide

DOK 2 · Skills & concepts

Why DOK 2: Students must compare two separate sets of test results, pick the best feature for each goal, and combine them, which requires interpreting the data rather than reading one value.

Omar records blade power and base stability under wind. Blade sets and base designs were tested separately at matched wind and load. The goals are greater power and less tower tilt.

Curve trial settings: blade angle (degrees) = 10, 20, 30, 40 for Records 1 to 4. Only that setting changed in the curve tests. The second table supplies additional matched component comparisons.

Record data: electrical power (W).

Record	electrical power (W)
1	2
2	3
3	5
4	8

Component tests (each feature tested with other parts fixed):

Source design	First feature	electrical power (W)	Second feature	tower tilt (degrees)
P	Use curved blade set.	8	Use small base.	12
Q	Use flat blade set.	3	Use wide base.	4
R	Use narrow blade set.	5	Use medium base.	9

Which tested features should be combined in a new design and checked again?

Unknown visual type: line

- ◯ Combine the curved blade set from P with the wide base from Q, then test both goals in the hybrid. ✓

- Use both features from Q and ignore P even though its first feature performs better.
- Combine both best features and declare success without testing how they work together.
- Use both features from P and ignore Q even though its second feature performs better.

FIND MORE LIKE THIS

Create questions › Course: All › MS Engineering Design › ETS1 › MS-ETS1-3 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must weigh several data sets and a mass limit, plan a new combined design, justify it with evidence, and reason about why it still needs testing.

A class tested three paper-glider designs. Each design used a different wing and tail. The goals are a flight distance of at least 8 m and no more than 5 uncontrolled turns over 10 launches. The total mass of the wing plus tail must be no more than 14 g. Launch method and flight space were the same for every test.

No design met every requirement. Use the data to propose a new design that combines the best features of the tested designs. Support your choice with evidence for each requirement, and explain why the new design still needs to be tested.

Glider Test Results

Design	Wing (mass)	Tail (mass)	Flight distance (m)	Uncontrolled turns
P	Broad wing (8 g)	Small tail (4 g)	9	12
Q	Short wing (5 g)	Stable tail (5 g)	4	2
R	Narrow wing (4 g)	Wide tail (5 g)	6	6

Model response: Combine the broad wing from Design P with the stable tail from Design Q. The broad wing gave the longest flight (9 m, above the 8 m goal), and the stable tail gave the fewest uncontrolled turns (2, below the 5-turn limit). Together they weigh 8 g + 5 g = 13 g, which is within the 14 g limit. The new glider still needs repeated matched tests because the parts were tested in different gliders; the heavier tail could change the balance and shorten the flight, so the combination might not perform as well as each part did alone.

Rubric: One point for the correct combination of features, one point for evidence addressing every requirement including the mass calculation, and one point for explaining why the hybrid must be tested.

FIND MORE LIKE THIS

Create questions › Course: All › MS Engineering Design › ETS1 › MS-ETS1-3 › DOK 3 › Generate

Written for this guide

GRADE 8 SCIENCE · ENGINEERING DESIGN · ETS1 ENGINEERING DESIGN

MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall the purpose of iterative testing of a model, a basic fact about the engineering design process.

Engineers often build a model of a proposed design and test it again and again, changing it a little after each test.

What is the main reason for testing a model many times?

- ✓ To collect data that show how to change the design until it best meets the criteria and constraints
- To prove that the first version of the design never needs to be changed
- To replace measurements with opinions about how the design looks
- To change many variables at once so the tests finish faster

FIND MORE LIKE THIS

Create questions › Course: All › MS Engineering Design › ETS1 › MS-ETS1-4 › DOK 1 › Generate

Written for this guide

DOK 2 · Skills & concepts

Why DOK 2: Students must judge each proposed change to the traffic model, deciding whether it keeps the test fair and respects the crossing constraint, which goes beyond recall.

Mateo develops a traffic-flow computer model. The model represents arrivals, signal time, pedestrian crossings, and vehicle queues. Three runs have mean waits of 70, 75, and 72 seconds, above a 60-second goal. Pedestrians need at least 20 seconds to cross. New runs must test a changed signal schedule.

Complete the model, then use it to predict what happens. Decide whether each proposed model relationship is supported. Select True or False for each statement.

	True	False
Reduce wait by deleting every pedestrian crossing requirement from the model.	☐	☑
Signal schedules change when vehicles can leave queues, while pedestrian time constrains which schedules are useful.	☑	☐
Model a changed signal schedule, repeat queue and crossing-time runs, and revise until wait and crossing requirements are met.	☑	☐
Use fewer arrivals in new runs and call the whole wait change a signal improvement.	☐	☑

FIND MORE LIKE THIS

Create questions › Course: All › MS Engineering Design › ETS1 › MS-ETS1-4 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must use the trend in the data to plan and justify the next design iteration and a fair test, and more than one well-reasoned proposal can earn credit.

Tyler is developing an insulated cup. The goal is a water-temperature rise of no more than 5 °C in 3 hours when cold water sits in a warm room. The foam wall must have a mass of no more than 200 g. Tyler tested three versions of the model with the same water volume, starting temperature, and room conditions. The table shows the results.

No version met both requirements. Use the data to propose the next version Tyler should build and test. Predict how it will perform, explain your prediction using how energy moves through the cup wall, and describe how Tyler should test it.

Insulated Cup Model Tests

Version	Foam wall thickness (mm)	Temperature rise in 3 hours (°C)	Wall mass (g)
1	2	9	110
2	4	6	160
3	6	4	210

Model response: Sample answer: Tyler should try a 5 mm foam wall. The data show that each extra millimetre of foam lowered the temperature rise and added about 25 g, so a 5 mm wall should give a rise of about 5 °C and a mass of about 185 g, which could meet both limits. Thicker foam slows the transfer of thermal energy from the warm room into the cold water. Tyler should test the 5 mm cup several times with the same water volume, starting temperature, room conditions, and 3-hour time, then revise again if either limit is missed.

Rubric: One point for a data-supported proposal and prediction, one point for an energy-transfer explanation, and one point for a fair, repeated test plan that checks both requirements.

FIND MORE LIKE THIS

Create questions › Course: All › MS Engineering Design › ETS1 › MS-ETS1-4 › DOK 3 › Generate

Written for this guide

Sources

- Performance expectations and disciplinary core ideas: NGSS Lead States (2013), Next Generation Science Standards: For States, By States. https://www.nextgenscience.org

- State science test (CAST) item specifications: these describe PEs and item clusters but do not assign DOK levels.
- DOK level definitions: Webb Depth of Knowledge, as used by Smarter Balanced, summarised on the "How to use" page.
- Example questions: the AchieveMetrics Test Bank, reviewed for this guide.

AchieveMetrics Test Bank · DOK Progression Guide · Grade 8 Science · October 2026 edition.

AchieveMetrics Test Bank

DOK PROGRESSION GUIDE · NGSS SCIENCE

High School Science

Every NGSS performance expectation in the high school PEs, tested once in high school, with a Test Bank question at DOK 1, DOK 2 and DOK 3, and the clicks to find more.

DOK 1 Recall

DOK 2 Skills & concepts

DOK 3 Strategic thinking

DOK 4 Extended thinking

For high school science teachers. Organized by domain, core idea (DCI) and performance expectation (PE), the way the Test Bank files science.

achievemetricstestbank.com · October 2026 edition

How to use this booklet

Depth of Knowledge (DOK) describes the kind of thinking a question asks for, not how hard it is. For each performance expectation (PE), this booklet shows one question at DOK 1, DOK 2 and DOK 3, so you can see the climb from recalling an idea to using evidence and reasoning with it, and then pick questions at the level your students need next.

The four DOK levels

DOK 1 · Recall — Recall a fact, term or property, or carry out a routine one-step procedure. Read a value straight from a table or graph.

DOK 2 · Skills & concepts — Decide how to approach it and use two or more steps: compare, classify, interpret data, or move between representations.

DOK 3 · Strategic thinking — Reason and plan: justify an answer, critique an argument, use evidence, or solve a problem with no routine path.

DOK 4 · Extended thinking — Carry out an extended investigation that connects several ideas, conditions or sources. The Test Bank tags science questions DOK 1 to 3, so this booklet shows those three levels.

Reading a PE page

1. The heading names the disciplinary core idea (DCI), the performance expectation (PE) code and its wording.
2. The DOK ladder shows the levels this guide gives an example for. Every PE has a DOK 1, DOK 2 and DOK 3 example.
3. One example question at each level, lowest first, with the answer shown. Read them top to bottom to see how the thinking climbs.
4. "Why DOK n" explains in one sentence what makes the question that level, so you can spot the same thing in your own questions.
5. "Find more like this" lists the exact Test Bank clicks that generate more questions for the same PE at the same level.

The state science test item specifications do not assign DOK levels to PEs, so the levels here come from the Test Bank's own DOK tags. Every example was then checked by hand against the DOK definitions above. Where no Test Bank question truly fit a level, we wrote one; those are marked "Written for this guide."

Finding these questions in the Test Bank

Every example page ends with the exact clicks. Science is filed by course, subject, core idea and PE. The courses are Biology (Life Science), Chemistry or Physics (Physical Science) and Earth Science.

One PE at one DOK level

Create questions › Course › Subject › Disciplinary core idea (DCI) › Performance expectation (PE) › Practice and crosscutting concept (optional) › Options: DOK 1, 2 or 3 › Generate

Pick a practice and crosscutting concept to narrow the questions further, or leave them open for any.

Engineering Design (ETS1)

Engineering Design is not tied to one course.

Create questions › Course: All › HS Engineering Design › ETS1 › PE › Options: DOK › Generate

Questions you have saved

Saved questions are filed the same way in your Item Bank.

More › Item Bank › Course › Discrete or task › Subject › Core idea (DCI) › Performance expectation (PE) › DOK

Tip: to move a class up the ladder, generate the same PE at the next DOK level. To check that an idea is secure before going further, generate a set at DOK 1.

All performance expectations at a glance

Every PE has an example question at DOK 1, DOK 2 and DOK 3 in this booklet.

Life Science

PE		DOK 1	DOK 2	DOK 3	DOK 4
HS-LS1-1	Construct an explanation for how the structure of DNA determines the structure of proteins	●	●	●	–
HS-LS1-2	Develop and use a model to illustrate the hierarchical organization of interacting systems	●	●	●	–
HS-LS1-3	Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis	●	●	●	–
HS-LS1-4	Use a model to illustrate the role of cellular division and differentiation in producing and maintaining complex organisms	●	●	●	–
HS-LS1-5	Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy	●	●	●	–
HS-LS1-6	Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and lipids	●	●	●	–
HS-LS1-7	Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules are broken releasing energy	●	●	●	–
HS-LS2-1	Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems	●	●	●	–
HS-LS2-2	Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations	●	●	●	–
HS-LS2-3	Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions	●	●	●	–
HS-LS2-4	Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem	●	●	●	–
HS-LS2-5	Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere	●	●	●	–
HS-LS2-6	Evaluate claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms	●	●	●	–
HS-LS2-7	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity	●	●	●	–
HS-LS2-8	Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce	●	●	●	–
HS-LS3-1	Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits	●	●	●	–
HS-LS3-2	Make and defend a claim based on evidence that inheritable genetic variations may result from new genetic combinations through meiosis	●	●	●	–
HS-LS3-3	Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population	●	●	●	–

PE		DOK 1	DOK 2	DOK 3	DOK 4
HS-LS4-1	Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence	●	●	●	–
HS-LS4-2	Construct an explanation based on evidence that the process of evolution primarily results from four factors	●	●	●	–
HS-LS4-3	Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion	●	●	●	–
HS-LS4-4	Construct an explanation based on evidence for how natural selection leads to adaptation of populations	●	●	●	–
HS-LS4-5	Evaluate the evidence supporting claims that changes in environmental conditions may result in the emergence of new species	●	●	●	–
HS-LS4-6	Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity	●	●	●	–

Physical Science

PE		DOK 1	DOK 2	DOK 3	DOK 4
HS-PS1-1	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level	●	●	●	–
HS-PS1-2	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states	●	●	●	–
HS-PS1-3	Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces	●	●	●	–
HS-PS1-4	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy	●	●	●	–
HS-PS1-5	Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs	●	●	●	–
HS-PS1-6	Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium	●	●	●	–
HS-PS1-7	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction	●	●	●	–
HS-PS1-8	Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay	●	●	●	–
HS-PS2-1	Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration	●	●	●	–
HS-PS2-2	Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system	●	●	●	–
HS-PS2-3	Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision	●	●	●	–
HS-PS2-4	Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects	●	●	●	–
HS-PS2-5	Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current	●	●	●	–
HS-PS2-6	Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials	●	●	●	–
HS-PS3-1	Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other	●	●	●	–

PE		DOK 1	DOK 2	DOK 3	DOK 4
	component(s) and energy flows in and out of the system are known				
HS-PS3-2	Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects)	●	●	●	–
HS-PS3-3	Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy	●	●	●	–
HS-PS3-4	Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution	●	●	●	–
HS-PS3-5	Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction	●	●	●	–
HS-PS4-1	Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media	●	●	●	–
HS-PS4-2	Evaluate questions about the advantages of using a digital transmission and storage of information	●	●	●	–
HS-PS4-3	Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model	●	●	●	–
HS-PS4-4	Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter	●	●	●	–
HS-PS4-5	Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information	●	●	●	–

Earth & Space Science

PE		DOK 1	DOK 2	DOK 3	DOK 4
HS-ESS1-1	Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy	●	●	●	–
HS-ESS1-2	Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe	●	●	●	–
HS-ESS1-3	Communicate scientific ideas about the way stars, over their life cycle, produce elements	●	●	●	–
HS-ESS1-4	Use mathematical or computational representations to predict the motion of orbiting objects in the solar system	●	●	●	–
HS-ESS1-5	Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks	●	●	●	–
HS-ESS1-6	Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history	●	●	●	–
HS-ESS2-1	Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features	●	●	●	–
HS-ESS2-2	Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems	●	●	●	–
HS-ESS2-3	Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection	●	●	●	–
HS-ESS2-4	Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate	●	●	●	–
HS-ESS2-5	Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes	●	●	●	–
HS-ESS2-6	Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere	●	●	●	–
HS-ESS2-7	Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth	●	●	●	–
HS-ESS3-1	Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity	●	●	●	–
HS-ESS3-2	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios	●	●	●	–
HS-ESS3-3	Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity	●	●	●	–
HS-ESS3-4	Evaluate or refine a technological solution that reduces impacts of human activities on natural systems	●	●	●	–

PE		DOK 1	DOK 2	DOK 3	DOK 4
HS-ESS3-5	Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth's systems	●	●	●	–
HS-ESS3-6	Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity	●	●	●	–

Engineering Design

PE		DOK 1	DOK 2	DOK 3	DOK 4
HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants	●	●	●	–
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering	●	●	●	–
HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts	●	●	●	–
HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem	●	●	●	–

NGSS DOMAIN

Life Science

24 performance expectations, grouped by disciplinary core idea. In the Test Bank, choose the Biology course, then HS Life Science.

Create questions › Biology › HS Life Science › Core idea (DCI) › PE › Options: DOK › Generate

HIGH SCHOOL SCIENCE · LIFE SCIENCE · LS1 FROM MOLECULES TO ORGANISMS

HS-LS1-1 Construct an explanation for how the structure of DNA determines the structure of proteins

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall one fact: the order of bases in a gene sets the order of amino acids in a protein. No data or reasoning is needed, so it is recall.

A gene is a section of DNA that carries the instructions for making one protein. A student reads that the order of the four bases (A, T, C, and G) in a gene is very important. What does the order of bases in a gene directly determine?

- ✓ The order of amino acids in the protein that the gene codes for
- The number of chromosomes found in each of the body's cells
- The order of sugar units in the starch that a cell stores
- The kinds of fat molecules that make up the cell membrane

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS1 › LS1-1 › DOK 1 › Generate

Written for this guide

DOK 2 · Skills & concepts

Why DOK 2: Students must connect two ideas, the same DNA in every cell and different genes turned on, to explain why cells with identical DNA make different proteins.

A muscle cell and a nerve cell in the same person contain the same DNA sequences, yet they look different and do different jobs. A student writes an explanation for this. Which statements correctly explain how the cells become specialized? Select all that apply.

- [ ] Muscle and nerve cells must have different DNA sequences because they do different jobs.
- [ ] If a gene's base sequence is changed, no protein can ever be made from that gene.
- [x] The two cells make different proteins, even though they carry the same genes.
- [x] The base order of each expressed gene sets the amino acid order of its protein.
- [x] Different genes are turned on in muscle and nerve cells, so they make different proteins.
- [ ] Nerve cells removed their muscle genes from their DNA once they became nerve cells.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS1 › LS1-1 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students choose the claim the evidence supports, explain the cause, and then identify what result would weaken the claim, which requires reasoning about evidence.

Use the drop-down menus to complete the statement.

At an aquarium in Mexico City, researchers watch an axolotl regrow a lost front leg. Cells near the wound divide and form new bone, muscle, and skin. Tests show the new muscle cells have the same DNA sequence as the new skin cells. But the two kinds of cells make different proteins. This evidence best supports the claim that

[cells with the same DNA can make different proteins ▾] . The new cells become different kinds of cells because [they turn on different genes ▾] . A result that would weaken this claim is finding new muscle cells that [have DNA unlike the skin cells ▾] .

Drop-down 1 choices: regrowing a leg changes the animal's DNA; muscle and skin cells have different genes; **cells with the same DNA can make different proteins ✓**

Drop-down 2 choices: **they turn on different genes ✓**; they lose genes they do not need; they receive different DNA

Drop-down 3 choices: **have DNA unlike the skin cells ✓**; make muscle proteins; have the same DNA as bone cells

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS1 › LS1-1 › DOK 3 › Generate

Test Bank question

HS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall which body system each organ or tissue belongs to and its basic job. Each row is a one-step fact check.

A veterinarian at a dairy farm in Tulare County explains how different parts of a cow's body help turn grass into milk. Select True or False for each statement.

	True	False
The rumen, a stomach chamber where microbes break down grass, is part of the digestive system.	☑	☐
The blood vessels that carry absorbed nutrients to the udder are part of the digestive system.	☐	☑
The jaw muscles that grind cud are part of the muscular system.	☑	☐
The heart belongs to the digestive system because it moves nutrients.	☐	☑
The lining of the small intestine absorbs nutrients into the blood.	☑	☐

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS1 › LS1-2 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students apply a given model of three interacting systems (digestive, circulatory, skeletal) to explain an observation, linking several steps rather than recalling one fact.

Grace raises laying hens in Georgia. Eggshells are made mostly of calcium. Her model of calcium in a hen: the digestive system absorbs calcium from feed into the blood, the blood carries calcium to the shell gland of the reproductive system, and the bones store calcium and can release it into the blood. Grace fed one flock a low-calcium feed for a month, and at first the hens kept laying eggs with normal shells. Based on the model, which explanation best accounts for the normal shells?

- ○ The shell gland made new calcium on its own, so the hens did not need any from feed.
- ○ Calcium released from the hens' bones entered the blood and was carried to the shell gland. ✓
- ○ The stomach stored a month of calcium and passed it straight to the shell gland without the blood.
- ○ The hens' leg muscles made extra calcium to replace the calcium missing from the feed.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS1 › LS1-2 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students predict the outcome of a planned experiment and justify it by reasoning across levels, from root cells needing oxygen to the whole plant wilting.

After heavy rain, part of a squash field in the Central Valley stays flooded for three days. The squash plants in the flooded area wilt, even though their roots sit in water. Root cells need oxygen to release energy, and waterlogged soil has very little oxygen. In a greenhouse, a farmer grows squash in flooded pots. He bubbles air into half the pots and not into the others.

Part A: Which prediction best fits the farmer's greenhouse test?

Choose one answer.

- ○ Plants in both groups will stay firm, because their roots are surrounded by water.
- ○ Plants without air will wilt less, because their leaves will get extra water.
- ○ Plants with air bubbled in will wilt less, because their roots can keep taking in water. ✓
- ○ Plants in both groups will wilt, because the water around the roots is the same.

Part B: Which evidence or idea best supports your prediction in Part A?

Choose one answer.

- ○ Flooded soil holds more water, so the leaves will always get more of it.
- ○ The root system and shoot system work separately in squash plants.
- ○ Root cells need oxygen for energy to take in water and send it to the leaves. ✓
- ○ Leaves take in water from the air, so roots are not needed on flooded days.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS1 › LS1-2 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · LIFE SCIENCE · LS1 FROM MOLECULES TO ORGANISMS

HS-LS1-3 Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students identify the one data point that shows a return to a set point, using the basic definition of a feedback mechanism.

A student measured her resting heart rate: 72 beats per minute. She ran on a treadmill for 5 minutes, and right after stopping her heart rate was 145 beats per minute. Over the next 10 minutes, it slowly decreased back to 72 beats per minute. Which piece of evidence best shows a feedback mechanism returning her body to a stable state?

- ○ Her resting heart rate was 72 beats per minute before she began to run.
- ○ Her heart rate rose to 145, which shows her body could not stay stable.
- ○ Her heart rate fell back to 72 within 10 minutes after she stopped running. ✓
- ○ Her heart rate was higher right after running than it was at rest.

FIND MORE LIKE THIS

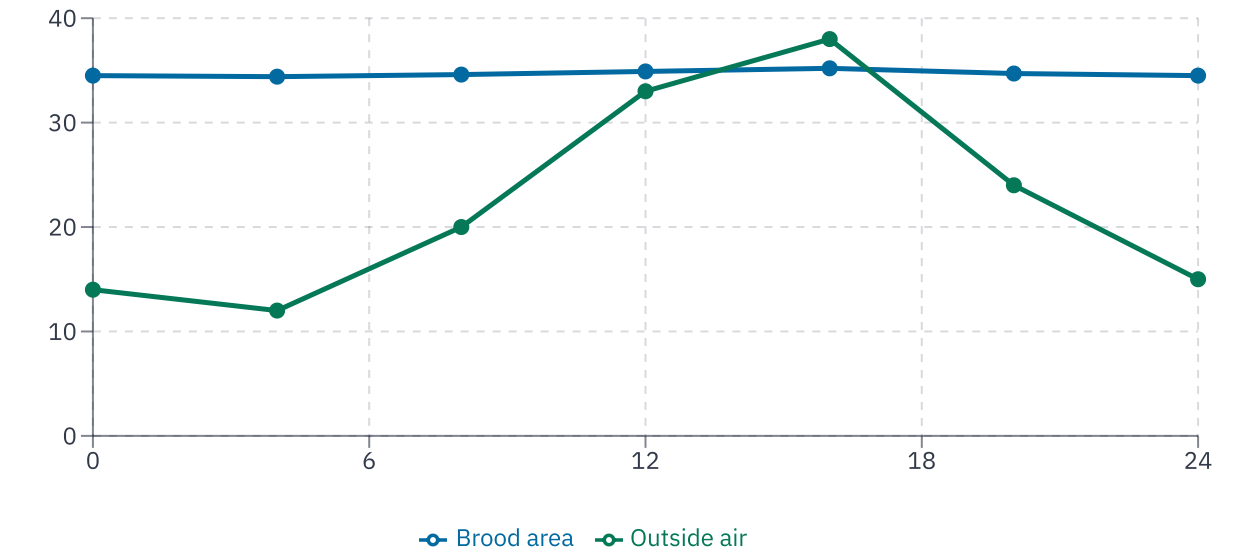
Create questions › Biology › HS Life Science › LS1 › LS1-3 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret a two-line graph and compare the steady brood temperature with the changing outside air to draw a conclusion about regulation.

A beekeeper in Fresno put one temperature sensor in the center of a hive's brood area, where young bees develop. She put another sensor outside the hive. The graph shows readings every 4 hours for one day. Which conclusion is best supported by the graph?



- ○ The brood area warmed and cooled by about as much as the outside air did.
- ○ The bees kept the brood area near 35°C while outside air changed by over 20°C. ✓
- ○ The brood area stayed steady only because the outside air never changed.
- ○ The brood area was coolest at hour 16, when the outside air was hottest.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS1 › LS1-3 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students critique an investigation plan and decide which changes would improve accuracy and precision, which requires planning and reasoning about experimental design.

The pupil of the eye gets smaller in bright light, which keeps the light reaching the back of the eye in a safe range. Three students tested this response. Each held a millimeter ruler next to a partner's eye. They read pupil width once after 1 minute in a dim room and once after 1 minute under a bright lamp. Which changes would most improve the accuracy and precision of their measurements? Select all that apply.

Pupil Width in Dim and Bright Light

Partner	Dim room (mm)	Bright lamp (mm)
Lena	7	3
Omar	6	3
Yuki	7	2

- [x] Photograph each eye next to a scale and measure the pupil from the photo.
- [ ] Round every reading to the nearest centimeter to make the values simpler.
- [x] Have two students read each pupil and compare their readings.
- [ ] Let each student choose how bright the lamp should be for a partner.
- [ ] Stop after the first partner, since the pattern is already clear.
- [x] Take several readings in each condition and average them for each person.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS1 › LS1-3 › DOK 3 › Generate

Test Bank question

HS-LS1-4 Use a model to illustrate the role of cellular division and differentiation in producing and maintaining complex organisms

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall basic facts: mitosis increases cell number, daughter cells have identical DNA, and different genes are expressed in different cell types.

In a plant lab, Mateo takes one cell from an orchid leaf and places it on a growth gel. The cell divides over and over. Months later it has grown into a whole orchid with roots, stems, and leaves. Choose the missing values from the drop-down menus.

Question about the new orchid	Answer
Process that increased the number of cells	Blank 1
DNA in a root cell compared with the original leaf cell	Blank 2
Why root cells and leaf cells look different	Blank 3

Blank 1 (Row 1, Answer): mitosis ▾

Blank 2 (Row 2, Answer): identical ▾

Blank 3 (Row 3, Answer): different genes are expressed ▾

Drop-down 1 choices: meiosis | fertilization | **mitosis ✓**

Drop-down 2 choices: **identical ✓** | half as much | different

Drop-down 3 choices: they lost different genes | they have different chromosomes | **different genes are expressed ✓**

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS1 › LS1-4 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students explain why specialized cells differ from the stem cells that made them, then choose the evidence that supports that explanation.

A model of skin repair after a scrape shows skin stem cells in the bottom layer, called the basal layer, dividing. The daughter cells move upward. As they move, they change shape and job, and they become flat, protective cells at the surface.

Part A: What best explains why the flat surface cells look and work so differently from the basal stem cells that made them?

Choose one answer.

- ○ The surface cells went through meiosis, which changed their genetic material.
- ○ The surface cells lost half of their chromosomes as they moved away from the basal layer.
- ○ The surface cells contain sister chromatids, while basal cells contain homologous chromosomes.
- ✓ ○ The surface cells have the same DNA as the basal cells but turn different genes on and off.

Part B: Which evidence, if found, best supports your answer to Part A?

Choose one answer.

- ✓ ○ Surface cells and basal cells from the same skin have matching DNA.
- ○ Basal cells divide often, but surface cells do not divide.
- ○ Surface cells are flat, while basal cells are rounder.
- ○ Surface cells have half as many chromosomes as basal cells.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS1 › LS1-4 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students coordinate two changing data sets over time, dividing cells and fin growth, to build a supported claim and pick the evidence that links them.

Researchers in a Pasadena, California, lab clip the tail fins of zebrafish. Every two days, they count the dividing cells in a sample near the cut and measure how much fin has grown back.

Dividing Cells and Fin Regrowth After Clipping

Day after clipping	Dividing cells per sample	Fin regrown (mm)
1	5	0
3	60	0.5
5	45	1.5
7	15	2.5

Part A: Which claim is best supported by the data?

Choose one answer.

- ○ The number of dividing cells rose steadily during the whole week.
- ✓ ○ The fin grew fastest after a burst of cell division near the cut.
- ○ The fin regrew without cell division, since dividing cells dropped by day 7.
- ○ The fin stopped growing by day 7 because no cells were dividing.

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ○ Only 5 cells per sample were dividing on day 1.
- ✓ ○ Dividing cells peaked on day 3, and the fin grew most between days 3 and 7.
- ○ Dividing cells dropped from 60 to 15 between day 3 and day 7.
- ○ The fin was 2.5 mm longer on day 7 than on day 1.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS1 › LS1-4 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · LIFE SCIENCE · LS1 FROM MOLECULES TO ORGANISMS

HS-LS1-5 Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall the inputs and energy source of photosynthesis and that atoms are conserved. Each blank is a single remembered fact.

Use the drop-down menus to complete the statement.

Zara grows cyanobacteria, tiny bacteria that carry out photosynthesis, in a flask near a sunny lab window. The carbon atoms in the sugar the cyanobacteria make come from [carbon dioxide ▾]. During photosynthesis, the total number of atoms in the flask [stays the same ▾]. The sugar stores chemical energy that came from [absorbed light ▾].

Drop-down 1 choices: **carbon dioxide ✓** | the sunlight | the glass flask

Drop-down 2 choices: decreases | **stays the same ✓** | increases

Drop-down 3 choices: the water | **absorbed light ✓** | new atoms

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS1 › LS1-5 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students use outputs of a computer model to describe the energy change in photosynthesis and select the model evidence that supports it.

A student uses a computer model of photosynthesis in a water plant. The student can change the amount of light the plant gets. The model shows the mass of glucose made and the O_2 released. It also shows that CO_2 and water start with less stored chemical energy than the glucose and O_2 made at the end. Each time the student raises the light, both glucose made and O_2 released go up. Use the computer model to answer both parts.

Part A: Which statement best describes what happens to energy during photosynthesis?

Choose one answer.

- ○ Glucose appears from nothing, and light energy is only used to make O_2.
- ○ The chemical energy already in CO_2 is rearranged into glucose, with none added.
- ○ Light energy disappears and turns into the O_2 gas that the plant releases.
- ○ Light energy is changed into chemical energy that is stored in glucose. ✓

Part B: Which evidence from the model best supports your answer to Part A?

Choose one answer.

- ○ Light energy is fully used up, so no energy is left in the glucose or the O_2.
- ○ More O_2 is made than glucose, which shows light mainly breaks apart water.
- ○ The CO_2 used matches the glucose made, which shows a one-step process.
- ○ The products store more energy than the inputs, and more light makes more glucose. ✓

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS1 › LS1-5 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate two competing explanations against an energy diagram and justify which one the model supports, which is critiquing with evidence.

A student made an energy diagram of photosynthesis in a leaf. The reactants (CO_2 and water) are on the left at a low energy level. The products (glucose and O_2) are on the right at a higher energy level. The only energy input shown is an arrow for absorbed light. Two classmates explain the gap between the levels. Omar says it is energy the plant took in with water from the soil. Grace says it is absorbed light energy, now stored as chemical energy in glucose. Which evaluation of the two explanations is best supported by the energy diagram?

- ○ Neither is correct, because the gap shows energy that the plant loses as heat in the reaction.
- ○ Grace is correct, because absorbed light is the only energy input, and the products store more. ✓
- ○ Omar is correct, because water enters through the roots and carries energy up to the leaves.
- ○ Both are correct, because light and soil water each add an equal share of the stored energy.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS1 › LS1-5 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · LIFE SCIENCE · LS1 FROM MOLECULES TO ORGANISMS

HS-LS1-6 Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and lipids

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall the ways a plant can use glucose atoms, such as building starch, cellulose, and amino acids with soil nitrogen.

A potato plant makes glucose in its leaves by photosynthesis. It takes in water and nitrogen-containing ions from the soil through its roots. Which statements correctly describe how the plant can use atoms from its glucose? Select all that apply.

- [ ] It must take in all of its amino acids whole from the soil.
- [x] It can use glucose atoms to build cellulose for the walls of its cells. ✓
- [ ] It can change glucose carbon atoms into the nitrogen its proteins need.
- [x] It can link glucose units into starch that is stored in the potatoes. ✓
- [ ] It can use glucose atoms only for energy and never to build new molecules.
- [x] It can combine glucose atoms with soil nitrogen to build amino acids. ✓

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS1 › LS1-6 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students explain at a basic level how glucose atoms are rearranged and combined with nitrogen to build amino acids and proteins for repair.

A student plays soccer for two hours, and afterward her leg muscles are sore from tiny tears in the muscle fibers. Her coach says her body breaks down glucose to release energy during exercise, but it also needs to build new protein to repair the fibers. Glucose is made of carbon, hydrogen, and oxygen atoms. Explain how atoms from glucose can help repair her muscle fibers instead of only being used for energy.

Model response: When glucose is broken down, its carbon, hydrogen, and oxygen atoms are not destroyed. Her cells can rearrange these atoms and combine them with nitrogen from other foods to build amino acids. The amino acids are joined into new proteins that repair the damaged muscle fibers.

Rubric: 2 points: Explains that glucose atoms are rearranged and combined with nitrogen to form amino acids, and that the amino acids are joined into proteins that repair the muscle. 1 point: Explains only that glucose atoms form amino acids, or only that new proteins repair the muscle, without linking the two. 0 points: Says glucose is used only for energy, or gives no relevant explanation.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS1 › LS1-6 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate a claim by comparing quantities, 30 kg of fat gained versus 12 kg eaten, and conclude the pig must have built fat from starch.

On a farm in North Carolina, a young pig ate 300 kg of feed while growing. The feed was mostly corn starch and contained 12 kg of fat. During that time the pig gained 30 kg of body fat. A student claims: "Animals can't make their own fat; all of the pig's fat came from fat in its feed." Which statement best evaluates the student's claim?

- ○ Supported: the feed contained fat, so that fat is where the pig's fat came from.
- ○ Supported: the pig ate far more feed than the amount of fat it gained.
- ○ Not supported: the pig's fat came from the air, since fat contains oxygen.
- ○ Not supported: the pig gained more fat than its feed held, so it built fat from starch. ✓

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS1 › LS1-6 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · LIFE SCIENCE · LS1 FROM MOLECULES TO ORGANISMS

HS-LS1-7 Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules are broken releasing energy

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students fill in the parts of a respiration model from memory: the reactants, the net energy release, and that atoms are rearranged, not created.

A veterinarian at a racetrack in Arcadia describes how a racehorse's muscle cells get usable energy from the food the horse eats. Choose the missing values from the drop-down menus.

Model component	Description
Reactants (inputs)	Blank 1
Bond changes	Bonds in glucose and oxygen break; new bonds form in carbon dioxide and water
Products (outputs)	carbon dioxide and water
Energy result	Blank 2
Matter change	Blank 3

Blank 1 (Row 1, Description): glucose and oxygen ▾

Blank 2 (Row 4, Description): net release, captured as ATP and heat ▾

Blank 3 (Row 5, Description): atoms rearranged, none created or destroyed ▾

Drop-down 1 choices: carbon dioxide and water | ATP and heat | **glucose and oxygen ✓**

Drop-down 2 choices: energy created from matter | energy stored in carbon dioxide | **net release, captured as ATP and heat ✓**

Drop-down 3 choices: atoms turned into energy for the muscles | atoms destroyed as the food is used up | **atoms rearranged, none created or destroyed ✓**

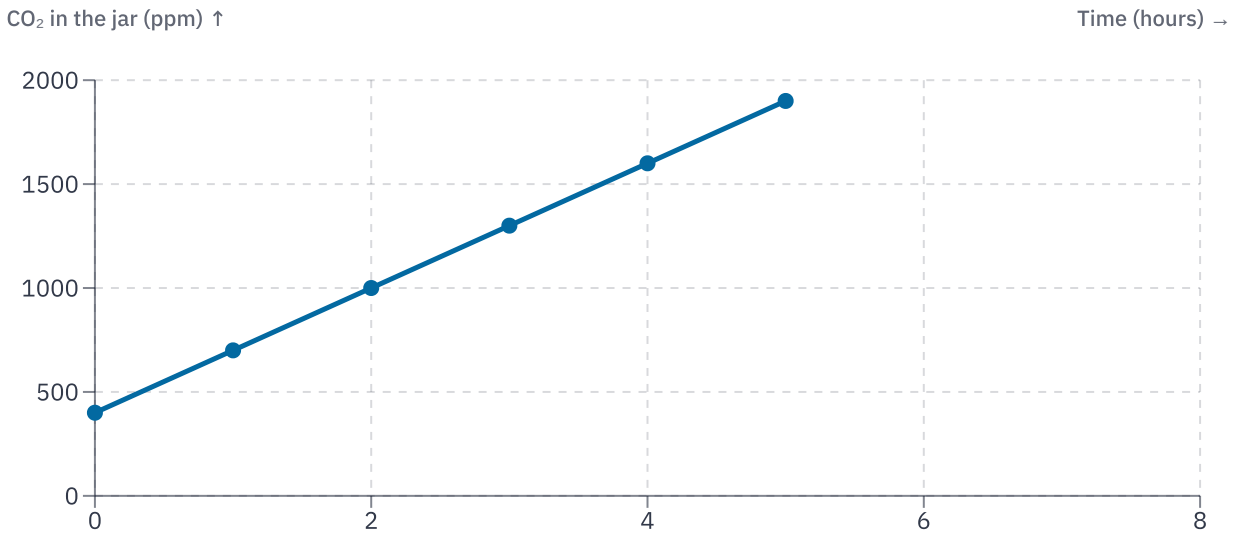
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Create questions › Biology › HS Life Science › LS1 › LS1-7 › DOK 1 › Generate Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret a steady rise on a graph and connect it to cellular respiration in the seeds, linking data to a process.

A student named Julia put sprouting corn seeds in a sealed jar with a CO_2 sensor. She recorded the CO_2 in the jar every hour for 5 hours. Which conclusion is best supported by the graph?



- ✓ The seeds' cells kept breaking down stored food with O_2, giving off CO_2 at a steady rate.
- The seeds' cells created new carbon atoms as they grew, so the CO_2 in the jar kept rising.
- The seeds' cells stopped respiring once the jar was sealed, so the CO_2 came from the air.
- The seeds' cells made CO_2 by photosynthesis, which adds about 300 ppm of CO_2 each hour.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS1 › LS1-7 › DOK 2 › Generate Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must reason that lost body mass leaves as carbon dioxide and water, rejecting tempting ideas that matter becomes energy, and back it with evidence.

Emperor penguin males in Antarctica stand on their eggs for about four months in winter and eat nothing. A research team weighed males at the start and end of this fast. They also measured the air the penguins breathed out.

Emperor Penguin Males Before and After a Winter Fast

Measurement	Start of fast	End of fast
Average body mass (kg)	38	23
Breathing out CO_2 and water vapor?	Yes	Yes

Part A: Where did most of the penguins' lost mass go?

Choose one answer.

- It was destroyed as the cells used up the fat for energy.
- It was changed into heat energy that kept the eggs warm.
- It was changed into the ATP stored in the penguins' muscles.
- It left as CO_2 and water made by respiring stored fat. ✓

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- The penguins huddled together to share heat in the freezing wind.
- The penguins lost about 15 kg while fasting on the ice.
- The penguins used O_2 and breathed out CO_2 and water vapor the whole time. ✓
- The penguins' body temperature stayed near 38 °C all winter.

FIND MORE LIKE THIS

HIGH SCHOOL SCIENCE · LIFE SCIENCE · LS2 ECOSYSTEMS: INTERACTIONS, ENERGY, AND DYNAMICS

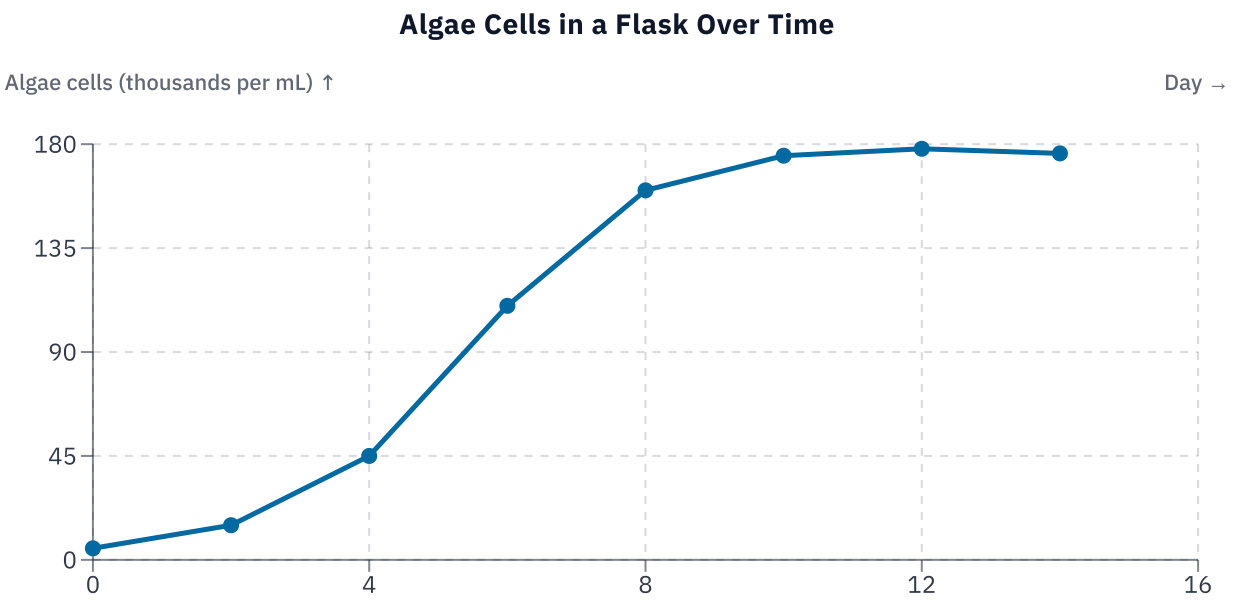
HS-LS2-1 Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students read the level where the growth curve flattens directly off the graph to find carrying capacity.

A student grows green algae in a flask of nutrient water under a lamp. She counts the algae cells every two days. The graph shows her results. Based on the graph, what is the approximate carrying capacity of the flask for algae?



- [x] About 175 thousand cells per mL
- [ ] About 350 thousand cells per mL
- [ ] About 45 thousand cells per mL
- [ ] About 110 thousand cells per mL

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS2 › LS2-1 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students find the pattern in a table (about 1 rat per 5 kg of seeds) and choose the evidence that shows the relationship.

On the Carrizo Plain in California, a team measures the seeds on the ground each fall and counts giant kangaroo rats, which eat these seeds. Their results are in the table.

Seeds and Kangaroo Rats on the Carrizo Plain

Year	Seeds (kg per hectare)	Kangaroo rats per hectare
1	60	12
2 (drought)	20	4
3	45	9
4	80	16

Part A: Which statement best describes the relationship in the data?

Choose one answer.

- ○ Rat numbers stayed near 16 per hectare every year of the study.
- ○ Rat numbers rose in the years when the seed supply fell.
- ○ Rat numbers rose and fell with the seed supply, about 1 rat per 5 kg of seeds. ✓
- ○ Rat numbers did not depend on how many seeds were on the ground.

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ○ In the drought year, seeds fell to 20 kg and rats fell to 4. ✓
- ○ The highest count in the study was 16 rats per hectare.
- ○ The team counted kangaroo rats every fall for four years.

Giant kangaroo rats gather seeds and store them in burrows.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS2 › LS2-1 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students calculate percent change, test whether the change is even, predict a new value, and reason about effects on a predator, drawing several conclusions from the data.

In a lab, a team raised brine shrimp from a salt lake in tanks at four different salt levels. The team recorded the highest shrimp density each tank could maintain. Eared grebes, a kind of bird, feed on these shrimp in the lake. Select True or False for each statement.

Highest Stable Brine Shrimp Density at Four Salt Levels

Salt level (grams per liter)	Highest stable density (shrimp per cubic meter)
70	30,000
85	26,000
100	18,000
115	9,000

	True	False
Salt level is an abiotic factor that affects the shrimp's carrying capacity.	☑	☐
Raising the salt level from 70 to 115 grams per liter lowered the highest density by 70%.	☑	☐
Each 15 gram per liter increase in salt lowered the density by the same amount.	☐	☑
Lowering the salt level from 100 to 85 grams per liter would likely let the density rise toward 26,000.	☑	☐
A change in shrimp numbers would have no effect on the grebes that eat them.	☐	☑

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS2 › LS2-1 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · LIFE SCIENCE · LS2 ECOSYSTEMS: INTERACTIONS, ENERGY, AND DYNAMICS

HS-LS2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students read the steady population value and recall that food and space set carrying capacity. Each blank is a single step.

Use the drop-down menus to complete the statement.

A class raises guppies in a 100-liter tank with the same amount of food each day. The population grows for a few months and then stays between 58 and 62 fish for the rest of the year. The carrying capacity of the tank is about [60 ▾] guppies. After it levels off, the population [moves up and down around ▾] that number. The number of guppies the tank can support is set mainly by [the food and space in the tank ▾].

Drop-down 1 choices: 30 | **60 ✓** | 100

Drop-down 2 choices: **moves up and down around ✓** | drops steadily below | keeps rising far above

Drop-down 3 choices: **the food and space in the tank ✓** | how fast guppies can swim | the color of the guppies

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS2 › LS2-2 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must pick the correct starting value and apply a proportional change (270 x 1.5) to estimate the new population, a two-step use of a math model.

Scientists studied a moose population in a forest for 20 years. In Years 1–5, the forest had enough food and shelter to support 450 moose. In Year 6, a big fire destroyed 40% of the forest, and afterward the forest could support only 270 moose because there was less food. By Year 15, the forest had grown back, and the amount of food plants was 50% higher than right after the fire. If the number of moose the forest can support is proportional to its food, about how many moose can the forest support now?

- ○ 270 moose, because a forest damaged by fire can never support more moose again
- ○ 405 moose, because food is 50% above the after-fire level, and 270 × 1.5 = 405 ✓
- ○ 450 moose, because carrying capacity always returns to its original number
- ○ 675 moose, because food is 50% higher than before, and 450 × 1.5 = 675

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS2 › LS2-2 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students analyze 20 years of counts to identify a cycle and judge which conclusions about the population are justified and which go too far.

A team counts snowshoe hares in a study plot in an Alaska forest for 20 years. Select True or False for each statement.

Snowshoe Hares Counted in a Study Plot

Year	Hares counted
1	400
3	1,200
5	700
8	150
10	500
13	1,100
15	600
18	180
20	450

	True	False
The hare population rose and fell in a cycle about 10 years long.	☑	☐
Because the population crashed to 150, the forest lost its ability to support hares.	☐	☑
Each crash was followed by a recovery.	☑	☐
The peaks show that the plot's carrying capacity is fixed at 1,200 hares.	☐	☑
A single year's count is a poor estimate of the long-term population level.	☑	☐

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS2 › LS2-2 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · LIFE SCIENCE · LS2 ECOSYSTEMS: INTERACTIONS, ENERGY, AND DYNAMICS

HS-LS2-3 Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recognize the basic fact that yeast break down glucose with or without oxygen and release carbon dioxide either way.

A baker notices that yeast cells used to make bread dough produce carbon dioxide gas both when oxygen is present in the dough and when the dough is sealed in an airtight container with limited oxygen. The baker wants to explain how yeast cells release energy from glucose under both conditions. Which statement best describes the evidence for how matter and energy flow through yeast cells in these two different situations?

- ✓ Yeast cells use different pathways to break down glucose and release energy depending on whether oxygen is available, and both pathways produce carbon dioxide as a waste product.
- Yeast cells in the sealed container do not actually respire; instead, the carbon dioxide comes from the flour reacting with water.
- Yeast cells release more total energy from glucose in the sealed container because the lack of oxygen forces them to use a more efficient energy pathway.
- Yeast cells only break down glucose to release energy when oxygen is available, so the sealed container must have allowed oxygen to enter through the dough.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS2 › LS2-3 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students explain both energy release and matter rearrangement in fermentation, connecting two ideas about one process.

A student watches yeast cells ferment glucose in a sealed container with no oxygen. Carbon dioxide bubbles form, and ethanol builds up in the liquid. Which statement correctly explains both the flow of energy and the cycling of matter in this system?

- ✓ The yeast release some energy from glucose for life processes, and the atoms of glucose are rearranged into carbon dioxide and ethanol.
- The yeast release no energy because there is no oxygen, and the glucose atoms stay in the liquid as unused sugar.
- Energy cycles through the yeast just as it does in plant cells, and the carbon atoms are destroyed as the sugar is used.
- The glucose is turned completely into energy that the yeast store, so no matter leaves the yeast cells as waste.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS2 › LS2-3 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students compare two fields, build a claim about anaerobic versus aerobic decomposition, and choose the evidence that best supports it.

In Japan, a farm team compared two rice fields. Field A was kept flooded all season. Field B was drained for two weeks in midsummer, letting air into the soil. Field A gave off far more methane than Field B. Field B gave off more carbon dioxide during the dry weeks. Rice grew well in both fields.

Part A: Which claim best explains the difference in gases?

Choose one answer.

- ◯ Flooding kept oxygen out, so decomposers broke matter down without oxygen. ✓
- ◯ Rice plants make methane by photosynthesis in flooded water.
- ◯ Flooding added energy to the soil, so decomposers made methane.
- ◯ Draining the field stopped all decomposition in the soil.

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ◯ Field A was kept flooded with water for the whole season.
- ◯ After air entered Field B's soil, it gave off more CO_2 and less methane. ✓
- ◯ The two fields were side by side on the same farm in Japan.
- ◯ Rice plants grew well in both fields during the whole season.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS2 › LS2-3 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · LIFE SCIENCE · LS2 ECOSYSTEMS: INTERACTIONS, ENERGY, AND DYNAMICS

HS-LS2-4 Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students compare given energy values and recall that energy enters through producers and is not recycled. Each row needs one step.

Scientists measured the energy stored each year in a salt marsh food chain, in kcal per square meter: cordgrass 6,000, planthoppers that feed on cordgrass 450, and spiders that eat planthoppers 30. Select True or False for each statement.

	True	False
The cordgrass stores more energy than the planthoppers and spiders combined.	☑	☐
The spiders store more energy than the planthoppers.	☐	☑
Energy released as heat by the spiders is taken back up by the cordgrass.	☐	☑
Energy enters this food chain when cordgrass captures sunlight.	☑	☐

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS2 › LS2-4 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret an energy budget table, computing fractions and percents to decide which conclusions about energy transfer are supported.

A student named Oliver tracked the energy in the milkweed leaves eaten by a monarch caterpillar in a garden in Minnesota. Which conclusions are supported by Oliver's data? Select all that apply.

Energy Budget for a Monarch Caterpillar

Where the energy went	Energy (J)
Energy in milkweed eaten	100
Lost in droppings	50
Lost as heat from respiration	30
Stored as new body mass	20

- [ ] The 30 J lost as heat will be reused by the milkweed plant.
- [ ] The caterpillar stored all the energy in the leaves it ate.
- [x] Half of the energy it ate left in its droppings.
- [x] A bird eating the caterpillar could get at most 20 J of this energy.
- [ ] The caterpillar stored more energy than it lost as heat.
- [x] The caterpillar stored 20% of the energy it ate as new body mass.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS2 › LS2-4 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students use multi-year data on both carbon and energy to evaluate a claim, reasoning that carbon cycles while energy does not return.

A team studied carbon and energy in a small prairie over five years. Each year, they measured how much carbon the plants took in from the air and how much sunlight energy the plants captured. They also tracked how much of each returned to where it came from. A student claims that carbon and energy both cycle in the prairie. Which evaluation of the student's claim is best supported by the data?

Carbon and Energy in a Prairie Plot Each Year

Year	Carbon taken in by plants (kg)	Carbon returned to the air (kg)	Sunlight energy captured (MJ)	Energy returned as sunlight (MJ)
1	500	480	20,000	0
2	520	510	21,000	0
3	490	495	19,500	0
4	510	500	20,500	0
5	505	500	20,200	0

- ◯ Not supported, because carbon returns to the air but no energy returns as sunlight. ✓
- ◯ Not supported, because carbon is used up and energy is recycled.
- ◯ Supported, because carbon and energy amounts both stay about the same each year.
- ◯ Supported, because the plants take in both carbon and energy each year.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS2 › LS2-4 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · LIFE SCIENCE · LS2 ECOSYSTEMS: INTERACTIONS, ENERGY, AND DYNAMICS

HS-LS2-5 Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall that carbon dioxide is a reactant in photosynthesis. One fact answers the question.

Growers at a tomato greenhouse in Leamington, Ontario, pump extra carbon dioxide (CO_2) into the air inside the greenhouse on sunny days. The tomato plants grow faster when they do. Why does adding CO_2 help the plants grow?

- ○ CO_2 replaces the oxygen the plants would otherwise need for respiration.
- ○ CO_2 keeps the plants from respiring, so they save more of their sugar.
- ○ CO_2 is a reactant in photosynthesis, which the plants use to build sugar. ✓
- ○ CO_2 is a product of photosynthesis, so the plants release it as they grow.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS2 › LS2-5 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students apply their model of photosynthesis and respiration to predict how carbon dioxide differs at noon and midnight, connecting process to outcome.

Use the drop-down menus to complete the statement.

At Clear Lake, a water-quality technician measures dissolved carbon dioxide near a thick mat of algae at noon and again at midnight. At noon, dissolved carbon dioxide is [lower ▾] because the algae's [photosynthesis ▾] outpaces respiration. At midnight, carbon dioxide is [higher ▾] because respiration continues in the dark.

Drop-down 1 choices: higher | **lower ✓** | the same

Drop-down 2 choices: **photosynthesis ✓** | evaporation | decomposition

Drop-down 3 choices: zero | **higher ✓** | lower

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS2 › LS2-5 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students write a claim, cite data, and reason about when each process happens, building a full evidence-based explanation in their own words.

Researchers in Illinois measure carbon dioxide in the air just above a large cornfield in midsummer. Make a claim that explains the difference between noon and midnight. Support your claim with evidence from the data. Explain your reasoning about when corn plants photosynthesize and when they respire.

Carbon Dioxide Above an Illinois Cornfield in Midsummer

Time	Carbon dioxide (parts per million)
Noon	370
Midnight	430

Model response: Claim: At noon, the corn's photosynthesis removes more carbon dioxide than respiration adds, but at midnight photosynthesis stops and only respiration continues. Evidence: Carbon dioxide was 370 ppm at noon and 430 ppm at midnight. Reasoning: Photosynthesis needs light, so it only happens in the day. Cellular respiration happens day and night in the corn plants and soil organisms, so at night nothing removes the carbon dioxide they release and it builds up.

Rubric: 2 points: The response includes all required elements: Claims photosynthesis outpaces respiration at noon and only respiration occurs at midnight; cites 370 and 430 ppm; reasons that photosynthesis needs light while respiration happens day and night.
1 point: The response gives a correct claim with evidence or reasoning, but not both or the response gives a correct claim only, or evidence only. Credit for "Reasoning: photosynthesis needs light, while cellular respiration happens day and night" requires "Claim: at noon photosynthesis removes more carbon dioxide than respiration adds; at midnight only respiration occurs".
0 points: Claims plants respire only at night or gives no relevant answer. No correct required element; the response is incorrect, too vague to earn credit, irrelevant, blank, or only copies the prompt without answering.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS2 › LS2-5 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · LIFE SCIENCE · LS2 ECOSYSTEMS: INTERACTIONS, ENERGY, AND DYNAMICS

HS-LS2-6 Evaluate claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall the meaning of invasive species and read basic facts from the passage. Each statement is a direct check.

After World War II, brown tree snakes accidentally arrived on the Pacific island of Guam, most likely in military cargo. The snakes ate birds and eggs, and most of Guam's native forest bird species disappeared from the wild. Select True or False for each statement.

	True	False
The brown tree snake is an invasive species on Guam.	☑	☐
The snake increased the number of forest bird species on Guam.	☐	☑
Losing birds that spread seeds could change which plants grow in Guam's forests.	☑	☐
Guam's forests kept the same types of birds after the snakes arrived.	☐	☑

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS2 › LS2-6 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students sort living and nonliving factors and decide which observation supports a claim about a physical cause.

Eelgrass beds in an estuary in Oregon shrank over one year. A biologist claims that a change in a physical, nonliving factor caused the loss. Which observation, if true, best supports her claim?

- ○ Sea otters ate more of the crabs that dig up eelgrass roots.
- ○ An invasive snail that grazes on eelgrass spread across the mudflats.
- ○ Mud from a flood clouded the water and cut the light reaching the eelgrass. ✓
- ○ A new kind of shorebird that eats eelgrass seeds began nesting nearby.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS2 › LS2-6 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students weigh several data columns to judge whether an ecosystem recovered after a large disturbance and reject conclusions the data do not support.

Part of a Kansas prairie was plowed and farmed for corn for 40 years, then abandoned. Thirty years later, a team compares the old field with nearby prairie that was never plowed. Select True or False for each statement.

Plants in an Abandoned Cornfield and Never-Plowed Prairie

Area	Native prairie plant species	Nonnative plant species	Soil organic matter
Never-plowed prairie	85	4	6%
Old field, 30 years after farming	30	22	3%

	True	False
Thirty years after farming ended, the old field has not returned to its original prairie community.	☑	☐
Plowing and farming for 40 years was a large disturbance to the prairie ecosystem.	☑	☐
The old field has more plant species in total than the never-plowed prairie.	☐	☑
Lower soil organic matter could help explain why prairie plants have been slow to return.	☑	☐
Because the old field now has 52 plant species, it is just as healthy as the never-plowed prairie.	☐	☑

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS2 › LS2-6 › DOK 3 › Generate

Test Bank question

HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students match each solution to the type of human impact it reduces, recalling the standard categories.

A state wildlife agency lists solutions it uses to protect biodiversity. Each solution targets one type of human impact. Choose the missing values from the drop-down menus.

Solution	Type of impact it reduces
Washing boats before they move to a new lake	Blank 1
Limits on how many rockfish anglers can keep	Blank 2
A filter on a factory drain pipe	Blank 3
A wildlife bridge that reconnects forest on both sides of a highway	Blank 4

Blank 1 (Row 1, Type of impact it reduces): Introduction of nonnative species ▾

Blank 2 (Row 2, Type of impact it reduces): Overexploitation ▾

Blank 3 (Row 3, Type of impact it reduces): Pollution ▾

Blank 4 (Row 4, Type of impact it reduces): Habitat destruction ▾

Drop-down 1 choices: Habitat destruction | **Introduction of nonnative species ✓** | Pollution | Overexploitation

Drop-down 2 choices: **Overexploitation ✓** | Pollution | Habitat destruction | Introduction of nonnative species

Drop-down 3 choices: Habitat destruction | **Pollution ✓** | Overexploitation | Introduction of nonnative species

Drop-down 4 choices: Overexploitation | Pollution | Introduction of nonnative species | **Habitat destruction ✓**

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS2 › LS2-7 › DOK 1 › Generate Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret test data, computing a percent change and comparing outcomes, to judge how well a solution worked.

Albatrosses and other seabirds dive for baited hooks on longline fishing boats and drown. A fishing fleet in Alaska tested streamer lines, colorful ropes that flap over the baited hooks to scare birds away. The team counted catches per 100,000 hooks. Select True or False for each statement.

Catch per 100,000 Hooks With and Without Streamer Lines

Setup	Seabirds caught	Target fish caught
No streamer lines	50	4,000
Streamer lines	10	4,000

	True	False
Streamer lines cut the number of seabirds caught by 80%.	☑	☐
Streamer lines did not lower the fleet's catch of target fish.	☑	☐
Accidentally catching seabirds is a human impact on biodiversity.	☑	☐
Streamer lines lowered the target fish catch by 80%.	☐	☑
Since some seabirds were still caught, the streamer lines failed.	☐	☑

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS2 › LS2-7 › DOK 2 › Generate Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate a solution with data and then propose a refinement, which requires reasoning and design thinking beyond reading the table.

California tiger salamanders cross a road near Stanford each winter to reach breeding ponds, and many are killed by cars. Biologists built two small tunnels under the road with low walls that guide salamanders to the tunnels. They counted salamanders at the road over two winters. Make a claim about whether the tunnels reduced the impact of the road on the salamanders. Support your claim with evidence from the data, and suggest one way to refine the design.

California Tiger Salamanders at the Road

Winter	Salamanders killed on the road	Salamanders that used the tunnels
Before tunnels	60	0
After tunnels	12	110

Model response: The tunnels reduced the road's impact on the salamanders. Road deaths fell from 60 to 12, an 80% drop, and 110 salamanders used the tunnels to cross safely. Because 12 were still killed, the design could be refined with longer guide walls or another tunnel where salamanders still reach the road.

Rubric: 2 points: The response includes all required elements: Claim that the tunnels reduced the road's impact; evidence from the data (road deaths fell from 60 to 12, about 80%, and 110 used the tunnels); a reasonable refinement (longer walls, more tunnels, fixing gaps, or monitoring).
1 point: The response includes one or two of the three required elements above, but not all three. Credit for "Suggests a refinement, such as longer walls, more tunnels, or checking tunnel use" requires "Claim: the tunnels reduced the road's impact".
0 points: None. No correct required element; the response is incorrect, too vague to earn credit, irrelevant, blank, or only copies the prompt without answering.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS2 › LS2-7 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · LIFE SCIENCE · LS2 ECOSYSTEMS: INTERACTIONS, ENERGY, AND DYNAMICS

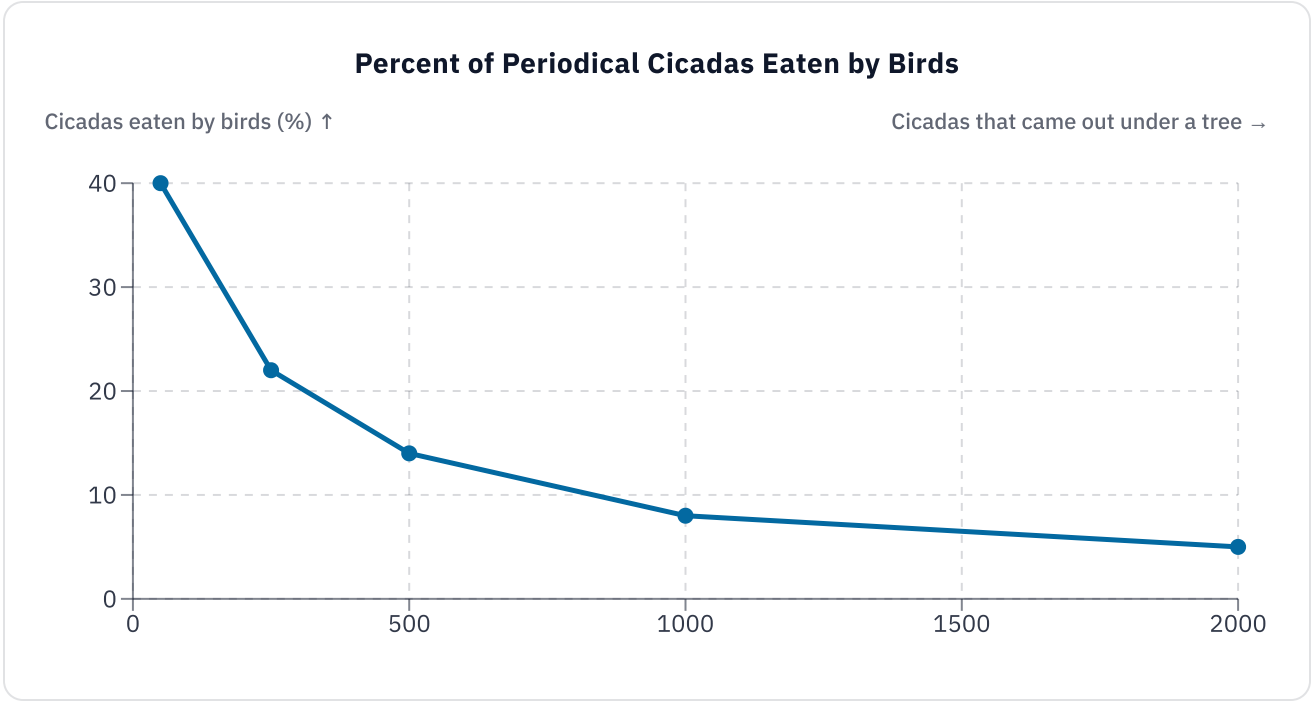
HS-LS2-8 Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students read the trend straight off the graph: as more cicadas emerge, a smaller percent are eaten.

Periodical cicadas come out of the ground in huge numbers every 17 years. In an Illinois forest, a team counted how many cicadas came out under each tree and what percent birds ate. Which statement does the graph support?



- ○ Where more cicadas came out, a larger percent of them were eaten.
- ○ Birds ate almost all of the cicadas under the busiest trees.
- ○ Birds ate the same percent of cicadas under every tree.
- ○ Where more cicadas came out, a smaller percent of them were eaten. ✓

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS2 › LS2-8 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students compare two survival rates to choose a claim about group living and match it with the supporting data.

A scientist studied meerkats in the Kalahari Desert for 5 years. Meerkats in groups of 15 to 30 survived about 76% of the time each year. The few meerkats living alone survived about 18% of the time. In groups, some meerkats act as lookouts and give an alarm call when they see a hawk or jackal, and the whole group runs to its burrows.

Part A: Which claim is best supported?

Choose one answer.

- ○ Each meerkat must choose group life or solo life forever.
- ○ Meerkats alone survive better because they do not share food.
- ○ Living in a group raises a meerkat's chance of surviving each year. ✓
- ○ Group living helps every kind of animal survive the same amount.

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ○ About 76% of group meerkats survived each year, and 18% of lone ones. ✓
- ○ Lookouts give an alarm call when they see a hawk or jackal.
- ○ Groups of meerkats in the study had between 15 and 30 members.
- ○ Some group members act as lookouts while other members dig.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS2 › LS2-8 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students judge the strength of each piece of evidence, spotting confounded and anecdotal data, which requires evaluating evidence rather than reading it.

A wildlife biologist claims that pronghorn fawns in larger herds are less likely to be killed by coyotes. She gathers information from several sources. Match each piece of information to the column for how well it supports her claim.

	Strong evidence	Weak evidence	Not relevant
Across 5 years, collared fawns in herds of 10 or more were killed by coyotes less often than collared fawns in herds of 2 or 3 on the same range.	☑	☐	☐
In a second study, fawns in large herds survived their first summer more often than fawns in small herds sharing the same range.	☑	☐	☐
Pronghorn can run faster than 80 kilometers per hour.	☐	☐	☑
In one survey, the larger herds were mostly on range where coyotes had been removed.	☐	☑	☐
A rancher once saw a coyote chase a fawn away from a herd.	☐	☑	☐
Pronghorn eat sagebrush in winter.	☐	☐	☑

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS2 › LS2-8 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · LIFE SCIENCE · LS3 HEREDITY: INHERITANCE AND VARIATION

HS-LS3-1 Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall the definitions of gene, protein, and trait and sort each item. Each sort is a single fact.

Keepers at a zoo in San Diego learn how a single DNA change makes some tigers white. Sort each item into the correct column.

	Gene	Protein	Trait
A different version of the pigment gene	☑	☐	☐
The DNA code of the pigment gene	☑	☐	☐
An orange coat with black stripes	☐	☐	☑
An enzyme that makes orange pigment	☐	☑	☐
A white coat on a white tiger	☐	☐	☑
A protein that moves pigment into hair	☐	☑	☐

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS3 › LS3-1 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students select a question that connects environment, genes, and trait, then choose a finding that would answer it.

Jada volunteers with a sea turtle program in Florida. Loggerhead sea turtles do not have sex chromosomes. Instead, the temperature of the sand while the eggs develop decides whether a hatchling becomes male or female. Warm nests produce mostly females, and cool nests produce mostly males.

Part A: Which question best clarifies how warm sand leads to female hatchlings?

Choose one answer.

- ◯ Does warmth turn on genes for building female body parts in the embryos? ✓
- ◯ Does the warm sand change the DNA letters in the embryos' genes?
- ◯ Do the embryos in warm nests get a different set of chromosomes?
- ◯ Are the eggs in the warm nests laid by older mother turtles?

Part B: Which finding would best support a yes answer to the question in Part A?

Choose one answer.

- ◯ Embryos in warm sand make much more of an enzyme needed for ovaries to form. ✓
- ◯ Male and female hatchlings have the same number of chromosomes.
- ◯ Nests on dark sand are often warmer than nests on pale sand.
- ◯ Eggs in warm nests hatch a few days sooner than eggs in cool nests.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS3 › LS3-1 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students compare three questions, choose the best one, and explain why the others are weaker, using evidence about shared DNA.

Students studying why human liver cells and skin cells differ write three questions. Question 1: "Do liver cells have different genes than skin cells?" Question 2: "Which genes are turned on in liver cells but off in skin cells, and what turns them on?" Question 3: "Are liver cells more important than skin cells?" Liver cells and skin cells in one person have the same DNA. Choose the question that best clarifies why the cells differ. Explain why it is best and why the other two are weaker.

Model response: Question 2 is best. The cells have the same DNA, so Question 1 is weaker because we already know they have the same genes. The difference must come from gene expression, and Question 2 asks which genes are turned on and what signal turns them on. Question 3 is weaker because it is an opinion and cannot be measured, so it is not a science question.

Rubric: 2 points: The response includes all required elements: Chooses the question about which genes are turned on, uses the shared DNA to show why the gene-difference question is weaker, and explains that gene expression causes the difference or that the importance question is not scientific.
1 point: The response includes one or two of the three required elements above, but not all three. Credit for "Explains that gene expression causes the difference or that the third question is not scientific" requires "Chooses the question about which genes are turned on".
0 points: None. No correct required element; the response is incorrect, too vague to earn credit, irrelevant, blank, or only copies the prompt without answering.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS3 › LS3-1 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · LIFE SCIENCE · LS3 HEREDITY: INHERITANCE AND VARIATION

HS-LS3-2 Make and defend a claim based on evidence that inheritable genetic variations may result from new genetic combinations through meiosis

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall how meiosis creates variation: random assortment and crossing over. No data analysis is needed.

A plant breeder is developing new varieties of wheat by crossing two parent plants with different traits. During sexual reproduction, meiosis occurs in the parent plants, producing gametes. The breeder observes that offspring plants show new combinations of traits not seen in either parent plant. Which statements correctly explain how genetic variation in the offspring can result from meiosis? Select all that apply.

- [ ] The variation observed in offspring must have resulted from exposure of the parent plants to radiation, which is the only environmental factor that causes mutations.
- [ ] The new trait combinations in offspring prove that mutations occurred in the parent plants' body cells during their lifetime and were inherited by the offspring.
- [x] Meiosis causes genetic variation in offspring because it produces gametes with different combinations of alleles from the parents.
- [x] During meiosis, new genetic combinations are produced because homologous chromosomes separate, and alleles are distributed randomly into different gametes.
- [x] Crossing over during meiosis exchanges segments of DNA between homologous chromosomes, creating new genetic combinations that are passed to offspring.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS3 › LS3-2 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret cross results to name independent assortment as the cause and pick the new trait combinations as evidence.

A plant breeder crossed a true-breeding summer squash with yellow, long fruit and one with white, round fruit. In her squash variety, yellow is dominant to white and round is dominant to long, and the two genes are on different chromosomes. The offspring plants were crossed with each other, and the breeder counted the next generation.

Squash Fruit Types in the Second Generation

Fruit type	Number of plants
Yellow, round	180
Yellow, long	62
White, round	58
White, long	20

Part A: Which process best explains the new fruit types?

Choose one answer.

- ◯ Independent assortment of the color and shape alleles during meiosis ✓
- ◯ Differences in sunlight on different plants
- ◯ New mutations caused by the garden soil
- ◯ Crossing over that joined color and shape into one gene

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ◯ The first original parent had yellow, long fruit.
- ◯ The breeder counted 320 plants in the second generation.
- ◯ Yellow, round plants were the most common type of plant.
- ◯ Yellow, round and white, long plants appeared, unlike both parents. ✓

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS3 › LS3-2 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate several pieces of information as strong, weak, or irrelevant support for a mutation claim, including spotting confounding factors.

A student claims that a pesticide in a pond caused heritable mutations in leopard frogs. She gathers several pieces of information. Match each piece of information to the column that shows how well it supports her claim.

	Strong evidence	Weak evidence	Not relevant
In a lab, frogs exposed to the pesticide produced offspring with more DNA changes than unexposed frogs	☑	☐	☐
One frog from the pesticide pond had an extra leg	☐	☑	☐
Tadpoles of frogs from the pesticide pond had new traits far more often than tadpoles of frogs from a clean pond, in 3 years of sampling	☑	☐	☐
The pesticide pond is also warmer and has more parasites than the clean pond	☐	☑	☐
Leopard frogs eat insects	☐	☐	☑

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS3 › LS3-2 › DOK 3 › Generate

Test Bank question

HS-LS3-3 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students carry out a routine probability calculation for a one-gene cross (1/2 x 1/2 = 1/4).

At a school garden in Albuquerque, Kamal crosses two pea plants with purple flowers. Both plants are Pp. Purple (P) is dominant over white (p).

Part A: What is the probability that one offspring plant will have white flowers?

Choose one answer.

- ○ 50%
- ○ 25% ✓
- ○ 0%
- ○ 75%

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ○ Each parent passes on p half the time, and 1/2 × 1/2 = 1/4. ✓
- ○ Half of the alleles in the parents are p, so half the plants are white.
- ○ Purple is dominant, so three of every four plants must be purple.
- ○ White is recessive, so white plants cannot come from purple parents.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS3 › LS3-3 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students compare cross data with a 1:2:1 prediction and decide which probability statements are supported, using several ideas together.

A biologist crosses many pairs of pink snapdragons. Flower color shows incomplete dominance: RR plants are red, RW plants are pink, and WW plants are white. Of 900 offspring, 225 are red, 450 are pink, and 225 are white. Which statements are supported by the data and the principles of probability? Select all that apply.

- [ ] Pink is the most common color, so the allele for pink must be dominant in snapdragons.
- [x] The 1:2:1 prediction describes expected proportions but cannot say what color any one seedling will be.
- [ ] Because the pink plants are an in-between color, the trait must involve a third, pink allele.
- [ ] A gardener who grows only 8 seeds from this cross should get exactly 2 red, 4 pink, and 2 white plants.
- [x] If two pink plants are crossed, about 25% red, 50% pink, and 25% white offspring are expected.
- [x] The phenotype ratio matches the genotype ratio because neither allele masks the other.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS3 › LS3-3 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate a claim by comparing observed and expected counts and reasoning that chance causes variation in samples, not just computing a ratio.

Diego crosses two pea plants that are both Pp for flower color. Purple (P) is dominant over white (p). Using probability, he expects 3/4 of the offspring to be purple and 1/4 to be white, so for 120 offspring he expects 90 purple and 30 white. He grows 120 offspring and counts 84 purple and 36 white. Diego claims: "My results do not match 90 and 30, so flower color in these plants does not follow the rules of inheritance."

Part A: Which statement best evaluates Diego's claim?

Choose one answer.

- ✓ The claim is not supported, because 84 to 36 is close to the expected 90 to 30, and chance makes small differences likely.
- The claim is supported, because any result other than exactly 90 to 30 means the parents could not both be Pp.
- The claim is supported, because getting 36 white plants shows that white must be the dominant color.
- The claim is not supported, because every cross of two Pp plants always gives exactly 3 purple for every 1 white.

Part B: Which evidence or reasoning best supports your answer to Part A?

Choose one answer.

- ✓ Each offspring has a 1/4 chance of being white, so the white count varies around 30; 36 out of 120 is 30%, near the expected 25%.
- There were more purple plants (84) than white plants (36) in the garden.
- Purple (P) is dominant over white (p) in pea plants.
- Both parent plants in the cross had purple flowers.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS3 › LS3-3 › DOK 3 › Generate Written for this guide

HIGH SCHOOL SCIENCE · LIFE SCIENCE · LS4 BIOLOGICAL EVOLUTION: UNITY AND DIVERSITY

HS-LS4-1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students read and compare two percentages from the table to find the pair with more matching DNA.

A scientist compared the same stretch of DNA in four kinds of songbirds. The American robin and the European blackbird belong to the same genus of thrushes. The house sparrow and the northern cardinal belong to other songbird families. Which fact from the table best shows that the American robin and the European blackbird share a more recent common ancestor than the robin and the house sparrow?

DNA Match Between Pairs of Songbirds

Pair of birds	Matching DNA (%)
American robin and European blackbird	96
American robin and house sparrow	86
American robin and northern cardinal	86
House sparrow and northern cardinal	90

- ◯ The robin and blackbird match 96 percent, more than the robin and sparrow's 86. ✓
- ◯ The robin matches the sparrow and the cardinal equally, at 86 percent each.
- ◯ The sparrow and cardinal match 90 percent, so one must be the other's ancestor.
- ◯ The robin and blackbird live on different continents, so they cannot be related.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS4 › LS4-1 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students classify an example as convergent evolution and interpret anatomy evidence to decide relationships, connecting several ideas.

Use the drop-down menus to complete the statement.

Dolphins and tuna both have streamlined bodies, fins, and tails for fast swimming. Dolphins breathe air with lungs, feed their young milk, and have finger bones inside their flippers. Tuna breathe with gills and have no finger bones. The similar body shapes of dolphins and tuna are an example of [convergent ▾] evolution. The lungs, milk, and finger bones show that dolphins are more closely related to [land mammals than to tuna ▾]. This case shows that [outward body shape ▾] can mislead scientists about relationships.

Drop-down 1 choices: divergent | **convergent ✓** | reverse

Drop-down 2 choices: sharks than to land mammals | **land mammals than to tuna ✓** | tuna than to land mammals

Drop-down 3 choices: bone patterns | DNA sequences | **outward body shape ✓**

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS4 › LS4-1 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate a claim using several lines of evidence and explain why one difference does not disprove it, writing a reasoned argument.

Scientists claim that birds evolved from small meat-eating dinosaurs. The table lists some evidence. Evaluate the claim that birds evolved from small meat-eating dinosaurs. Support your evaluation with evidence from the table, and explain why a difference such as teeth does not disprove the claim.

Evidence Comparing Birds and Small Meat-Eating Dinosaurs

Evidence	Small meat-eating dinosaurs	Modern birds
Hollow bones	Yes	Yes
Wishbone (fused collarbones)	Yes	Yes
Feathers	Found on fossils from China over 120 million years old	Yes
Teeth	Yes	No

Model response: The claim is supported. Birds and small meat-eating dinosaurs both have hollow bones and a wishbone, and fossils from China over 120 million years old show dinosaurs with feathers. Birds lack teeth, but that does not disprove the claim, because traits can be lost over time as a lineage changes, and early birds like Archaeopteryx still had teeth.

Rubric: 2 points: The response includes all required elements: Evaluates the claim as supported; evidence from the table (hollow bones, wishbone, feathered dinosaur fossils); reasoning that traits such as teeth can be lost over time as a lineage changes.
1 point: The response includes one or two of the three required elements above, but not all three. Credit for "Reasoning: traits can be lost over time as a lineage changes, so missing teeth fits evolution" requires "Evaluates the claim as supported".
0 points: None, or rejects the claim only because birds lack teeth. No correct required element; the response is incorrect, too vague to earn credit, irrelevant, blank, or only copies the prompt without answering.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS4 › LS4-1 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · LIFE SCIENCE · LS4 BIOLOGICAL EVOLUTION: UNITY AND DIVERSITY

HS-LS4-2 Construct an explanation based on evidence that the process of evolution primarily results from four factors

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall basic natural selection facts, such as inherited variation and that individuals do not change on purpose.

In some streams on the island of Trinidad, a fish called the pike cichlid eats guppies. Brightly colored male guppies are easier for it to see. In streams with these predators, biologists find that most male guppies are dull. In streams without them, many males are bright. Select True or False for each statement.

	True	False
Male guppies vary in color because of inherited genes.	☑	☐
Dull males in predator streams are more likely to live long enough to mate.	☑	☐
Guppies in predator streams became dull because each male faded his colors on purpose.	☐	☑
Bright color can never help a male guppy leave offspring.	☐	☑

FIND MORE LIKE THIS

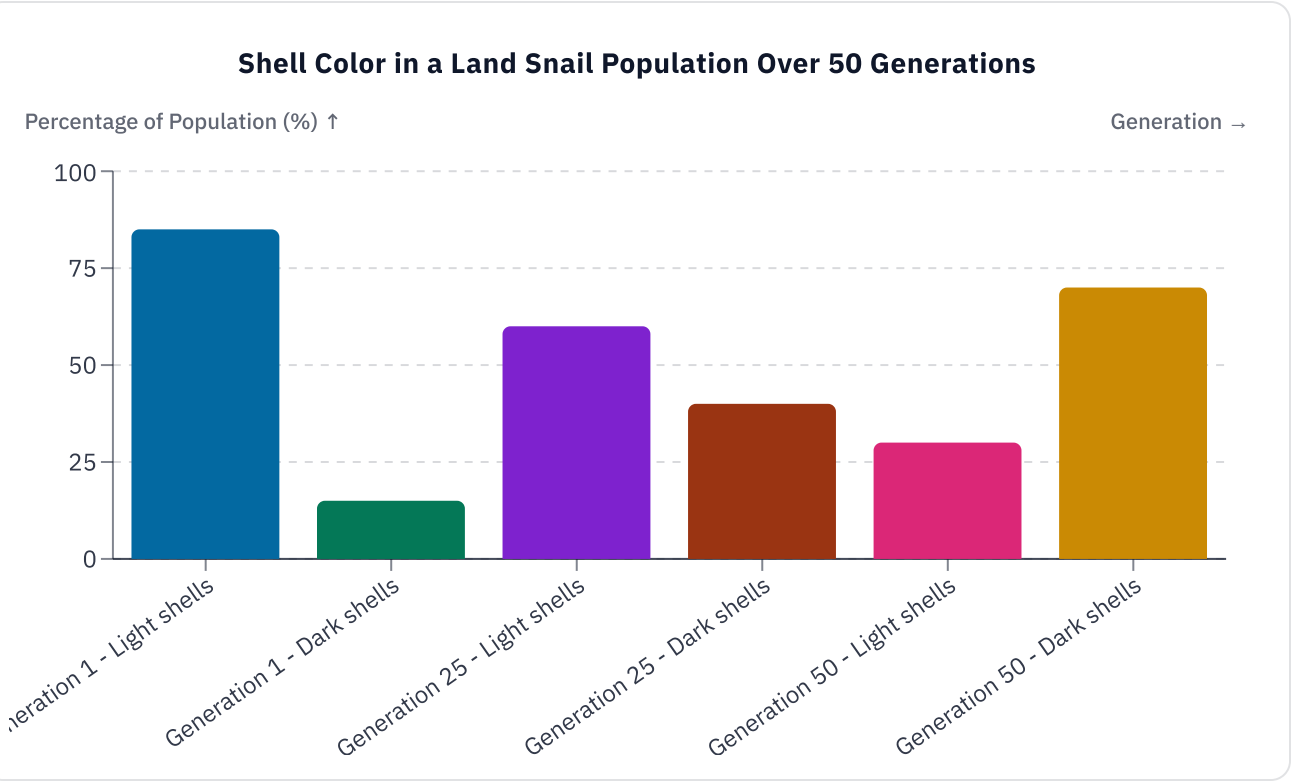
Create questions › Biology › HS Life Science › LS4 › LS4-2 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret a graph of changing shell color and connect it to predation and inheritance to explain the change.

A population of land snails varies in shell color, and shell color is inherited. The snails live in a forest where the soil became darker because of industrial pollution. Birds hunt the snails by sight. The graph shows the percent of light and dark snails at three generations. Which statement best explains why dark shells became more common?



- ✓ Dark shells were harder for birds to see on dark soil, so dark snails survived and bred more.
- The darkening soil caused mutations that turned the shells of many adult snails dark.
- Snails darkened their shells during their lives to match the soil and passed this on.
- Dark-shelled snails were stronger, so they won more fights for food than light snails.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS4 › LS4-2 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students critique a student model, deciding which parts are correct and which contain misconceptions, which requires evaluating reasoning.

Dandelions in a city park in Toronto are mowed every week, while dandelions in a nearby unmowed field are not. A student named Noah wrote a model to explain why park dandelions now flower on much shorter stems. His teacher asks the class to find the parts of his model that should be revised. Which parts of Noah's model are incorrect and should be revised? Select all that apply.

- [ ] Short dandelions in the park made more seeds than tall ones.
- [ ] Mowers cut off tall flower heads before they could make seeds.
- [x] Each park dandelion learned to grow short stems to avoid the mower. ✓
- [ ] Dandelions in the park varied in stem height, and height is inherited.
- [x] Park dandelions became shorter so that the species would not die out. ✓
- [x] Mowing caused mutations that made every park dandelion short. ✓

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS4 › LS4-2 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · LIFE SCIENCE · LS4 BIOLOGICAL EVOLUTION: UNITY AND DIVERSITY

HS-LS4-3 Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students subtract two percentages and recall that heritable resistance spreads when resistant individuals survive. Each blank is one step.

Use the drop-down menus to complete the statement.

Oysters in a bay on the East Coast were struck by a deadly oyster disease. Some oysters carry heritable resistance. Researchers found that resistant oysters rose from 10% to 50% of the population over 15 years. The share of resistant oysters rose by [40 ▾] percentage points. This happened because resistance is [heritable ▾] and resistant oysters [survived to spawn more often ▾].

Drop-down 1 choices: 5 | **40 ✓** | 50

Drop-down 2 choices: caused by the disease | **heritable ✓** | learned

Drop-down 3 choices: grew shells over the disease | chose cleaner water | **survived to spawn more often ✓**

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS4 › LS4-3 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret a change in trait frequency and judge which statements the pattern supports, including spotting overclaims.

A population of leaf beetles was studied over 40 years in a forest where a fungal disease turned tree bark from light gray to dark gray. Researchers recorded the percentage of beetles with dark-colored wings versus light-colored wings each decade. Data showed dark-winged beetles increased from 12% to 78% of the population, while light-winged beetles decreased from 88% to 22% over the same period. Camouflage studies confirmed dark-winged beetles were caught by birds far less often on dark bark. Decide whether each statement about this pattern is True or False.

	True	False
The increase in dark-winged beetles over time is a statistical pattern that supports the explanation that dark coloration improved survival on dark bark.	☑	☐
Because the percentage of dark-winged beetles rose while bark darkened, this pattern by itself proves darker bark directly caused the wing color change, with no other explanation possible.	☐	☑
Individual beetles changed their own wing color during their lifetimes to better match the darker bark.	☐	☑
The wing-color variation existed in the population before the bark darkened, due to mutation and normal genetic variation among individuals.	☑	☐
Because dark-winged beetles survived bird predation more often, they were more likely to reproduce and pass the trait to offspring, increasing its proportion in the population.	☑	☐

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS4 › LS4-3 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students build a claim from an experiment and reason that repeating the result in two separate pools rules out chance.

Guppies in Trinidad live in streams. Downstream pools have pike cichlids, which eat guppies, and upstream pools have few predators. Males with more colored spots attract more mates but are easier for predators to see. Spot number is inherited. Researchers moved guppies from a predator pool into two separate upstream pools with few predators. After 15 generations, males in both new pools averaged 13 spots, compared with 9 before. Males in the original pool still averaged 9.

Part A: Which claim is best supported by the results?

Choose one answer.

- ◯ With few predators, males with more spots left more young, so spot number rose. ✓
- ◯ Spot number rose by chance, since moving fish often causes random changes.
- ◯ Predators in the original pool caused the spots of those males to fade.
- ◯ Males grew more spots during their lives once they were safe from predators.

Part B: Which evidence best argues against the idea that the change happened by chance?

Choose one answer.

- ◯ The researchers counted the spots after 15 generations had passed.
- ◯ Males with more spots are easier for predators to see and catch.
- ◯ The same increase happened in both of the separate upstream pools. ✓
- ◯ The guppies were moved from a pool that has pike cichlids in it.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS4 › LS4-3 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · LIFE SCIENCE · LS4 BIOLOGICAL EVOLUTION: UNITY AND DIVERSITY

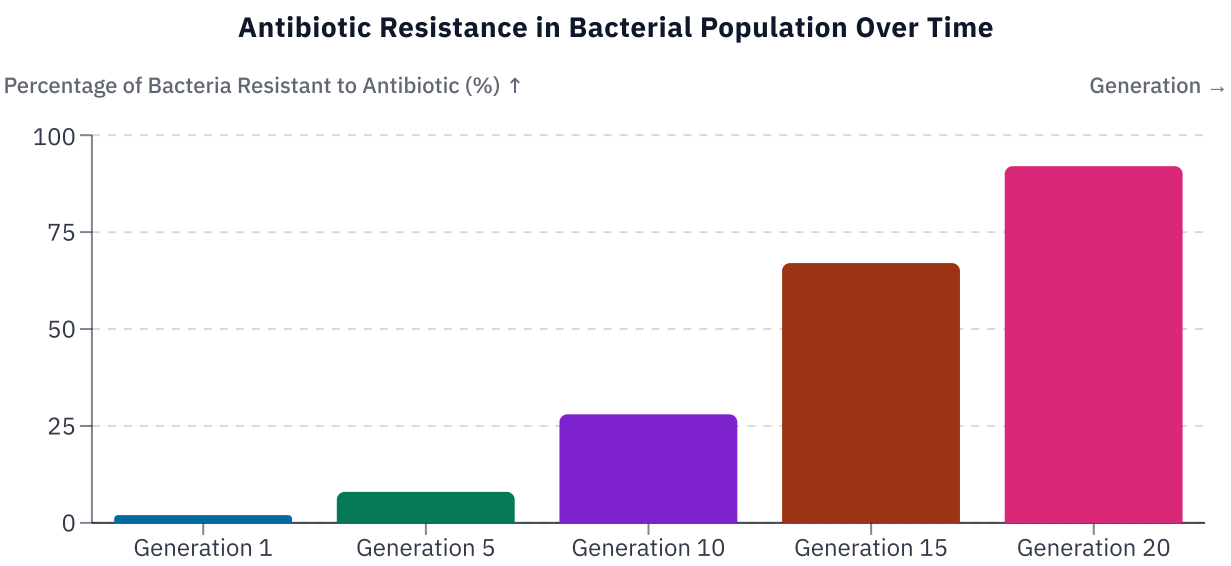
HS-LS4-4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recognize the standard explanation of natural selection for antibiotic resistance; it checks recall of the mechanism.

A hospital tracks a bacterial population exposed to the same antibiotic over 20 generations. The graph shows the percentage of bacteria with resistance genes increases a lot over time. Which statement best explains why this happens?



- ○ The antibiotic stays the same strength the whole time, so every bacterium becomes resistant at the same steady pace.
- ○ Bacteria that survive the antibiotic gain resistance during their own lifetime and then pass that new trait to their offspring.
- ○ The antibiotic slowly gets stronger each generation, which forces every bacterium's genes to change so it can survive.
- ○ Bacteria with resistance genes survive and reproduce when exposed to the antibiotic, so the resistance gene becomes more common in the population. ✓

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS4 › LS4-4 › DOK 1 › Generate Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students explain what a common-garden result shows and connect a trait to survival in a new habitat, a two-part explanation.

Puerto Rican crested anoles from cities have longer limbs than those from forests, even when both are hatched in the same lab. Explain what the lab result shows, and explain how city surfaces could make long limbs more common.

Model response: Because lizards hatched in the same lab still differed, the difference is inherited. On smooth walls and wide surfaces, long-limbed lizards can run and grip better, so they escape predators and survive and reproduce more, making long limbs more common in cities.

Rubric: 2 points: explains that the lab result shows the limb difference is inherited, and that long limbs help lizards run or grip on smooth city surfaces so they survive and reproduce more. 1 point: gives only one of these ideas. 0 points: says limbs grew longer from climbing, or gives no reasoning.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS4 › LS4-4 › DOK 2 › Generate Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students reason through a food-web story to explain an adaptation and choose what new evidence would show the trait is inherited.

Kelp forests off Alaska were nearly wiped out when sea otters were hunted almost to extinction, because sea urchins, which eat kelp, were no longer eaten by otters. Where otters later returned, urchins became scarce and kelp grew back. Researchers found that kelp growing where urchins had been common for decades made more of a bitter chemical in its tissue than kelp in areas where urchins had always been rare.

Part A: A researcher claims the difference is an adaptation. Which statement describes how natural selection would produce it?

Choose one answer.

- ○ Kelp made more chemical because it was grazed during its own life.
- ○ Urchin grazing favored kelp that made more of the bitter chemical. ✓
- ○ Otters made the kelp bitter by eating the urchins near it.
- ○ The bitter chemical has no effect on which kelp survives.

Part B: Which additional evidence would best support the claim that the difference is inherited?

Choose one answer.

- ○ Urchins eat much more kelp when otters are not around to eat them.
- ○ Kelp from both areas grown in one tank still differed in the chemical. ✓
- ○ Sea otters float on their backs to crack open the urchins they catch.
- ○ Kelp forests give shelter to many kinds of young fish in summer.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS4 › LS4-4 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · LIFE SCIENCE · LS4 BIOLOGICAL EVOLUTION: UNITY AND DIVERSITY

HS-LS4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in the emergence of new species

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall that human changes to the environment can cause population decline and extinction. Each blank is a direct fact.

Use the drop-down menus to complete the statement.

Passenger pigeons once flew in flocks of millions across eastern North America. In the 1800s, people hunted them heavily and cut down the forests where they nested. The last passenger pigeon died in 1914. Hunting and forest loss [harmed ▾] the pigeons. Their numbers [fell ▾]. This shows that [human changes to the environment ▾] can lead to extinction.

Drop-down 1 choices: helped | did not affect | **harmed ✓**

Drop-down 2 choices: stayed steady | **fell ✓** | rose

Drop-down 3 choices: competition with other bird species | **human changes to the environment ✓** | slow natural climate cycles

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS4 › LS4-5 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students apply what they know about salt tolerance to predict how a sudden environmental change shifts which species are common.

Many small lagoons on the California coast are cut off from the ocean by a sandbar for part of the year, so their water is fairly fresh. At one lagoon, a large storm broke through the sandbar, and ocean water flowed in, making the lagoon much saltier. A student group had netted fish there before the storm. Which result would they most likely find when they net fish after the storm?

- ○ All fish became less common, since storms always harm living things.
- ✓ ○ Ocean fish became more common, while freshwater fish became less common.
- ○ All fish became more common, since the storm brought in fresh water.
- ○ Freshwater fish became more common, while ocean fish became less common.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS4 › LS4-5 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate an argument line by line and find the flawed reasoning about whether a population of two females can recover.

Only two northern white rhinos are alive today, and both are female. Kofi wrote an argument about whether they can avoid extinction. Select the line of his argument that makes a reasoning mistake.

- ○ Poaching for horns cut northern white rhinos from thousands of animals to just a few.
- ○ The last male died in 2018, leaving only two females, a mother and her daughter.
- ✓ ○ Since two females are still alive, the population can recover naturally if they are well protected.
- ○ Scientists are trying to use stored eggs and cells to create new rhino embryos.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS4 › LS4-5 › DOK 3 › Generate

Test Bank question

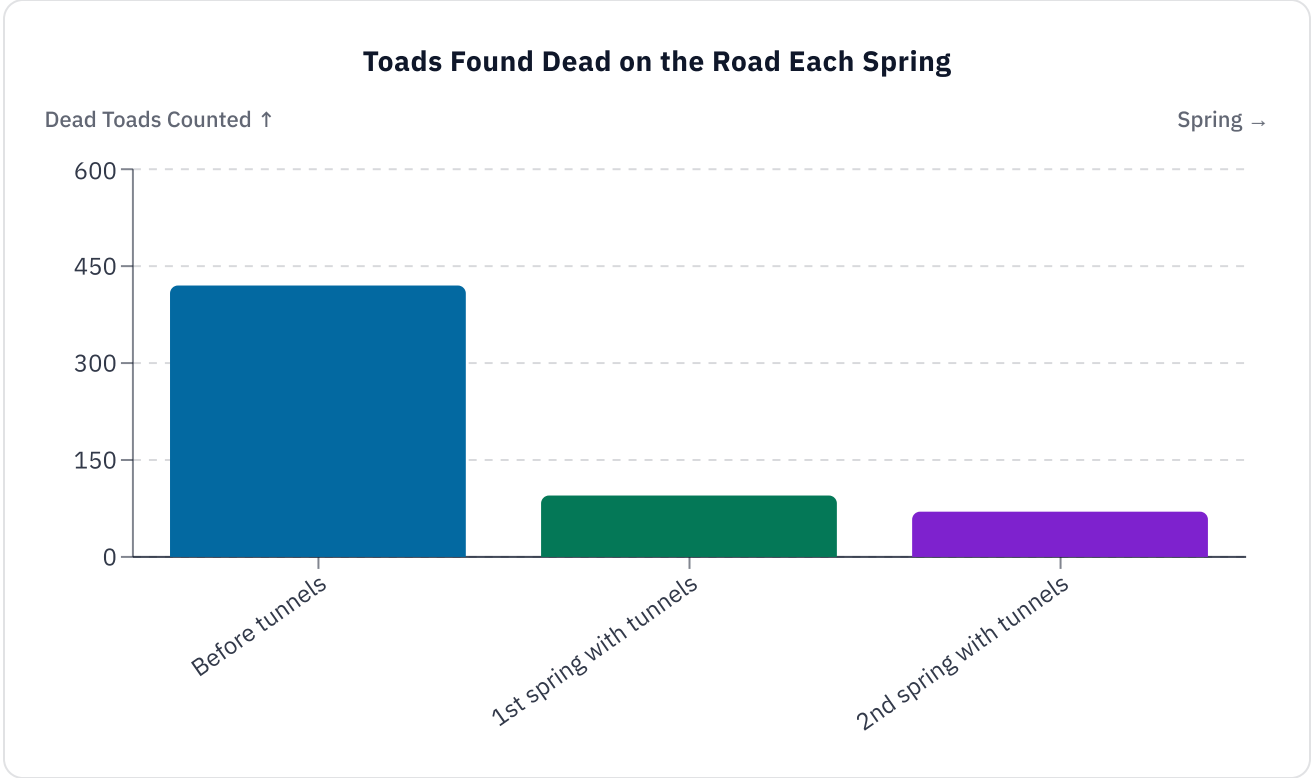
HS-LS4-6 Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students read the bar heights directly to see that road deaths fell after the tunnels were built.

Every spring, toads cross a busy road to reach the pond where they breed, and many are hit by cars. A town built tunnels under the road with low walls that guide the toads into them. Volunteers counted the toads found dead on the road each spring. Which statement is best supported by the graph?



- ○ The tunnels stopped every toad from being killed on the road.
- ○ About the same number of toads were killed before and after.
- ○ Far fewer toads were killed on the road after the tunnels were built. ✓
- ○ More toads were killed on the road after the tunnels were built.

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS4 › LS4-6 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret simulation results comparing two rules and decide what the model does and does not show.

A fishery simulated two rules for a fish stock. Rule A limits the total catch each year. Rule B protects young fish by requiring larger net holes. After 20 simulated years, the average stock was 40 percent higher under Rule B than under Rule A. Select True or False for each statement.

	True	False
Both rules are human actions meant to reduce a harmful human impact.	☑	☐
Protecting young fish lets more fish reach breeding age.	☑	☐
The result shows Rule B will produce exactly 40 percent more fish in the real ocean.	☐	☑
Scientists might test a plan that combines both rules.	☑	☐
Overfishing does not affect fish populations.	☐	☑

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS4 › LS4-6 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students critique revisions to a simulation and judge which change would make it a poor test of the solution, which requires reasoning about model design.

Red-cockaded woodpeckers nest only in cavities they dig in old, living pines, and logging removed many of those trees. A team revised its simulation of the birds and wrote these notes. Select the revision that would make the simulation a poor test of the solution.

- ○ Version 1 of our model tracked woodpecker family groups in a pine forest.
- ○ We learned that the birds nest only in cavities in old, living pines.
- ○ In Version 2, we added artificial nest cavities placed in pines as a variable we can change.
- ○ We also set Version 2 so woodpecker numbers can never go down, to keep the results clear. ✓

FIND MORE LIKE THIS

Create questions › Biology › HS Life Science › LS4 › LS4-6 › DOK 3 › Generate

Test Bank question

NGSS DOMAIN

Physical Science

24 performance expectations, grouped by disciplinary core idea. In the Test Bank, choose the Chemistry or Physics course, then HS Physical Science.

Create questions › Chemistry or Physics › HS Physical Science › Core idea (DCI) › PE › Options: DOK › Generate

HIGH SCHOOL SCIENCE · PHYSICAL SCIENCE · PS1 MATTER AND ITS INTERACTIONS

HS-PS1-1 Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students read the last number in each electron arrangement straight from the table to find valence electrons, a single recall-and-read step.

A chemistry teacher labels six element samples and models their neutral atoms. The table lists electron populations from the innermost to outermost occupied level. Match each element to the column showing the number of electrons in its outermost level.

Element	Electrons in occupied levels, inner to outer
Cl	2, 8, 7
Ca	2, 8, 8, 2
F	2, 7
S	2, 8, 6
Mg	2, 8, 2
O	2, 6

	2 valence electrons	6 valence electrons	7 valence electrons
Chlorine (Cl)	☐	☐	☑
Calcium (Ca)	☑	☐	☐
Fluorine (F)	☐	☐	☑
Sulfur (S)	☐	☑	☐
Magnesium (Mg)	☑	☐	☐
Oxygen (O)	☐	☑	☐

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS1 › PS1-1 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must locate each pair on the periodic table, decide whether a group or period trend applies, and then compare, which takes several reasoning steps.

A periodic-table model places Li, Na, K, and Cs in Group 1 in Periods 2, 3, 4, and 6, respectively. Mg and Cl are in Period 3 in Groups 2 and 17. F and Ne are in Period 2 in Groups 17 and 18. The first ionization energy is the energy needed to remove one outer electron. Use the model to predict which comparisons are correct. Select all that apply.

- [ ] Magnesium has a higher first ionization energy than chlorine.
- [x] Neon has a higher first ionization energy than fluorine. ✓
- [x] Lithium has a higher first ionization energy than sodium. ✓
- [ ] Potassium has a higher first ionization energy than sodium.
- [x] Chlorine has a higher first ionization energy than sodium. ✓
- [ ] Cesium has a higher first ionization energy than lithium.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS1 › PS1-1 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must critique a plausible claim and build an evidence-based argument linking energy levels, distance, and shielding to reactivity.

A student claims: "Fluorine and iodine both have 7 valence electrons, so they should react with sodium at the same rate." Evaluate the student's claim. Use the structure of fluorine and iodine atoms to support your evaluation.

Model response: The claim is incorrect. Fluorine and iodine both have seven valence electrons, but fluorine is much smaller because it has fewer energy levels, so its outer level is closer to the nucleus. An extra electron added to fluorine feels a stronger pull, while iodine's outer level is far away and shielded by many inner electrons. So fluorine reacts with sodium much faster than iodine.

Rubric: 2 points: The response includes all required elements: states the claim is incorrect because fluorine reacts faster; uses atomic structure as evidence (fluorine is smaller, with fewer energy levels, outer level closer to the nucleus); explains that an added electron is attracted more strongly by fluorine (iodine's is farther and shielded).
1 point: The response includes one or two of the three required elements above, but not all three. Credit for "Reasoning: an added electron is attracted more strongly by fluorine (iodine's is shielded)" requires "States that the claim is incorrect (fluorine reacts faster)".
0 points: none. No correct required element; the response is incorrect, too vague to earn credit, irrelevant, blank, or only copies the prompt without answering.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS1 › PS1-1 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · PHYSICAL SCIENCE · PS1 MATTER AND ITS INTERACTIONS

HS-PS1-2 Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall that a Group 1 metal gives its one valence electron to a Group 17 nonmetal, a direct recall of a basic pattern.

Potassium metal reacts with liquid bromine to form potassium bromide. Potassium is in Group 1 and bromine is in Group 17. Which statement best describes what happens to electrons in this reaction?

- ◯ Each potassium atom gives one electron to a bromine atom. ✓
- ◯ Each potassium atom gives seven electrons to a bromine atom.
- ◯ Each bromine atom gives one electron to a potassium atom.
- ◯ Potassium and bromine atoms share a pair of electrons equally.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS1 › PS1-2 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must judge each explanation by applying valence counts and charge balance to Mg3N2, classifying statements rather than recalling one fact.

Magnesium metal burns in nitrogen gas to form solid magnesium nitride, Mg3N2, according to the pattern: 3 Mg + N2 -> Mg3N2. Match each statement to the correct column based on whether it correctly uses valence electron patterns and periodic trends to explain this reaction.

	Correctly explains the formation of magnesium nitride	Does not correctly explain the reaction
Since magnesium and nitrogen are both nonmetals, they share electrons equally to form a covalent bond in Mg3N2.	☐	☑
Nitrogen has 5 valence electrons and gains 3 electrons to complete an octet, forming a N3- ion.	☑	☐
A ratio of 3 Mg2+ ions to 2 N3- ions is needed because the total positive charge (3 x 2+) must equal the total negative charge (2 x 3-).	☑	☐
Magnesium has 2 valence electrons and loses both to form a stable Mg2+ ion with a full outer shell.	☑	☐
All elements, including hydrogen and helium, gain or lose electrons until they have exactly 8 valence electrons.	☐	☑

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS1 › PS1-2 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students combine two clues, a formula and a reactivity ranking, to identify an unknown and justify it with electron-transfer reasoning.

An unknown Group 2 metal reacts with cold water faster than magnesium but more slowly than strontium, and forms XCl_2. Explain why calcium is the most likely element using group position and electron transfer.

Model response: The formula XCl_2 shows a 2+ metal ion and two valence electrons, placing X in Group 2. The reaction pattern increases down that group. Calcium lies between magnesium and strontium; its outer electrons are farther out than magnesium's and are lost more easily. Calcium therefore fits both clues.

Rubric: 2 points: identifies Group 2 and calcium, connects XCl_2 to loss of two electrons, and uses calcium's position between Mg and Sr to explain relative reaction behavior. 1 point: gives the correct identification or a valid formula/group-position explanation, but does not connect both clues. 0 points: gives no correct relevant information.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS1 › PS1-2 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · PHYSICAL SCIENCE · PS1 MATTER AND ITS INTERACTIONS

HS-PS1-3 Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall that melting point is the bulk property that reflects the strength of attractions between particles.

A student wants to compare how strongly ions attract each other in table salt (NaCl), magnesium oxide (MgO), and calcium chloride ($CaCl_2$). Which measurement would give the best evidence about the strength of the electrical forces between the ions?

- ✓ The melting point of each sample, because stronger forces need more heat
- The mass of each sample, because heavier samples have stronger forces
- The color of each sample, because color shows how strong bonds are
- The volume of each sample, because weaker forces make a sample bigger

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS1 › PS1-3 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must predict an outcome and explain the relationship between melting point and particle attractions, connecting a bulk measurement to particle-level forces.

A student wants to compare how strongly particles attract each other in table salt (NaCl), which is made of positive and negative ions, and in candle wax, which is made of nonpolar molecules. She plans to heat each substance at the same rate and measure its melting point. Predict which substance will have the higher melting point, and explain how its melting point shows the strength of the attractions between its particles.

Model response: Table salt will have the higher melting point. Melting takes energy to overcome the electrical attractions that hold particles in place in a solid. The positive and negative ions in salt attract each other strongly, so much more energy, and a higher temperature, is needed to melt it than to melt wax, whose nonpolar molecules attract each other weakly. A higher melting point means stronger attractions between particles.

Rubric: 2 points: Predicts that table salt has the higher melting point AND explains that melting requires energy to overcome the attractions between particles, so a higher melting point shows stronger attractions.
1 point: Predicts table salt correctly but gives no reasoning or unclear reasoning about energy and attractions, OR gives the correct reasoning with a missing or incorrect prediction.
0 points: Incorrect prediction and no correct reasoning (for example, says melting is a chemical change), or the response is blank or off topic.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS1 › PS1-3 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate an investigation plan and its claim, deciding which controls, inferences, and cross-checks make the evidence trustworthy.

A student places equal drops of water, rubbing alcohol, and nail polish remover on a dish and times how long each takes to evaporate. She then claims that the evaporation times rank the attractions between particles. Select True or False for each statement.

	True	False
The drops should be the same size and at the same temperature.	☑	☐
The liquid that evaporates slowest likely has the strongest attractions.	☑	☐
Comparing her ranking with the boiling points of the liquids would help check the claim.	☑	☐
Placing one dish in sunlight and the others in shade would improve the test.	☐	☑

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS1 › PS1-3 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · PHYSICAL SCIENCE · PS1 MATTER AND ITS INTERACTIONS

HS-PS1-4 Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students apply the basic rule that a reaction that cools its surroundings absorbs more energy breaking bonds than it releases forming them.

Diego mixes baking soda with vinegar in a paper cup. The mixture fizzes, and the cup feels cooler in his hand. Which statement best explains why the mixture gets cooler, using bond breaking and bond forming?

- ◯ Breaking the reactant bonds absorbs more energy than forming the product bonds releases. ✓
- ◯ Forming the product bonds absorbs more energy than breaking the reactant bonds releases.
- ◯ Breaking the reactant bonds releases energy, and that energy escapes with the gas bubbles.
- ◯ Forming the product bonds releases more energy than breaking the reactant bonds absorbs.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS1 › PS1-4 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students subtract bond-energy totals to find the net change, then interpret where the energy goes and what stays conserved.

Ms. Reyes's class models a hydrogen fuel-cell car. The reaction is $2\ H_2 + O_2 \rightarrow 2\ H_2O$, and each water molecule has two O–H bonds. The table gives the class's totals from average bond energies. Choose the missing values from the drop-down menus.

Part of the model	Value
Energy absorbed breaking 2 mol of H–H bonds and 1 mol of O=O bonds (kJ)	1370
Energy released forming 4 mol of O–H bonds (kJ)	1852
Net energy change of the reacting system	Blank 1
Where the net energy goes	Blank 2
Total energy of the system plus its surroundings	Blank 3

Blank 1 (Row 3, Value): 482 kJ lost ▾

Blank 2 (Row 4, Value): out to the motor and surroundings ▾

Blank 3 (Row 5, Value): stays the same ▾

Drop-down 1 choices: 3222 kJ lost | 482 kJ gained | **482 kJ lost ✓**

Drop-down 2 choices: into the system from the car | nowhere, because it is destroyed | **out to the motor and surroundings ✓**

Drop-down 3 choices: increases by 482 kJ | **stays the same ✓** | decreases by 482 kJ

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS1 › PS1-4 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must evaluate several claims about a real device against both the bond model and conservation of energy, reasoning about each with numbers.

A delivery drone runs on a hydrogen fuel cell, $2H_2 + O_2 \rightarrow 2H_2O$, which releases 482 kJ per 2 mol of H_2. Students write claims about the drone's energy. Sort each claim by whether it is consistent with conservation of energy and the bond model.

	Consistent	Not consistent
The cell releases 482 kJ; the motor does 290 kJ of work and 192 kJ becomes heat	☑	☐
The cell releases 482 kJ; the motor does 500 kJ of work	☐	☑
Doubling the hydrogen releases 964 kJ	☑	☐
The cell releases 482 kJ, and 100 kJ of it is destroyed by friction	☐	☑
The chemical energy drops 482 kJ while the surroundings gain 482 kJ	☑	☐
The cell's chemical energy rises as it powers the drone	☐	☑

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS1 › PS1-4 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · PHYSICAL SCIENCE · PS1 MATTER AND ITS INTERACTIONS

HS-PS1-5 Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall that fewer reactant particles per volume means fewer collisions, a direct application of the collision idea.

A student notices that the reaction between zinc and hydrochloric acid bubbles quickly at first, then more and more slowly, even though the temperature stays the same. Which statement best explains why the reaction slows down?

- ◯ As acid is used up, fewer acid particles remain in each milliliter, so collisions happen less often. ✓
- ◯ As the reaction goes on, the acid particles lose kinetic energy, so they hit the zinc more gently.
- ◯ As the reaction goes on, the activation energy rises, so fewer collisions can succeed.
- ◯ As bubbles form, the zinc gets colder, so its particles stop colliding with the acid.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS1 › PS1-5 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students calculate rates from table data and see the doubling pattern, moving between a data table and a rate relationship.

A student investigated how temperature affects the rate of a decomposition reaction. She measured the time it took for a fixed amount of hydrogen peroxide to completely decompose at different temperatures. The table shows her results. Choose the missing values from the drop-down menus.

Temperature (°C)	Volume of O_2 Gas Produced (mL)	Time for Complete Reaction (min)	Reaction Rate (mL/min)
15	80	16	Blank 1
25	80	8	Blank 2
35	80	4	Blank 3
45	80	2	Blank 4

Blank 1 (Row 1, Reaction Rate (mL/min)): 5.0 ▾

Blank 2 (Row 2, Reaction Rate (mL/min)): 10.0 ▾

Blank 3 (Row 3, Reaction Rate (mL/min)): 20.0 ▾

Blank 4 (Row 4, Reaction Rate (mL/min)): 40.0 ▾

Drop-down 1 choices: 0.2 | **5.0 ✓** | 10.0 | 16.0

Drop-down 2 choices: 0.1 | 8.0 | **10.0 ✓** | 16.7

Drop-down 3 choices: 0.05 | 4.0 | **20.0 ✓** | 28.3

Drop-down 4 choices: 0.025 | 2.0 | 20.0 | **40.0 ✓**

FIND MORE LIKE THIS

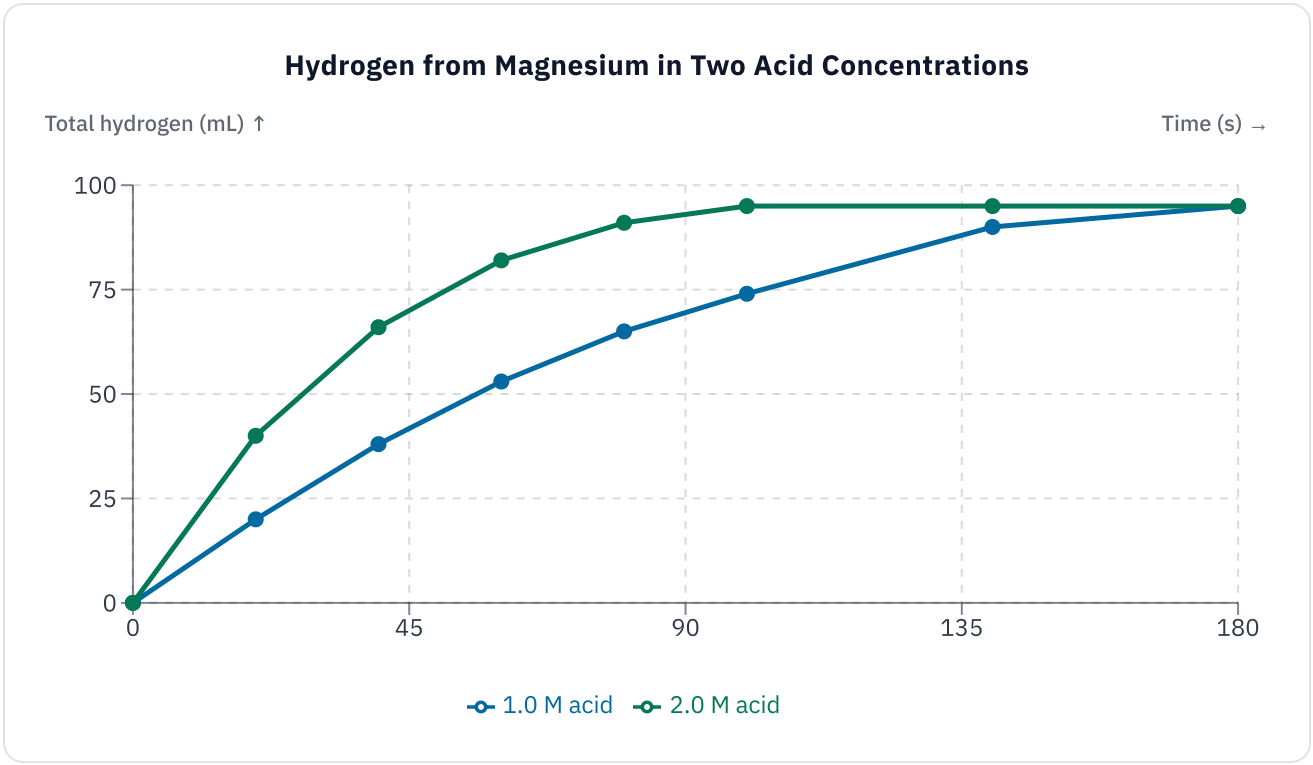
Create questions › Chemistry or Physics › HS Physical Science › PS1 › PS1-5 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must draw a conclusion from two features of the graph, early slope and final plateau, and separate rate from total amount.

A student reacts identical 0.10 g strips of magnesium with excess 1.0 M and 2.0 M hydrochloric acid at the same temperature. The graph shows the total hydrogen collected over time. Which conclusion is best supported by the graph?



- ○ Both acids react at the same rate, because they end at the same volume.
- ✓ ○ The 2.0 M acid starts about twice as fast, but both make the same total gas.
- ○ The 2.0 M acid makes about twice as much total gas as the 1.0 M acid.
- ○ The 1.0 M acid starts faster, but the 2.0 M acid makes more gas overall.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS1 › PS1-5 › DOK 3 › Generate

Test Bank question

HS-PS1-6 Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall the basic response of an equilibrium to added reactant and that rates become equal again.

Use the drop-down menus to complete the statement.

The reaction $Fe^{3+} + SCN^{-} \rightleftharpoons FeSCN^{2+}$ makes a red solution. Adding more SCN^{-} makes the forward reaction go [faster ▾] for a while, so the solution turns [deeper ▾] red. Eventually, the forward and reverse rates become [equal ▾] again.

Drop-down 1 choices: slower | **faster ✓** | backward

Drop-down 2 choices: the same | lighter | **deeper ✓**

Drop-down 3 choices: **equal ✓** | zero | unequal

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS1 › PS1-6 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must weigh four possible changes, using heat release and gas-molecule counts to decide which one shifts the equilibrium toward more product.

A student is designing a system to produce ammonia by the reversible reaction $N_2(g) + 3\ H_2(g) \rightleftharpoons 2\ NH_3(g)$, which releases heat. The system is at equilibrium. The student wants more ammonia at equilibrium without adding more reactants. Which single change would best accomplish this goal?

- ○ Increase the container volume so the molecules have more room to react
- ○ Decrease the temperature of the reaction system ✓
- ○ Add a catalyst so the forward reaction makes ammonia faster
- ○ Raise the temperature so more collisions have enough energy

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS1 › PS1-6 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students transfer equilibrium reasoning to an unfamiliar biological system and then choose the evidence that justifies their explanation.

A team of climbers spends three weeks at 5,000 m, where the air has about half the oxygen pressure of sea level. Blood tests show their hemoglobin levels rose by about 10 %. In blood, $Hb + O_2 \rightleftharpoons HbO_2$.

Part A: How does the rise in hemoglobin help the climbers?

Choose one answer.

- ○ It stops HbO_2 from breaking apart
- ○ It shifts the equilibrium back toward HbO_2 ✓
- ○ It adds O_2 to the air they breathe
- ○ It works as a catalyst for O_2 binding

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ○ A catalyst raises the amount of product at equilibrium.
- ○ HbO_2 cannot release oxygen once it forms.
- ○ Hb is a reactant, so adding more of it shifts the balance forward. ✓
- ○ Lower O_2 pressure shifts the balance toward HbO_2.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS1 › PS1-6 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · PHYSICAL SCIENCE · PS1 MATTER AND ITS INTERACTIONS

HS-PS1-7 Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students add reactant masses and recall that atoms are not created or destroyed, a routine one-step application.

A student reacts 56 g of iron with 32 g of sulfur in a closed tube: Fe + S → FeS. Both react completely. Match each statement to the correct column.

	Correct	Incorrect
The FeS formed has a mass of 88 g.	☑	☐
The FeS formed has a mass of 56 g.	☐	☑
The tube and its contents weigh the same before and after.	☑	☐
Every iron atom ends up in the FeS.	☑	☐
Some sulfur atoms were destroyed.	☐	☑
Heating the tube added mass to the iron.	☐	☑

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS1 › PS1-7 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students convert grams to moles, use the equation's ratio, and convert back to grams, a multi-step mathematical representation.

A student burns 4.8 g of magnesium completely in oxygen: $2\ Mg + O_2 \rightarrow 2\ MgO$. The molar masses are Mg = 24, O_2 = 32, and MgO = 40 g/mol. Which statements are correct? Select all that apply.

- [ ] The MgO formed has less mass than the Mg and O_2 that reacted, because heat and light leave.
- [x] The 4.8 g of Mg forms 8.0 g of MgO.
- [x] For every 2 Mg atoms that react, the 2 O atoms of one O_2 molecule join them.
- [x] About 3.2 g of O_2 reacts with the 4.8 g of Mg.
- [ ] 0.20 mol of O_2 reacts, since each Mg atom needs one O_2 molecule.
- [ ] The reaction makes 4.8 g of MgO, since the mass of the metal is conserved.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS1 › PS1-7 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students reconcile two experiments that seem to disagree and decide which conclusions the combined evidence supports.

Two students heat 43.3 g of mercury oxide: $2HgO \rightarrow 2Hg + O_2$. Student A uses a sealed vessel and finds no change in total mass. Student B uses an open dish and finds that 3.2 g is lost. Which conclusions are supported? Select all that apply.

- [ ] Only Student A's result is valid.
- [x] Both results agree with conservation of mass. ✓
- [x] The oxygen gas produced has a mass of 3.2 g. ✓
- [ ] Student B's result shows that 3.2 g of atoms were destroyed.
- [x] The mercury left behind has a mass of about 40.1 g. ✓
- [ ] Student A's vessel must have gained 3.2 g of air.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS1 › PS1-7 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · PHYSICAL SCIENCE · PS1 MATTER AND ITS INTERACTIONS

HS-PS1-8 Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall what beta decay does to the proton count and identify the new element, a single routine step.

Iodine-131 (53 protons) is used in medicine. It decays by beta decay, in which a neutron becomes a proton and an electron is given off. What nucleus is produced?

- ◯ Xenon-131 ✓
- ◯ Xenon-132
- ◯ Tellurium-131
- ◯ Iodine-130

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS1 › PS1-8 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must track protons and mass number through three decay steps in order, applying different rules at each step.

A nucleus of radon-222 (86 protons) undergoes alpha decay, then alpha decay again, then beta decay. Identify the final nucleus, and show how the protons and mass number change at each step.

Model response: The first alpha decay turns radon-222 into polonium-218: the protons drop from 86 to 84 and the mass number drops from 222 to 218. The second alpha decay makes lead-214, with 82 protons and mass number 214. The beta decay turns a neutron into a proton, so the protons rise to 83 and the mass number stays 214. The final nucleus is bismuth-214.

Rubric: 2 points: identifies bismuth-214 and shows the proton and mass number after each step (84/218, 82/214, 83/214). 1 point: one of these. 0 points: neither.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS1 › PS1-8 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students work backward from start and end nuclei to deduce an unknown number of decays, a non-routine problem justified with evidence.

Thorium-232 (90 protons) decays through a series of alpha and beta decays to lead-208 (82 protons).

Part A: How many alpha and beta decays occur?

Choose one answer.

- ◯ 6 alpha and 4 beta ✓
- ◯ 8 alpha and 6 beta
- ◯ 4 alpha and 4 beta
- ◯ 6 alpha and 0 beta

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ◯ The number of alphas equals the number of betas.
- ◯ A 24 drop takes 6 alphas; they leave 78 protons, so 4 betas. ✓
- ◯ Each decay lowers the mass number by 4.
- ◯ Beta decays lower the proton number.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS1 › PS1-8 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · PHYSICAL SCIENCE · PS2 MOTION AND STABILITY: FORCES AND INTERACTIONS

HS-PS2-1 Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall **Why DOK 1:** Students divide net force by mass for each row, a routine one-step use of Newton's second law.

A student pulls a 25 kg shopping cart with different net forces and records the acceleration. The mass stays the same in every trial. Choose the missing values from the drop-down menus.

Net force (N)	Mass of cart (kg)	Acceleration (m/s²)
50	25	Blank 1
100	25	Blank 2
150	25	6
200	25	Blank 3

Blank 1 (Row 1, Acceleration (m/s²)): 2 ▾

Blank 2 (Row 2, Acceleration (m/s²)): 4 ▾

Blank 3 (Row 4, Acceleration (m/s²)): 8 ▾

Drop-down 1 choices: 0.5 **2 ✓** 1250

Drop-down 2 choices: 0.25 **4 ✓** 2500

Drop-down 3 choices: 0.125 **8 ✓** 50

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS2 › PS2-1 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students find acceleration from a table, then net force, then the backward forces, linking several steps and interpreting the data.

Engineers test a 1,200 kg car on a level track. The road pushes forward on the tires with a force of 3,600 N. Air resistance and rolling friction act backward. The table shows the car's speed. Select True or False for each statement.

Test Car Speed on a Level Track

Time (s)	Speed (m/s)
0	0
2.0	5.0
4.0	10.0
6.0	15.0

	True	False
The car's acceleration is 2.5 m/s².	☑	☐
The net force on the car is 3,000 N.	☑	☐
Air resistance and rolling friction together are about 600 N.	☑	☐
The 3,600 N forward push from the road is the net force on the car.	☐	☑
Because the car's speed keeps increasing, the net force on it must also keep increasing.	☐	☑

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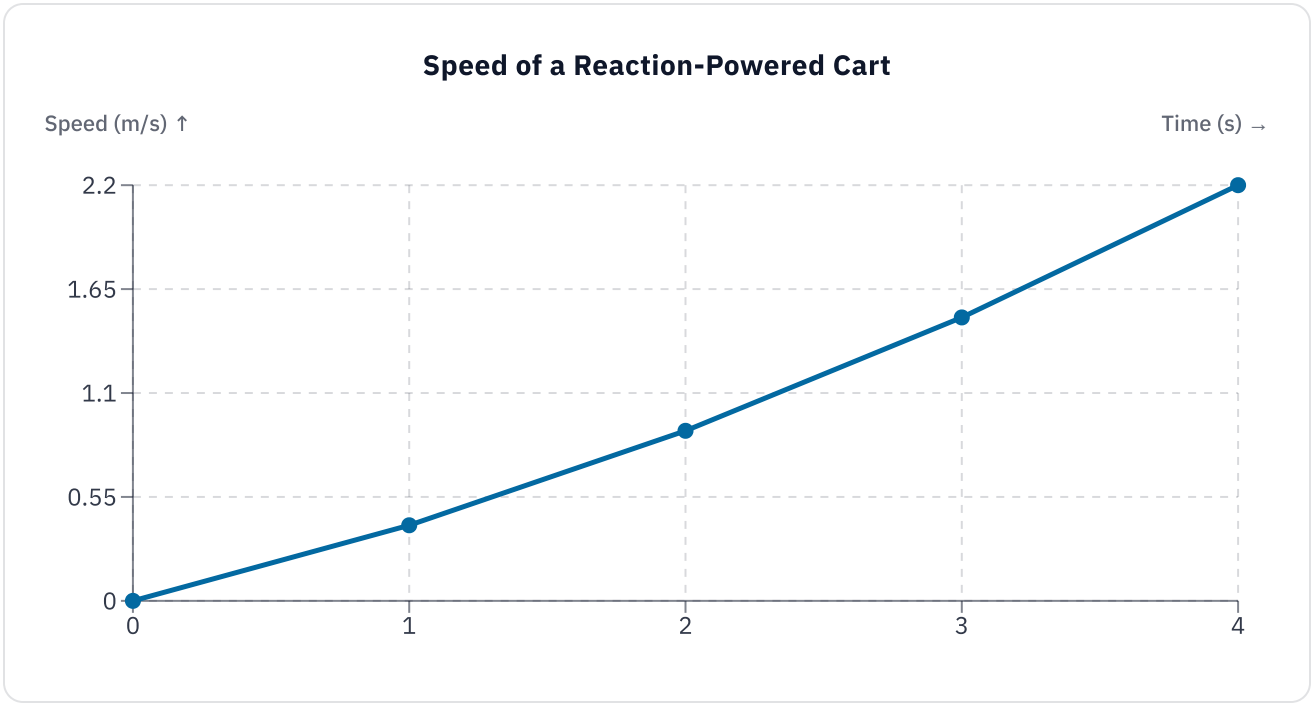
Create questions › Chemistry or Physics › HS Physical Science › PS2 › PS2-1 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students notice the graph's slope increases while thrust is constant and reason that the mass must be decreasing, a non-routine inference.

A cart carries a bottle where baking soda and vinegar react. The CO_2 gas builds pressure and forces liquid out through a nozzle at the back. A force sensor shows the thrust stays about the same during the run, and friction is small. The graph shows the cart's speed. Which conclusion is best supported?



- ○ The acceleration is constant, because the thrust stays about the same during the run.
- ○ The thrust must be rising, because the cart's speed keeps increasing during the run.
- ○ The slope grows because liquid leaves the cart, so the same thrust acts on less mass. ✓
- ○ The cart gains mass from the CO_2 gas, which is why its speed rises faster over time.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS2 › PS2-1 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · PHYSICAL SCIENCE · PS2 MOTION AND STABILITY: FORCES AND INTERACTIONS

HS-PS2-2 Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall the conditions for momentum conservation and the meaning of internal and external forces.

Two gliders collide on a frictionless air track. The system is the two gliders. Select True or False for each statement.

	True	False
The total momentum of the two gliders is conserved in the collision.	☑	☐
Momentum is conserved only if the gliders stick together.	☐	☑
Friction from the track, if there were any, would be an external force on the system.	☑	☐
The forces the gliders exert on each other are internal forces.	☑	☐
The internal forces between the gliders change the system's total momentum.	☐	☑

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS2 › PS2-2 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students calculate total momentum of two moving cars and then use it to find the combined speed, a two-step calculation.

Use the drop-down menus to complete the statement.

On a slick road, a 1,200 kg car moving at 10 m/s bumps into an 800 kg car moving the same direction at 5.0 m/s, and the bumpers lock. The total momentum of the two cars is [16,000 kg·m/s ▾]. Right after the bump, the locked cars move at [8.0 m/s ▾].

Drop-down 1 choices: 8,000 kg·m/s | 12,000 kg·m/s | **16,000 kg·m/s ✓**

Drop-down 2 choices: 7.5 m/s | **8.0 m/s ✓** | 10 m/s

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS2 › PS2-2 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students judge data quality across trials, separate measurement error from a real anomaly, and propose a cause, drawing conclusions from multiple pieces of evidence.

A chemistry class collides dry ice pucks that glide on a thin layer of CO_2 gas. The totals before and after four trials are shown in the table. Which statements are supported? Select all that apply.

Total Momentum in Four Dry Ice Puck Trials

Trial	Before (kg·m/s)	After (kg·m/s)
1	0.100	0.099
2	0.140	0.137
3	0.120	0.084
4	0.080	0.079

- [ ] Trial 3 lost momentum because heat from the sublimating dry ice carried it away.
- [x] Friction from the bench, if a gas layer thinned, could explain Trial 3.
- [x] Trial 3 lost about 30% of its momentum, which points to an external force.
- [ ] All four trials prove that the CO_2 gas adds momentum to the pucks.
- [ ] The data show that momentum is never conserved when dry ice pucks collide.
- [x] Trials 1, 2, and 4 are consistent with conservation within a few percent.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS2 › PS2-2 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · PHYSICAL SCIENCE · PS2 MOTION AND STABILITY: FORCES AND INTERACTIONS

HS-PS2-3 Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall that a cushion reduces force by lengthening stopping time while momentum change stays the same.

In a car crash, the airbag fills with nitrogen gas made when sodium azide breaks down. How does the gas-filled airbag reduce the force on the passenger?

- ◯ It lengthens the time over which the passenger stops. ✓
- ◯ It makes the passenger stop more quickly than the dashboard would.
- ◯ The nitrogen gas makes the passenger lighter.
- ◯ It reduces the passenger's change in momentum.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS2 › PS2-3 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students compute force for six designs from momentum change and time and classify each against a design limit.

An engineering class tests six package designs by dropping a packed object inside each one. Each row gives the object's momentum change and the time the packing takes to stop it. A design passes only if the average force on the object is 50 N or less. Sort each design by the average force on the object.

	100 N	50 N	25 N
Design 1: Δp = 2.0 kg·m/s, Δt = 0.04 s	☐	☑	☐
Design 2: Δp = 1.0 kg·m/s, Δt = 0.04 s	☐	☐	☑
Design 3: Δp = 0.5 kg·m/s, Δt = 0.01 s	☐	☑	☐
Design 4: Δp = 2.0 kg·m/s, Δt = 0.02 s	☑	☐	☐
Design 5: Δp = 0.5 kg·m/s, Δt = 0.02 s	☐	☐	☑
Design 6: Δp = 1.0 kg·m/s, Δt = 0.01 s	☑	☐	☐

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS2 › PS2-3 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must find impulse as an area, separate peak from average force, and use the results to evaluate design claims.

An engineer records force-time graphs for two catches of identical balls thrown at the same speed. Both graphs are triangles. Catch A has a peak force of 800 N and lasts 0.015 s. Catch B has a peak force of 200 N and lasts 0.060 s. Select True or False for each statement.

	True	False
Both catches give the ball the same impulse.	☑	☐
The average force in catch B is 100 N.	☑	☐
The average force in catch A is 800 N.	☐	☑
Catch B stopped a ball with more momentum than catch A.	☐	☑
Catch B is more likely to have used a padded mitt.	☑	☐

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS2 › PS2-3 › DOK 3 › Generate

Test Bank question

HS-PS2-4 Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students apply the inverse-square rule directly to given distances and recall that gravitational forces come in equal pairs.

A satellite weighs 2,000 N on Earth's surface, one Earth radius from Earth's center. Select True or False for each statement.

	True	False
At two Earth radii from Earth's center, the gravitational force on it is 500 N.	☑	☐
At three Earth radii from Earth's center, the force is about 222 N.	☑	☐
At two Earth radii from Earth's center, the force is 1,000 N.	☐	☑
The satellite pulls on Earth with the same size force that Earth pulls on it.	☑	☐
Far out in space, the gravitational force on the satellite becomes exactly zero.	☐	☑

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS2 › PS2-4 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must combine two changes, mass and radius, in the gravitation formula and see how they offset.

Use the drop-down menus to complete the statement.

Planet W has four times Earth's mass and twice Earth's radius. The gravity at its surface is [the same as ▾] the gravity at Earth's surface, so a person who weighs 500 N on Earth would weigh [500 N ▾] on Planet W.

Drop-down 1 choices: **the same as ✓** | four times | twice

Drop-down 2 choices: **500 N ✓** | 1,000 N | 2,000 N

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS2 › PS2-4 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students set two gravitational pulls equal in a new situation and reason with square roots, a non-routine problem with justification.

Earth's mass is 81 times the Moon's, and their centers are 384,000 km apart. A spacecraft travels from Earth to the Moon.

Part A: About how far from Earth are the two pulls on the spacecraft equal?

Choose one answer.

- ○ 375,000 km
- ○ 379,000 km
- ○ 192,000 km
- ○ 346,000 km ✓

Part B: Which reasoning best supports your answer to Part A?

Choose one answer.

- ○ The distances split 81 to 1, but only for a light spacecraft.
- ○ The distances split $\sqrt{81} = 9$ to 1, since the pulls depend on $1/d^2$. ✓
- ○ The masses differ by 81, so the distances split 81 to 1.
- ○ The pulls are equal halfway, since both bodies pull on the same spacecraft.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS2 › PS2-4 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · PHYSICAL SCIENCE · PS2 MOTION AND STABILITY: FORCES AND INTERACTIONS

HS-PS2-5 Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students identify the simple cause-and-effect shown when a field appears only while current flows.

A student designed an investigation to test what causes a magnetic field. She wrapped wire around an iron nail, connected it to a battery, and observed that a compass needle near the nail deflected. She then disconnected the battery and observed that the compass needle returned to its original position. Based on this investigation, which statement correctly describes the cause-and-effect relationship?

- ✓ The magnetic field near the nail was caused by the electric current flowing through the wire.
- The magnetic field near the nail was caused by the presence of the iron nail itself.
- The compass needle's deflection was caused by a static magnetic field that existed before the battery was connected.
- The return of the compass needle to its original position was caused by the iron nail producing an electric current.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS2 › PS2-5 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret a pattern in observations to identify a changing field as the cause and predict a new result.

Use the drop-down menus to complete the statement.

A magnet is pushed into a coil connected to a galvanometer at different speeds, and faster pushes give larger deflections. This shows that [a changing magnetic field ▾] is the cause of the induced current. If the magnet is then held still inside the coil, the needle will [show no deflection ▾].

Drop-down 1 choices: the coil's resistance | a steady magnetic field | **a changing magnetic field ✓**

Drop-down 2 choices: show a large deflection | **show no deflection ✓** | keep deflecting more

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS2 › PS2-5 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students plan their own investigation, choosing variables, controls, and the result that would count as evidence.

Coil A is connected to a battery and switch, and coil B is connected to a galvanometer. Plan an investigation to find out how the distance between the two coils affects the current induced in coil B when the switch is closed. Name the independent and dependent variables, two variables you would control, and what result would show that the field reaching coil B is weaker at larger distances.

Model response: The independent variable is the distance between the coils, such as 1, 2, 4 and 8 cm. The dependent variable is the peak galvanometer reading in coil B each time the switch is closed. I would keep the same battery (so the same current in coil A) and the same two coils, and I would close the switch the same way each time and repeat each distance. If the peak reading gets smaller as the distance increases, that shows the changing field reaching coil B is weaker farther away.

Rubric: 2 points: The response includes all required elements: names the distance as the independent variable and the peak galvanometer reading as the dependent variable; controls variables such as the battery and the coils; states that smaller peak readings at larger distances would show a weaker field.
1 point: The response includes one or two of the three required elements above, but not all three. Credit for "States that a smaller peak reading at larger distances would show a weaker field" requires "Names distance as the independent variable and the peak galvanometer reading as the dependent variable".
0 points: no correct element. No correct required element; the response is incorrect, too vague to earn credit, irrelevant, blank, or only copies the prompt without answering.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS2 › PS2-5 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · PHYSICAL SCIENCE · PS2 MOTION AND STABILITY: FORCES AND INTERACTIONS

HS-PS2-6 Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall that weak forces between long polymer chains let them slide, explaining stretchiness.

A plastic grocery bag stretches a lot before it tears. Which feature of its structure explains this?

- ○ Its atoms form a rigid network of bonds in all directions.
- ○ Its free electrons move apart when the bag is pulled.
- ○ Its ions line up and repel each other when it is pulled.
- ○ Its long chains slide past each other under weak forces. ✓

FIND MORE LIKE THIS

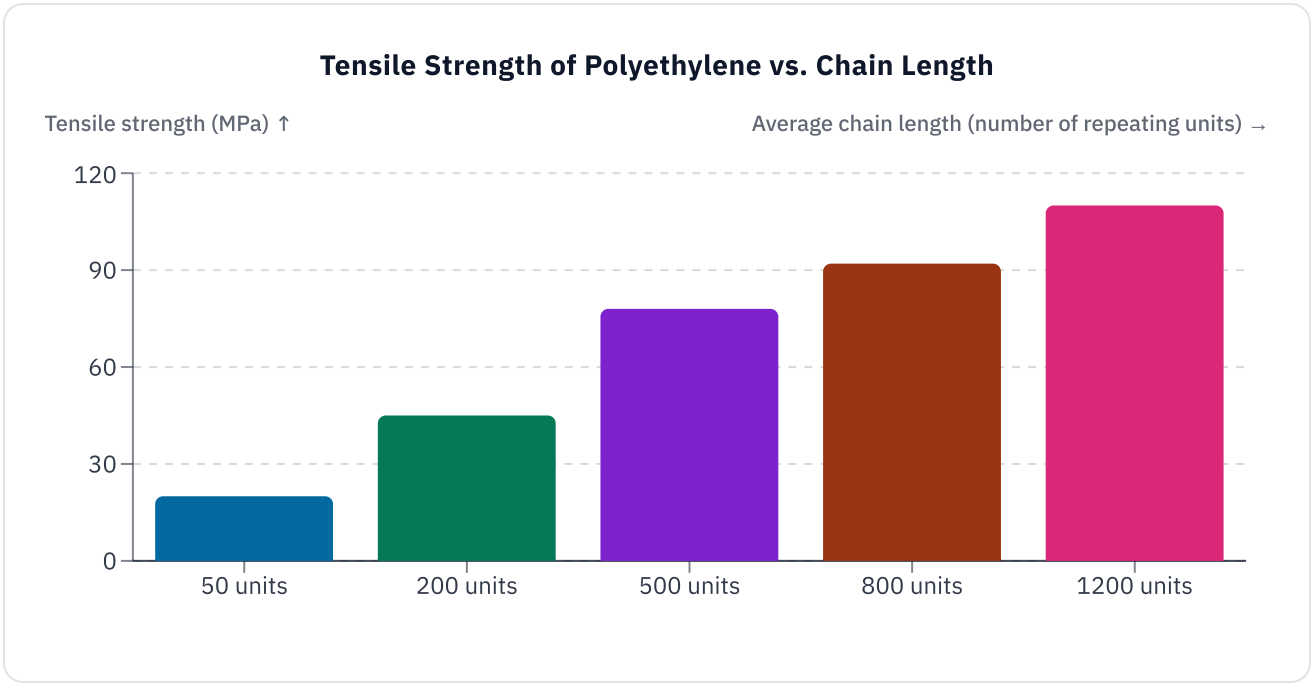
Create questions › Chemistry or Physics › HS Physical Science › PS2 › PS2-6 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret a trend in a graph and connect it to a molecular-level explanation for a material property.

An engineer is picking plastic for a cable sleeve. It must resist tearing but still bend around corners. The graph shows how tensile strength changes as the plastic's chain length grows. Which statement best explains why longer chains make the plastic stronger?



- ○ Longer chains have more electrons, so they push away from nearby chains and stop sliding.
- ○ Longer chains let electrons move freely through the plastic, forming strong metallic bonds.
- ○ Longer chains touch more neighbors, so more weak attractions add up to hold them together. ✓
- ○ Longer chains form covalent bonds with neighboring chains, joining the plastic into one molecule.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS2 › PS2-6 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students reason about two molecular factors at once, pore size and surface chemistry, to evaluate how a designed material works.

A jacket has a PTFE membrane with pores far smaller than raindrops but far larger than single water molecules. Select True or False for each statement.

	True	False
Rain beads up on PTFE because its fluorine-covered chains are nonpolar.	☑	☐
Raindrops cannot pass through the pores because they are too large.	☑	☐
Sweat vapor can escape because single water molecules fit through the pores.	☑	☐
A cotton membrane with the same pores would keep rain out just as well.	☐	☑
PTFE keeps rain out because it attracts water and holds it.	☐	☑

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS2 › PS2-6 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · PHYSICAL SCIENCE · PS3 ENERGY

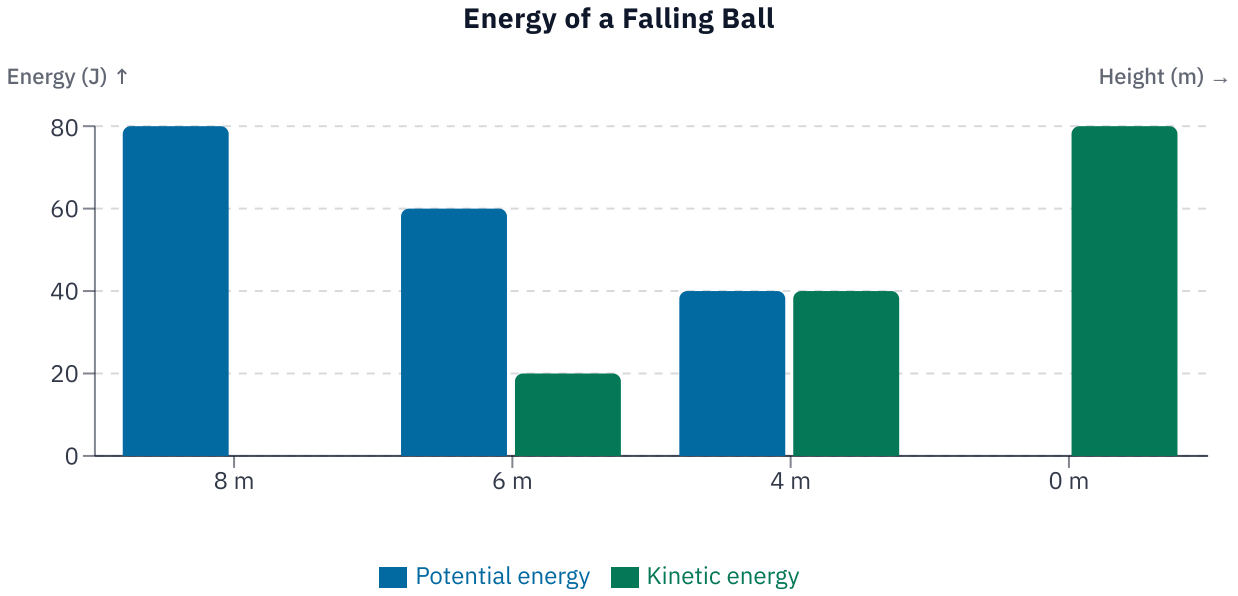
HS-PS3-1 Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students read and add values straight from the bar graph to see that the total stays the same.

The graph shows the gravitational potential energy and kinetic energy of a falling ball at several heights, with no air resistance. Which conclusion is best supported?



- ○ Potential energy stays constant.
- ○ The total energy grows as the ball falls.
- ○ The two energies always add to 80 J. ✓
- ○ Kinetic energy is greatest at the top.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS3 › PS3-1 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students calculate starting and ending energy and subtract to find the energy transferred out, a multi-step energy accounting.

A 50 kg skier starts at rest at the top of a 20 m slope and reaches the bottom at 18 m/s. How much energy became thermal energy through friction and air resistance? Use g = 10 m/s².

- ○ 10,000 J
- ✓ 1,900 J
- ○ 8,100 J
- ○ 0 J

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS3 › PS3-1 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students model a chain of efficiencies, test several design changes, and justify which improves the system most.

A student designs a system to deliver light using three stages: a generator (80 % efficient), power lines (90 % efficient) and a bulb (25 % efficient). The student wants to raise the overall efficiency.

Part A: Which change would raise the overall efficiency the most?

Choose one answer.

- ○ Raise the power lines to 99 %
- ○ Replace the bulb with a 50 % LED ✓
- ○ Add a fourth stage
- ○ Raise the generator to 90 %

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ○ Generators produce the most energy in any system.
- ○ Adding more stages always adds energy.
- ○ With the LED, 18 % rises to about 36 %. ✓
- ○ Power lines are the longest part of the system.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS3 › PS3-1 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · PHYSICAL SCIENCE · PS3 ENERGY

HS-PS3-2 Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects)

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall where motion energy and position energy are greatest on a simple swing.

A student models a playground swing that is pulled back, released, and swings to the other side. Match each description to the column for the form of energy that is greatest at that moment.

	Kinetic energy is greatest	Gravitational potential energy is greatest
The swing stops for an instant on the far side	☐	☑
The swing passes through its lowest point	☑	☐
The swing is held back before release	☐	☑
The swing is moving at its top speed	☑	☐
The seat is at its highest point	☐	☑
The seat is closest to the ground	☑	☐

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS3 › PS3-2 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students apply how spring energy grows with compression and then connect stored energy to launch height, translating between quantities.

A spring launcher sends a ball straight up. The height reached depends on how far the spring is compressed. Choose the missing values from the drop-down menus.

Compression (cm)	Relative stored energy	Height (m)
1	1	0.2
2	Blank 1	Blank 2
3	Blank 3	Blank 4

Blank 1 (Row 2, Relative stored energy): 4 ▾

Blank 2 (Row 2, Height (m)): 0.8 ▾

Blank 3 (Row 3, Relative stored energy): 9 ▾

Blank 4 (Row 3, Height (m)): 1.8 ▾

Drop-down 1 choices: 2 | **4 ✓** | 8

Drop-down 2 choices: 0.4 | 0.6 | **0.8 ✓**

Drop-down 3 choices: 3 | 6 | **9 ✓**

Drop-down 4 choices: 0.6 | 0.9 | **1.8 ✓**

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS3 › PS3-2 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students track energy across several bounces, work forward and backward through the table, and account for energy leaving the system.

A 0.50 kg ball is dropped from 2.0 m onto a floor. Each bounce reaches a lower peak. The table tracks gravitational potential energy (PE) at each peak and energy transferred to thermal energy and sound since the previous peak. Use g = 10 m/s². Choose the missing values from the drop-down menus.

Peak	Height (m)	PE at peak (J)	Energy to thermal and sound since last peak (J)
Release	2.0	10	—
First bounce	1.6	Blank 1	Blank 2
Second bounce	1.28	Blank 3	Blank 4
Third bounce	Blank 5	5.12	Blank 6

Blank 1 (Row 2, PE at peak (J)): 8 ▾

Blank 2 (Row 2, Energy to thermal and sound since last peak (J)): 2 ▾

Blank 3 (Row 3, PE at peak (J)): 6.4 ▾

Blank 4 (Row 3, Energy to thermal and sound since last peak (J)): 1.6 ▾

Blank 5 (Row 4, Height (m)): 1.024 ▾

Blank 6 (Row 4, Energy to thermal and sound since last peak (J)): 1.28 ▾

Drop-down 1 choices: 4 | **8 ✓** | 9 | 16

Drop-down 2 choices: 0 | **2 ✓** | 8 | 10

Drop-down 3 choices: 3.2 | 6.0 | **6.4 ✓** | 12.8

Drop-down 4 choices: 0.8 | **1.6 ✓** | 2 | 3.2

Drop-down 5 choices: 0.512 | 0.96 | **1.024 ✓** | 2.048

Drop-down 6 choices: 0 | **1.28 ✓** | 1.6 | 2.56

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS3 › PS3-2 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · PHYSICAL SCIENCE · PS3 ENERGY

HS-PS3-3 Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students identify the input and output energy forms of a simple device and recall that wasted energy is transferred, not destroyed.

Use the drop-down menus to complete the statement.

A student designs a hand-crank flashlight: turning a crank spins a small generator, which lights an LED. After a few minutes of cranking, the device feels slightly warm. In this system, the useful energy conversion is [mechanical ▾] energy into [electrical ▾] energy, and the warmth shows that some energy is [transferred ▾] to the surroundings as thermal energy.

Drop-down 1 choices: **mechanical ✓** electrical thermal

Drop-down 2 choices: **electrical ✓** chemical sound

Drop-down 3 choices: created **transferred ✓** destroyed

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS3 › PS3-3 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must trace energy through a multi-part device and judge which statements about conversions and losses are accurate.

A student designs a device that uses a small generator attached to a skateboard wheel. The skateboard rolls down a ramp and across a flat floor, and the generator powers an LED. Which statements correctly describe energy in this device? Select all that apply.

- [x] Reducing friction in the wheel and generator would send more energy to the LED.
- [x] The input is gravitational potential energy, which becomes kinetic energy, then electrical energy.
- [ ] The LED's light and heat account for all of the skateboard's starting energy.
- [ ] Electrical energy that does not light the LED is destroyed inside the generator.
- [ ] A heavier generator would convert all of the kinetic energy without any losses.
- [x] Friction at the wheels and heating in the generator wires move energy to the surroundings.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS3 › PS3-3 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students diagnose a design problem from evidence and then choose the refinement that addresses the cause.

A student attaches a small generator to a skateboard's wheel axle to power an LED. At the bottom of a ramp, the wheels spin fast, but the LED is dimmer than the wheel speed would suggest, and the axle bearings feel warm.

Part A: Which statement best explains why the LED is dimmer than expected?

Choose one answer.

- ◯ Friction in the bearings turns some motion into heat, not electricity. ✓
- ◯ The ramp's potential energy goes straight to light, skipping electricity.
- ◯ The wheels' energy is destroyed as the skateboard slows down.
- ◯ The generator creates energy, but the LED cannot use all of it.

Part B: Which design change would best address this problem?

Choose one answer.

- ◯ Wrap insulation around the warm generator.
- ◯ Use an LED that needs less electrical power.
- ◯ Install better bearings and lubricate the axle. ✓
- ◯ Use a heavier skateboard on the same ramp.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS3 › PS3-3 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · PHYSICAL SCIENCE · PS3 ENERGY

HS-PS3-4 Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recognize the basic measurement needed to show energy spreading: repeated temperatures of both objects.

Sam wants to show thermal energy spreading between a warm towel and a cold can inside a closed cooler. Select the plan step that gives the best evidence.

- ◯ Read a thermometer on each object every 2 minutes. ✓
- ◯ Read the towel's temperature at the start only.
- ◯ Weigh the can before and after the test.
- ◯ Leave the lid open so the air can mix.

FIND MORE LIKE THIS

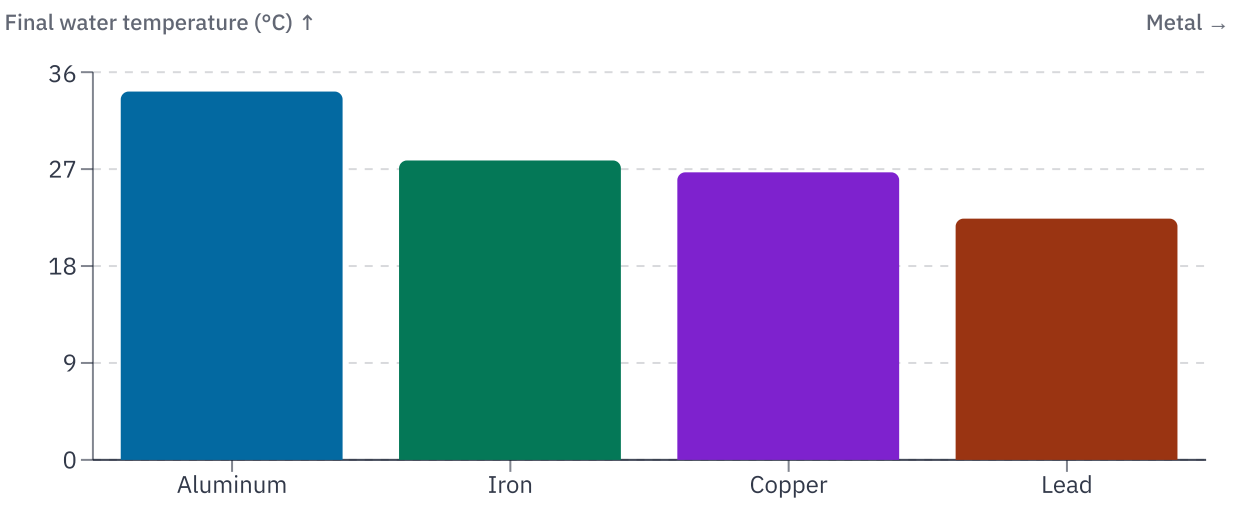
Create questions › Chemistry or Physics › HS Physical Science › PS3 › PS3-4 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret a graph and reason about which metal carried the most thermal energy, linking data to specific heat.

Equal 100 g samples of four metals are heated to 100°C and each dropped into 100 g of water at 20°C in identical calorimeters. The graph shows the final water temperatures. Which metal has the highest specific heat?



- ○ The iron sample
- ○ The lead sample
- ○ The aluminum sample ✓
- ○ The copper sample

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS3 › PS3-4 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate a claim using several trials, judge whether differences are meaningful, and explain small shortfalls.

A student tests the claim that energy lost by hot water equals energy gained by cold water. The table shows her calorimeter data and the final temperature predicted if no energy escapes. Which conclusions are supported? Select all that apply.

Predicted and Measured Final Temperatures

Trial	Hot water	Cold water	Predicted final (°C)	Measured final (°C)
1	100 g at 70°C	100 g at 20°C	45	44.6
2	50 g at 80°C	150 g at 20°C	35	34.4
3	150 g at 60°C	50 g at 20°C	50	49.3

- [ ] Trial 3 shows that energy was created.
- [x] The small shortfalls suggest a little energy escaped. ✓
- [x] Each result is within 1°C of the prediction. ✓
- [ ] The cold water gained more energy than the hot water lost.
- [x] The data support the claim that energy lost equals energy gained. ✓
- [ ] Trial 1 shows the result is always halfway between.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS3 › PS3-4 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · PHYSICAL SCIENCE · PS3 ENERGY

HS-PS3-5 Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall **Why DOK 1:** Students recall the field patterns of positive charges, negative charges, and bar magnets.

Match each description to the column for the object whose field it describes.

	Positive charge	Negative charge	Bar magnet
A positive test charge is pulled in	☐	☑	☐
A positive test charge is pushed away	☑	☐	☐
Lines leave one pole and enter the other	☐	☐	☑
Lines point straight out in all directions	☑	☐	☐
Lines point straight in from all directions	☐	☑	☐
Lines form closed loops	☐	☐	☑

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS3 › PS3-5 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts **Why DOK 2:** Students explain the relationship between stored field energy and kinetic energy as charges attract, then pick the supporting reason.

A physics student sets up two small charged spheres on a frictionless track. Sphere A is fixed in place and carries a negative charge. Sphere B carries a positive charge and is free to slide along the track. Sphere B is initially held at rest 8 cm from Sphere A, then released. Because the spheres have opposite charges, the electric field around Sphere A exerts an attractive force on Sphere B, pulling it toward Sphere A. As Sphere B slides closer, its speed increases.

> Part A: As Sphere B moves closer to Sphere A, what happens to the energy stored in the electric field of the two-sphere system and the kinetic energy of Sphere B?

Choose one answer.

- ○ The stored field energy stays the same because only Sphere B is moving.
- ○ The stored field energy decreases and the kinetic energy of Sphere B also decreases.
- ○ The stored field energy increases while the kinetic energy of Sphere B increases.
- ○ The stored field energy decreases while the kinetic energy of Sphere B increases. ✓

Part B: Which statement best supports your answer to Part A?

Choose one answer.

- ○ Electric field lines always push charged objects in the same direction the lines point, causing speed to increase.
- ○ As the distance between oppositely charged objects decreases, the attractive force does work on Sphere B, converting stored field energy into kinetic energy. ✓
- ○ Positively charged Sphere B is attracted toward Sphere A because Sphere A acts like the north pole of a magnet.
- ○ The magnetic field between the spheres only exists in the space outside the spheres, so energy is transferred from outside sources.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS3 › PS3-5 › DOK 2 › Generate

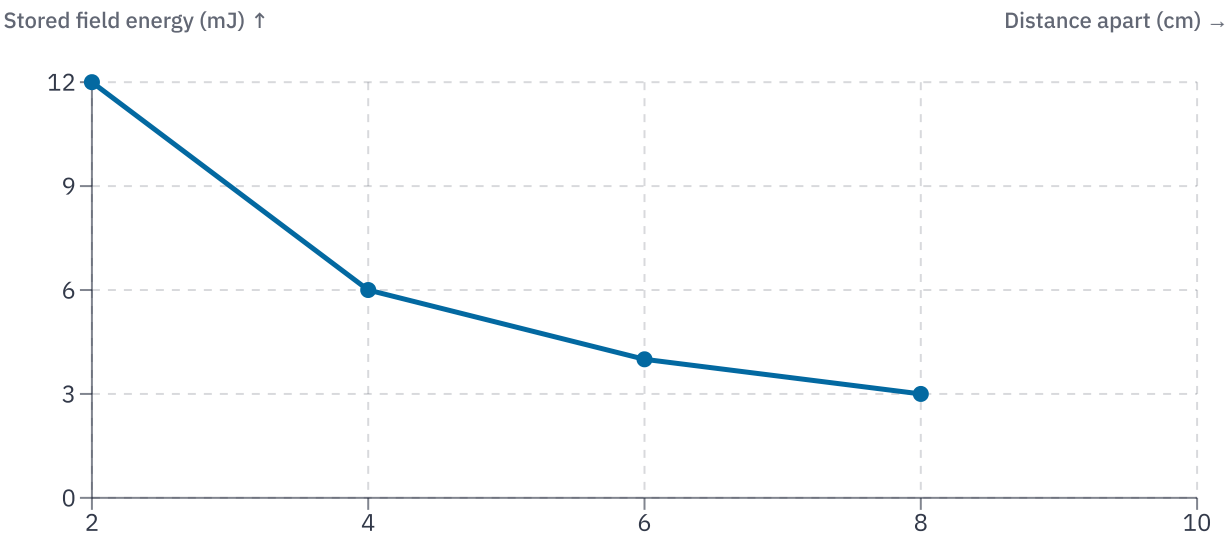
Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students use the graph and energy conservation to test a numeric prediction and explain why it is too high.

Two spheres with like charges are held 2 cm apart, then one is released on a frictionless track. The graph shows the stored field energy at several distances. A student predicts the sphere will have 12 mJ of kinetic energy at 8 cm. Which evaluation is supported?

Stored Field Energy Between Two Like Charges



- ◯ Too high, since only 9 mJ has been released by 8 cm. ✓
- ◯ Too high, since the sphere has only 3 mJ at 8 cm.
- ◯ Correct, since all 12 mJ has been released by 8 cm.
- ◯ Too low, since the sphere has 15 mJ at 8 cm.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS3 › PS3-5 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · PHYSICAL SCIENCE · PS4 WAVES AND ELECTROMAGNETIC RADIATION

HS-PS4-1 Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall **Why DOK 1:** Students rearrange the wave equation and do one division, a routine procedure.

A marine biologist studies whale songs traveling through ocean water. She observes that a particular whale call has a frequency of 20 Hz and travels at a speed of 1,480 meters per second through seawater. Using the mathematical relationship v = f λ, what is the wavelength of this whale song in seawater?

- ○ 1,500 meters
- ○ 1,460 meters
- ○ 74 meters ✓
- ○ 29,600 meters

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS4 › PS4-1 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students calculate two wavelengths from speed and period and explain that the speed change causes the wavelength change.

At Pismo Beach, the crests of an ocean swell pass a buoy every 12 s. Offshore, the swell travels 18 m/s. Near shore the water is shallow, and the swell slows to 6.0 m/s. Calculate the wavelength of the swell offshore and near shore. Explain what causes the wavelength to change.

Model response: Offshore wavelength is 216 m; nearshore wavelength is 72 m. The period stays the same at 12 s. Lower speed gives shorter wavelength nearshore.

Rubric: 2 points: Calculates both wavelengths and explains that lower speed at the same period causes shorter wavelength nearshore.
1 point: Gives at least one correct required calculation or explanation but not all required elements.
0 points: Gives no correct required element, is irrelevant, or is blank.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS4 › PS4-1 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students reason about a non-routine case where wavelength is fixed and speed changes, then explain the cause of the pitch change.

Use the drop-down menus to complete the statement.

An organ pipe in a church is modeled in the same resonant mode with wavelength of 1.30 m, set by the length of the pipe. On a cool 10 °C morning, sound travels 337 m/s in the church. On a warm 30 °C afternoon, sound travels 349 m/s. On the cool morning the pipe plays about [259 Hz ▾]. On the warm afternoon its pitch [rises to about 268 Hz ▾], because [warm air carries sound faster ▾].

Drop-down 1 choices: 0.0039 Hz | **259 Hz ✓** | 438 Hz

Drop-down 2 choices: falls to about 250 Hz | stays at about 259 Hz | **rises to about 268 Hz ✓**

Drop-down 3 choices: **warm air carries sound faster ✓** | warm air slows the sound down | warm air makes the pipe's wave longer

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS4 › PS4-1 › DOK 3 › Generate

Test Bank question

HS-PS4-2 Evaluate questions about the advantages of using a digital transmission and storage of information

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students sort each question as an advantage or disadvantage of digital storage, recalling basic features of digital files.

A music streaming app must decide how to store songs: as digital files, or as old-style analog vinyl grooves. Look at each question below. Decide if it is asking about an advantage or a disadvantage of digital storage.

	Advantage	Disadvantage
Question about digital storage: Will the song sound just as clear after being copied 1,000 times?	☑	☐
Question about digital storage: Could someone copy the song and share it without asking permission?	☐	☑
Question about digital storage: Can the song file be sent to millions of phones almost instantly?	☑	☐
Question about digital storage: Could the whole song file get deleted by accident with one click?	☐	☑

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS4 › PS4-2 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students convert units and compute download time, then connect the result to the trade-off of compression.

A movie file made with lossy compression is 3 GB. The internet connection carries 100 megabits per second, and 1 GB equals 8,000 megabits. How long does the download take?

- ○ 30 seconds
- ○ 16 minutes
- ○ 4 minutes ✓
- ○ 40 minutes

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS4 › PS4-2 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate a real backup plan, reasoning through different failure cases to judge its strengths and weaknesses.

The Patel family keeps its photos on a phone. The phone syncs automatically to a cloud account, and once a month the family also copies all the photos to a laptop. Evaluate this backup plan. Select True or False for each statement.

	True	False
The plan keeps exact copies of the photos in more than one place.	☑	☐
If the laptop's drive fails, the family loses all of its photos.	☐	☑
If a photo is deleted on the phone, the synced cloud copy may be deleted too.	☑	☐
Because the files are digital, the family never needs to check its backups.	☐	☑
The monthly laptop copy protects a photo deleted by mistake last week, if the photo was taken before the last monthly copy.	☑	☐

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS4 › PS4-2 › DOK 3 › Generate

Test Bank question

HS-PS4-3 Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students match each tool to the model of light it uses, recalling which behaviors are wave-like and which are particle-like.

Chemists use light in many lab tools. Match each tool to the column for the model of light that best explains how it works.

	Wave model	Particle model
A detector that counts single photons from a sample	☐	☑
A UV lamp that breaks bonds to kill germs	☐	☑
A grating that spreads light into a spectrum	☑	☐
X-ray crystallography that maps atoms in a crystal	☑	☐

FIND MORE LIKE THIS

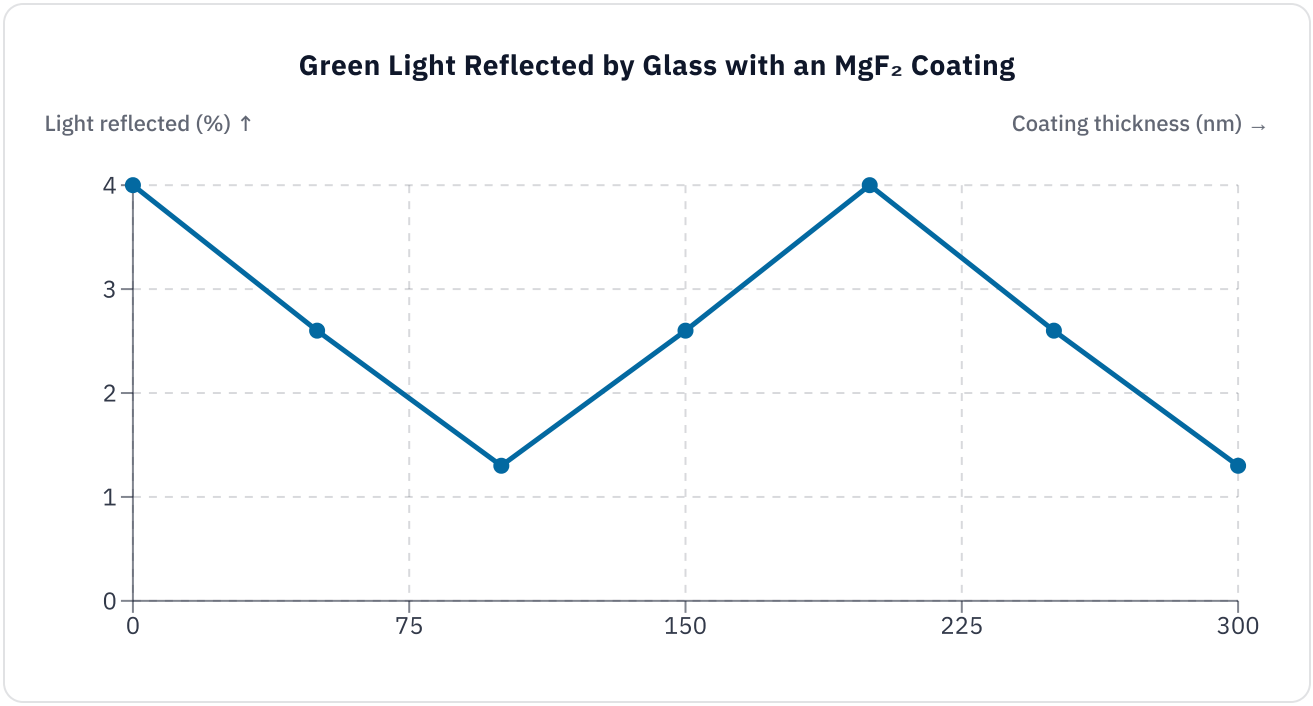
Create questions › Chemistry or Physics › HS Physical Science › PS4 › PS4-3 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret a repeating pattern in a graph and connect it to waves adding and canceling.

A chemist coats glass lenses with thin layers of magnesium fluoride (MgF_2) of different thicknesses. For each coating, she measures the percent of green light reflected from the lens. Which claim is best supported by the graph?



- ○ The coating reflects the same amount at every thickness, so it has no effect.
- ○ Photons collide inside the coating, so a 100 nm layer stops the most light.
- ○ Reflection rises and falls with thickness, so reflected waves add and cancel. ✓
- ○ Thicker coatings always absorb more photons, so reflection keeps dropping.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS4 › PS4-3 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate a claim by weighing two experiments, explaining what each supports and why one model alone cannot account for all the evidence.

A class does two experiments with light. Experiment 1: Green laser light passes through two narrow slits and makes a pattern of bright and dark bands on a screen. Making the laser brighter makes the bright bands brighter, but the dark bands stay dark. Experiment 2: The same green light shines on a clean metal plate and knocks electrons out of it. Red light does not knock out any electrons from the same plate, even when the red light is made much brighter. A student claims, "Experiment 1 proves that light is only a wave, so the results of Experiment 2 must be a mistake." Evaluate the student's claim. Use evidence from both experiments to explain which model of light each experiment supports.

Model response: The claim is not correct. In Experiment 1, the bright and dark bands come from light waves from the two slits adding together in some places and canceling in others, which supports the wave model. In Experiment 2, whether electrons are knocked out depends on the color (frequency) of the light, not its brightness. In the particle model, light comes in photons, and each photon's energy depends on its frequency. Each red photon has too little energy to free an electron, so adding more red photons does not help, while each green photon has enough. A wave-only model would predict that very bright red light should eventually free electrons, so Experiment 2 is not a mistake. Light shows both kinds of behavior, so scientists use the wave model to explain interference and the particle model to explain how light transfers energy to electrons.

Rubric: 2 points: States that the claim is not correct AND explains that Experiment 1 (interference bands) supports the wave model AND explains that Experiment 2 supports the particle model because each photon's energy depends on frequency, not brightness.
1 point: States that the claim is not correct and explains only one experiment correctly, OR correctly links both experiments to the wave and particle models without evaluating the claim.
0 points: Agrees with the claim, gives no correct link between either experiment and a model, or is blank or off topic.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS4 › PS4-3 › DOK 3 › Generate

Written for this guide

HIGH SCHOOL SCIENCE · PHYSICAL SCIENCE · PS4 WAVES AND ELECTROMAGNETIC RADIATION

HS-PS4-4 Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall that higher frequency means more energy per photon and pick the one correct claim.

A student reads an article about electromagnetic waves and human tissue. The article makes four claims about how the frequency of a wave affects tissue. Which claim is correct?

- ○ Radio waves have a high frequency, so they ionize atoms in tissue and cause the most damage.
- ○ Ultraviolet light has a higher frequency than visible light, so each photon can damage DNA. ✓
- ○ Microwaves heat tissue, and heating harms cells in the same way that ionizing does.
- ○ Only X-rays and gamma rays give energy to tissue, and other waves pass through with no effect.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS4 › PS4-4 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students compare photon energies across UVA, UVB, and visible light and use that to judge an advertising claim.

A tanning salon says, "Our beds give off mostly UVA, which is gentler than UVB, so our tans are safe." A student looks up that UVA has a longer wavelength than UVB and that UVA photons can still break bonds in DNA. Select True or False for each statement.

	True	False
Each UVA photon carries less energy than each UVB photon.	☑	☐
Because UVA is gentler than UVB, it cannot harm skin.	☐	☑
Each UVA photon carries more energy than a photon of visible light.	☑	☐
The student's research supports the salon's claim that tans are safe.	☐	☑

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS4 › PS4-4 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate the validity of several pieces of evidence and justify which one actually supports the claim.

A student claims that window glass protects people from sunburn. Select the piece of evidence that best supports this claim.

- ○ People sitting by a window feel warm on sunny days.
- ○ A UV meter reads much lower behind glass than outside at the same moment. ✓
- ○ Window glass looks clear and lets in plenty of daylight.
- ○ Office workers rarely go outside during the middle of the day.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS4 › PS4-4 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · PHYSICAL SCIENCE · PS4 WAVES AND ELECTROMAGNETIC RADIATION

HS-PS4-5 Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students classify familiar devices by the wave principle that makes each work, a recall task.

Engineers group devices by the physics that makes them work. Some carry light through glass, some cancel waves, and some turn photons into current. Sort the devices into the three groups.

	Total internal reflection	Interference	Absorption of photons
Solar panel	☐	☐	☑
Anti-glare coating on glasses	☐	☑	☐
Endoscope that carries light into the body	☑	☐	☐
Fiber optic internet cable	☑	☐	☐
Photodiode in a light meter	☐	☐	☑
Noise-canceling headphones	☐	☑	☐

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS4 › PS4-5 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret a data pattern and connect it to total internal reflection in a fiber.

An engineer winds a fiber optic cable around spools of different sizes and measures how much light gets through. On a 10 cm spool, 96% gets through. On a 2 cm spool, 80% gets through. On a 1 cm spool, only 40% gets through.

Part A: Why does less light get through on the smallest spool?

Choose one answer.

- ◯ In a tight bend, light hits the edge too steeply to reflect back in. ✓
- ◯ The smallest spool holds a longer piece of fiber than the others.
- ◯ The light slows down in tight bends and cannot reach the end in time.
- ◯ Tight bends make the glass absorb light and give it off as heat.

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ◯ The engineer used three different spools.
- ◯ Light getting through drops sharply as the bend gets tighter. ✓
- ◯ The fiber carries light from one end to the other.
- ◯ 96% of the light gets through on the largest spool.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS4 › PS4-5 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students justify a design choice by reasoning about how two substances absorb infrared and how that would affect the sensor's signal.

Engineers are building an infrared methane sensor for use outdoors in humid air. At the shorter wavelength, 3.3 micrometers, methane absorbs strongly and water vapor barely absorbs. At the longer wavelength, 7.7 micrometers, methane absorbs strongly and water vapor also absorbs strongly. Which wavelength should the sensor use? Justify your choice.

Model response: The sensor should use the shorter wavelength, 3.3 micrometers. There, methane absorbs strongly and water vapor barely absorbs, so a change in the light reaching the detector comes from methane alone. At the longer wavelength, water vapor also absorbs strongly, so on a humid day the extra absorption by water would make the sensor read more methane than is really there.

Rubric: 2 points: The response includes all required elements: chooses the shorter wavelength (3.3 micrometers), cites that water vapor barely absorbs there but absorbs strongly at the longer wavelength, and explains that water absorbing at the longer wavelength would change the reading and be mistaken for methane.
1 point: The response includes one or two of the three required elements above, but not all three. Credit for "Explains that water absorbing at the chosen wavelength would change the reading and be mistaken for methane" requires "Chooses the shorter wavelength (3.3 micrometers)".
0 points: none. No correct required element; the response is incorrect, too vague to earn credit, irrelevant, blank, or only copies the prompt without answering.

FIND MORE LIKE THIS

Create questions › Chemistry or Physics › HS Physical Science › PS4 › PS4-5 › DOK 3 › Generate

Test Bank question

NGSS DOMAIN

Earth & Space Science

19 performance expectations, grouped by disciplinary core idea. In the Test Bank, choose the Earth Science course, then HS Earth Science.

Create questions › Earth Science › HS Earth Science › Core idea (DCI) › PE › Options: DOK › Generate

HIGH SCHOOL SCIENCE · EARTH & SPACE SCIENCE · ESS1 EARTH'S PLACE IN THE UNIVERSE

HS-ESS1-1 Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall that the Sun is powered by nuclear fusion and that mass becomes energy, a single fact with no reasoning required.

Use the drop-down menus to complete the sentences.

The Sun's energy comes from [nuclear fusion ▾]. In this process, a tiny amount of [mass ▾] is changed into a large amount of energy.

Drop-down 1 choices: **nuclear fusion ✓** | chemical burning | radioactive decay

Drop-down 2 choices: heat | oxygen | **mass ✓**

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS1 › ESS1-1 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must apply $E = mc^2$ in two steps, squaring c and then multiplying by the mass, to connect fusion to the Sun's energy output.

Each second, the Sun turns about 4.2×10^9 kg of mass into energy. The energy made from a mass m is $E = mc^2$, where $c = 3.0 \times 10^8$ m/s. About how much energy does the Sun release each second?

- ○ 1.3×10^{18} joules
- ○ 1.3×10^{28} joules
- ○ 3.8×10^{26} joules ✓
- ○ 3.8×10^{17} joules

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS1 › ESS1-1 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students weigh each piece of evidence against two competing models of the Sun's future and decide which evidence favors one model over the other.

Two students model how the Sun will change in the future.

Student A: "The Sun will shine the same until its hydrogen is gone, then it will suddenly go dark."

Student B: "The Sun will slowly brighten, then swell into a red giant, then shrink into a white dwarf."
Which pieces of evidence support Student B's model over Student A's? Select all that apply.

- [ ] The Sun has shone for about 4.6 billion years.
- [x] The Sun has brightened by about 30% since it formed.
- [x] Astronomers see red giants and white dwarfs with about the Sun's mass.
- [ ] The Sun is mostly hydrogen and helium.
- [x] When core hydrogen runs low, the core shrinks and heats up enough to fuse helium.

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS1 › ESS1-1 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · EARTH & SPACE SCIENCE · ESS1 EARTH'S PLACE IN THE UNIVERSE

HS-ESS1-2 Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students compare two wavelengths and recall that a shift to a longer wavelength is a redshift meaning the galaxy is moving away.

A galaxy's hydrogen line appears at 672 nm. In a lab, the same line is at 656 nm. Describe the shift in the line and what it tells about the galaxy's motion.

Model response: The line has shifted to a longer wavelength, by 16 nm, which is a redshift. This means the galaxy is moving away from Earth.

Rubric: 2 points: Identifies the shift as a redshift (a shift to a longer wavelength) and concludes that the galaxy is moving away from Earth.

1 point: Identifies the shift correctly or the direction of motion correctly, but not both.

0 points: Does not correctly describe the shift or the motion, for example says the galaxy is moving toward Earth or that it looks red.

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS1 › ESS1-2 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret spectral observations and decide which statements correctly link the line shift and line pattern to the Big Bang theory.

Astronomers measure the spectrum of light from a distant galaxy. The hydrogen and helium lines form the same pattern as in an Earth lab, but every line is shifted toward the red end of the spectrum. Which statements correctly explain how these observations support the Big Bang theory? Select all that apply.

- [x] The redshift shows the galaxy is moving away, which fits a universe that is expanding.
- [ ] The galaxy is moving away, which shows that its stars and atoms have grown larger over time.
- [ ] The redshift shows the galaxy has turned red as it moved farther away from Earth.
- [x] The line pattern shows hydrogen and helium, so the same elements exist far beyond Earth.
- [x] The galaxy's motion and makeup together fit a universe that began hot and dense.
- [ ] The redshift shows the galaxy is hotter than nearby galaxies, so it formed earlier.

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS1 › ESS1-2 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must combine three separate lines of evidence (redshift pattern, microwave background, hydrogen-helium ratio) into one written explanation of the Big Bang.

Scientists look at light from hundreds of distant galaxies. Almost all of them have spectral lines shifted toward longer, redder wavelengths compared with the same lines made in a lab on Earth, and farther galaxies show a bigger shift. Scientists also find faint microwave radiation filling all of space, and they find hydrogen and helium everywhere in about the same ratio. Use this evidence to explain the Big Bang theory. Describe what the redshift pattern shows about how galaxies are moving and what the microwave radiation and the hydrogen-to-helium ratio show about the early universe.

Model response: The redshift shows that galaxies are moving away from us, because their light waves are stretched. Since farther galaxies show more redshift, space itself is expanding and carrying galaxies apart. If we run the expansion backward, the universe must once have been much smaller, hotter and denser. The microwave radiation is the cooled glow left from that hot early stage, and the hydrogen-to-helium ratio matches the amounts of helium that would have formed by fusion in the first few minutes, while the universe was hot and dense. Together, these clues support a universe that began hot and dense and has been expanding and cooling ever since.

Rubric: 2 points: Explains that the redshift pattern (larger redshift at greater distance) shows galaxies moving apart in an expanding universe, and connects the microwave radiation and the hydrogen-to-helium ratio to a hot, dense early universe.
1 point: Correctly explains either the redshift pattern as expansion or the microwave radiation and hydrogen-to-helium ratio as evidence of a hot, dense early universe, but not both.
0 points: Gives no correct explanation, for example says redshifted galaxies look red, that all elements formed at the Big Bang, or that expansion makes atoms grow.

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS1 › ESS1-2 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · EARTH & SPACE SCIENCE · ESS1 EARTH'S PLACE IN THE UNIVERSE

HS-ESS1-3 Communicate scientific ideas about the way stars, over their life cycle, produce elements

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall the single fact that helium nuclei fuse to make carbon in a Sun-like star.

Near the end of its life, a star like the Sun has a core that is hot enough to fuse helium. Which element is mainly made when helium nuclei fuse?

- ○ Hydrogen
- ○ Iron
- ◉ Carbon ✓
- ○ Gold

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS1 › ESS1-3 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must relate two variables, star mass and core conditions, to explain why some stars build heavier elements than others.

Use the drop-down menus to complete the statement.

A researcher makes a chart of star mass and the heaviest element each star can fuse in its core. The chart would show that [more massive ▾] stars can fuse heavier elements. This is because their cores are [hotter and denser ▾].

Drop-down 1 choices: less massive | older | **more massive ✓**

Drop-down 2 choices: cooler and larger | **hotter and denser ✓** | made of iron

FIND MORE LIKE THIS

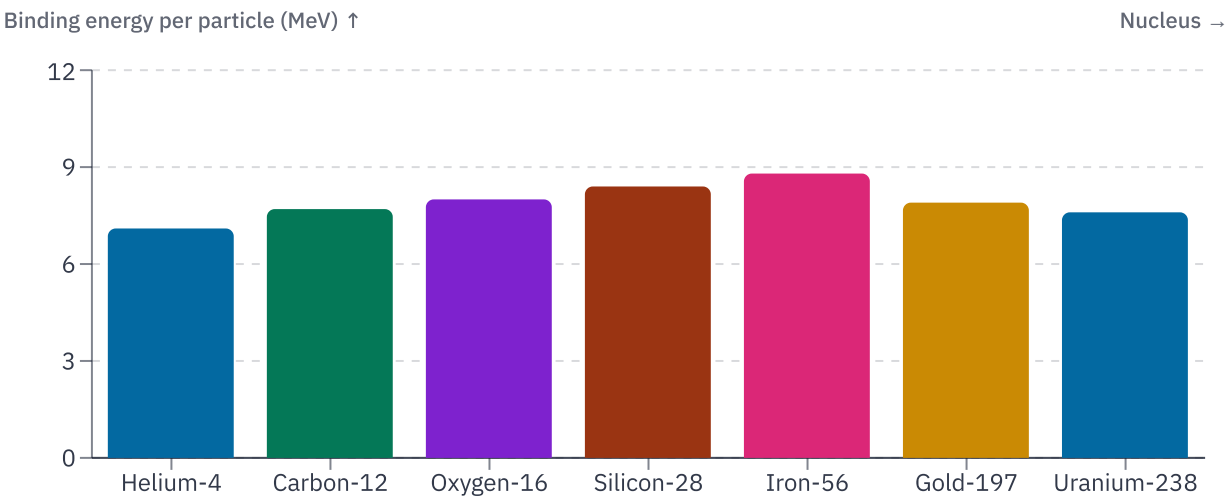
Create questions › Earth Science › HS Earth Science › ESS1 › ESS1-3 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate a claim using binding-energy data and must reason that fusing past iron absorbs energy, then pick the evidence that justifies it.

A student says, "Stars could make gold in their cores if they just got hot enough." Answer both parts.



Part A: Is the student's claim supported?

Choose one answer.

- [x] No, because making gold by fusion takes in energy.
- [ ] No, because stars cannot fuse anything past helium.
- [ ] Yes, because hotter cores can fuse any element.
- [ ] Yes, because gold has the most binding energy.

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- [ ] Helium-4 has the lowest value on the graph.
- [ ] Gold-197 is heavier than iron-56.

- Silicon-28 has a higher value than carbon-12.
- Binding energy per particle falls from iron to gold. ✓

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS1 › ESS1-3 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · EARTH & SPACE SCIENCE · ESS1 EARTH'S PLACE IN THE UNIVERSE

HS-ESS1-4 Use mathematical or computational representations to predict the motion of orbiting objects in the solar system

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall basic facts about elliptical orbits and Kepler's second law, such as faster motion near the Sun.

A comet moves on a long, stretched ellipse around the Sun. Which statements about the comet are correct? Select all that apply.

- [ ] The Sun is at the center of its ellipse.
- [ ] It moves at the same speed the whole time.
- [x] It moves slowest when it is farthest from the Sun. ✓
- [x] It moves fastest when it is closest to the Sun. ✓
- [ ] It moves fastest when it is farthest from the Sun.
- [x] Its distance from the Sun changes during its orbit. ✓

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS1 › ESS1-4 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students use ellipse geometry in two steps to find the far distance, then apply Kepler's second law to compare speeds.

Use the drop-down menus to complete the statement.

Halley's Comet has an average distance (semi-major axis) of 17.8 AU. Its closest distance to the Sun is 0.6 AU. For an ellipse, the closest and farthest distances add up to twice the average distance. The comet's farthest distance from the Sun is about [35 ▾] AU. At that point it moves [more slowly ▾] than at its closest point.

Drop-down 1 choices: 17.2 | 18.4 | **35 ✓**

Drop-down 2 choices: **more slowly ✓** | at the same speed | faster

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS1 › ESS1-4 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must plan how to run Kepler's third law backward, from a required period to an unknown distance, a non-routine multi-step problem.

Engineers want a satellite that orbits Earth once every 24 hours so it stays over one spot. A satellite 6,700 km from Earth's center takes 1.5 hours per orbit. About how far from Earth's center must the 24-hour satellite be?

- ○ About 107,000 km
- ○ About 42,000 km ✓
- ○ About 1,700,000 km
- ○ About 27,000 km

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS1 › ESS1-4 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · EARTH & SPACE SCIENCE · ESS1 EARTH'S PLACE IN THE UNIVERSE

HS-ESS1-5 Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall that continents grow by adding crust at their edges, which explains old centers and young margins.

The rock in the center of North America is billions of years old. The rock near the west coast is much younger. Which statement explains this pattern?

- ○ The west coast formed first, and the center formed later.
- ○ Pieces of crust were added to the edge of an old core over time. ✓
- ○ The rock in the center formed at a mid-ocean ridge.
- ○ Erosion near the coast wore away old rock and reset its age.

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS1 › ESS1-5 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students convert rock ages and distance into a spreading rate with unit conversion, then compare it with GPS data.

Use the drop-down menus to complete the statement.

A GPS station on one side of a ridge moves away from it by 3 cm each year. Rock 600 km from the ridge on that side is 20 million years old. The rock ages give a rate of [3 ▾] cm per year, which [matches ▾] the GPS rate.

Drop-down 1 choices: 0.3 | **3 ✓** | 30

Drop-down 2 choices: **matches ✓** | is far slower than | is far faster than

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS1 › ESS1-5 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students judge which conclusions the age data alone can justify and which need more evidence, reasoning about the limits of the data.

Scientists find a seamount chain whose ages rise toward the west. A student lists possible conclusions. Sort each conclusion by whether the ages alone justify it.

	Justified by the ages alone	Needs more evidence
The volcanoes formed one after another.	☑	☐
The plate moved at exactly 5 cm per year.	☐	☑
The plate moved west over a fixed hotspot.	☐	☑
The hotspot will stay active forever.	☐	☑
Either the plate moved west or the hotspot moved east.	☑	☐

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS1 › ESS1-5 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · EARTH & SPACE SCIENCE · ESS1 EARTH'S PLACE IN THE UNIVERSE

HS-ESS1-6 Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students read ages from a list and compare each one to 4 billion years, a direct look-up with no interpretation.

A student looks up the ages of several samples. Which samples are older than 4 billion years? Select all that apply.

- [x] Jack Hills zircon crystals, 4.4 billion years
- [x] Allende meteorite grains, 4.57 billion years
- [ ] Greenland Isua rocks, 3.8 billion years
- [ ] Moon mare lava, 3.3 billion years
- [x] Moon highland rocks, 4.4 billion years

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS1 › ESS1-6 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students turn an isotope ratio into a fraction left, count half-lives, compute an age and say what it means for early Earth.

A zircon from Earth's oldest crust has 1 atom of uranium-235 for every 63 atoms of lead-207. Uranium-235 has a half-life of about 0.7 billion years, and the zircon had no lead-207 when it formed. Calculate the age of the zircon. Show your work and explain what the age tells about early Earth.

Model response: With 1 parent for every 63 daughters, 1 out of 64 of the original uranium-235 is left, which is 1/64 = $(1/2)^6$, or six half-lives. The age is 6 × 0.7 = 4.2 billion years. This shows that Earth had solid crust at least 4.2 billion years ago, only a few hundred million years after it formed.

Rubric: 2 points: Finds that 1/64 of the parent is left (six half-lives) and an age of about 4.2 billion years with work shown, and explains that Earth had solid crust by then.
1 point: Gives the correct age without work or without the explanation, or uses the correct method but makes an arithmetic error.
0 points: Gives an incorrect age with no correct method, or no response.

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS1 › ESS1-6 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students draw conclusions about Earth's origin by combining ages and chemical makeup from three different kinds of samples.

A geologist compares a 4.57-billion-year-old meteorite, a 4.4-billion-year-old Moon rock, and a 4.0-billion-year-old Earth rock. The meteorite and Moon rock have similar amounts of certain elements, while the Earth rock has different amounts. Select True or False for each statement.

	True	False
The meteorite and Moon rock likely came from similar early material.	☑	☐
The Earth rock's different makeup shows Earth's crust changed.	☑	☐
The meteorite's age proves Earth has never changed.	☐	☑
The ages show Earth's crust formed after the solar system began.	☑	☐

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS1 › ESS1-6 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · EARTH & SPACE SCIENCE · ESS2 EARTH'S SYSTEMS

HS-ESS2-1 Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students name one internal process and one surface process and state what each did, recalling basic terms.

Kauai, one of the Hawaiian Islands, was built by volcanoes about 5 million years ago. Today it has deep canyons carved by rivers. Name the internal process and the surface process that shaped Kauai, and explain what each did.

Model response: The internal process was volcanism: magma from a hotspot rose and erupted, building the island. The surface process was erosion by rivers, which has cut deep canyons into the island since it stopped erupting.

Rubric: 2 points: Names volcanism (or rising magma over a hotspot) as the internal process that built the island and river erosion as the surface process that carved the canyons. 1 point: Names only one process correctly, or names both without explaining what each did. 0 points: Neither process is correct.

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS2 › ESS2-1 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students convert spreading rates, calculate opening times for two features and compare them, a multi-step use of table data.

The table shows two bodies of water formed by plates spreading apart. A rate of 1 cm per year equals 10 km every million years. Which statement is supported by the table?

Two Spreading Features

Feature	Width (km)	Spreading rate (cm per year)
Atlantic Ocean	4,500	2.5
Red Sea	300	1.5

- ○ Both features formed in about the same time.
- ○ The Atlantic took about 9 times as long to open as the Red Sea. ✓
- ○ The Red Sea took longer to open than the Atlantic.
- ○ The Atlantic opened in about 18 million years.

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS2 › ESS2-1 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students combine several clues about rock ages and active processes to reason how processes on different time scales shape one landscape.

A geologist is modeling the Cascade Range in the Pacific Northwest. The range has rock formations more than 50 million years old and volcanic peaks less than 2 million years old. Rivers are deepening valleys between the peaks today, and an ocean plate is still sinking beneath North America and feeding the volcanoes. Which statement best describes how processes at different time scales shape this landscape?

- ✓ Subduction has built the range over tens of millions of years, while rivers reshape its valleys over thousands of years.
- Subduction acts faster than river erosion, so the peaks will keep rising no matter how fast the rivers cut.
- River erosion formed both the young peaks and the deep valleys, so a single process on one time scale shaped the range.
- The young peaks formed at the surface and the old rocks formed inside Earth, so subduction no longer shapes the range.

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS2 › ESS2-1 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · EARTH & SPACE SCIENCE · ESS2 EARTH'S SYSTEMS

HS-ESS2-2 Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall how water vapor and warming affect each other and identify the feedback as amplifying.

Warmer air can hold more water vapor, and water vapor is a greenhouse gas. Select True or False for each statement.

	True	False
Warming adds water vapor to the air.	☑	☐
More water vapor traps more heat.	☑	☐
This is a balancing feedback.	☐	☑
This feedback links the ocean and the atmosphere.	☑	☐

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS2 › ESS2-2 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret a data table, comparing two variables over time to decide which conclusions about a feedback the data support.

Scientists tracked a permafrost site for 30 years. Which conclusions are supported by the data? Select all that apply.

Permafrost Site Data

Year	Summer thaw depth (m)	Methane released (g per m² per year)
1990	0.5	4
2005	0.8	9
2020	1.2	16

- [ ] Thaw depth stayed about the same.
- [x] Thaw depth more than doubled over 30 years. ✓
- [x] Methane release rose as thaw depth increased. ✓
- [ ] Methane release fell as the ground thawed deeper.
- [x] Methane release grew faster in the later 15 years. ✓

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS2 › ESS2-2 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must reason about which study design separates two possible causes, planning a fair test rather than recalling a fact.

A scientist wants to show that dust on snow, not warmer air, is the main reason a mountain snowpack melts early. Which study would best test this?

- ○ Measure the air temperature at one site for one spring.
- ○ Count how many dust storms occurred in the last decade.
- ○ Compare melting of cleaned and dusty snow plots side by side. ✓
- ○ Survey skiers about when the snow seemed to melt.

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS2 › ESS2-2 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · EARTH & SPACE SCIENCE · ESS2 EARTH'S SYSTEMS

HS-ESS2-3 Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall the basic convection model: heated rock becomes less dense and rises, cooled rock sinks, moving the plates.

Use the drop-down menus to complete the model of thermal convection in Earth's mantle.

In a model of Earth's interior, heat from radioactive decay causes mantle rock near the core-mantle boundary to become [less dense ▾] and rise, while cooler rock near the crust becomes [denser ▾] and sinks. This cycling of matter carries thermal energy from the interior toward the surface and drives the motion of [tectonic plates ▾] at the surface.

Drop-down 1 choices: more dense | **less dense ✓** | fully melted

Drop-down 2 choices: liquid | less dense | **denser ✓**

Drop-down 3 choices: the solid inner core | the liquid outer core | **tectonic plates ✓**

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS2 › ESS2-3 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students apply the convection concept to explain plate motion through solid rock, then choose the evidence that supports it.

Seismic waves show that Earth's mantle is solid rock. Yet the Pacific Plate above it moves about 8 cm a year. Answer both parts.

Part A: What mainly moves the plate?

Choose one answer.

- [x] Slow convection in the solid mantle
- [ ] The crust shrinking as it cools at night
- [ ] The inner core spinning under the plate
- [ ] Liquid iron in the outer core pushing up

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- [ ] S waves do not pass through the outer core, which shows it is liquid.
- [x] Seismic images show hot rock rising under ridges and cold slabs sinking.
- [ ] The inner core is solid and is the hottest layer of Earth's interior.
- [ ] Volcanoes along the plate's edges erupt hot magma onto the surface.

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS2 › ESS2-3 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must explain two observations with two different convection systems and justify the split with evidence about Earth's layers.

At the Mid-Atlantic Ridge, new crust forms evenly on both sides, and magnetic stripes in the crust match on both sides. A scientist wants to explain both the spreading and the stripes. Answer both parts.

Part A: Which explanation accounts for both?

Choose one answer.

- ◯ Mantle convection spreads plates; core convection flips the field. ✓
- ◯ Mantle convection causes both the spreading and the field.
- ◯ Core convection spreads plates; mantle convection flips the field.
- ◯ Neither is caused by convection inside Earth.

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ◯ Seismic waves show a liquid outer core and a solid mantle. ✓
- ◯ Spreading rates are different at different ridges.
- ◯ The inner core is hotter than the outer core.
- ◯ New crust forms evenly on both sides of the ridge.

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS2 › ESS2-3 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · EARTH & SPACE SCIENCE · ESS2 EARTH'S SYSTEMS

HS-ESS2-4 Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall the cause and effect of the greenhouse effect: more carbon dioxide traps outgoing heat.

A climate scientist explains why Earth's average surface temperature rose during the 20th century. Which statement correctly describes a cause and its effect?

- ○ Melting sea ice reflects more sunlight, so the Arctic warms faster.
- ○ Earth moved closer to the Sun each year, so it received more sunlight.
- ✓ More carbon dioxide traps outgoing heat, so the surface warms.
- ○ A steady tilt of Earth's axis made every summer warmer than the last.

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS2 › ESS2-4 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students calculate total energy gained from an imbalance and explain, at a basic level, why oceans slow surface warming.

Earth has an energy imbalance of about 1 W/m². Earth's surface area is about 5.1×10^{14} m². Calculate the extra energy Earth gains each second. Explain where most of this energy goes and why surface temperature rises only slowly.

Model response: Multiplying 1 W/m² by 5.1×10^{14} m² gives about 5.1×10^{14} W, or 5.1×10^{14} joules every second. About 90 percent of this energy goes into the oceans. Water can store a great deal of heat, so the ocean warms slowly and holds back the rise in surface temperature.

Rubric: 2 points: Calculates about 5.1×10^{14} W (joules per second) AND explains that most of the energy goes into the oceans, which store heat and slow surface warming. 1 point: Gives the correct calculation OR the correct explanation, but not both. 0 points: Neither the calculation nor the explanation is correct.

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS2 › ESS2-4 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate each prediction by reasoning about how fast each climate driver acts, applying time scales to new situations.

A student makes predictions about Earth's climate after different changes. Sort each prediction as reasonable or not reasonable.

	Reasonable	Not reasonable
Orbital changes will not cause an ice age within the next century	☑	☐
A big eruption next year would cool Earth for about two years	☑	☐
A smaller tilt will cool Earth within ten years	☐	☑
Continued emissions will keep warming Earth for decades	☑	☐
A strong El Niño will end global warming	☐	☑

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS2 › ESS2-4 › DOK 3 › Generate

Test Bank question

HS-ESS2-5 Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students identify independent, dependent and controlled variables, a routine classification of investigation parts.

A class plans an investigation of how water temperature affects how fast limestone dissolves. Sort each item by its role in the investigation.

	Independent variable	Dependent variable	Controlled variable
Length of time in the water	☐	☐	☑
Size of the limestone chips	☐	☐	☑
Temperature of the water	☑	☐	☐
Mass lost by the limestone	☐	☑	☐
Amount of water in each cup	☐	☐	☑

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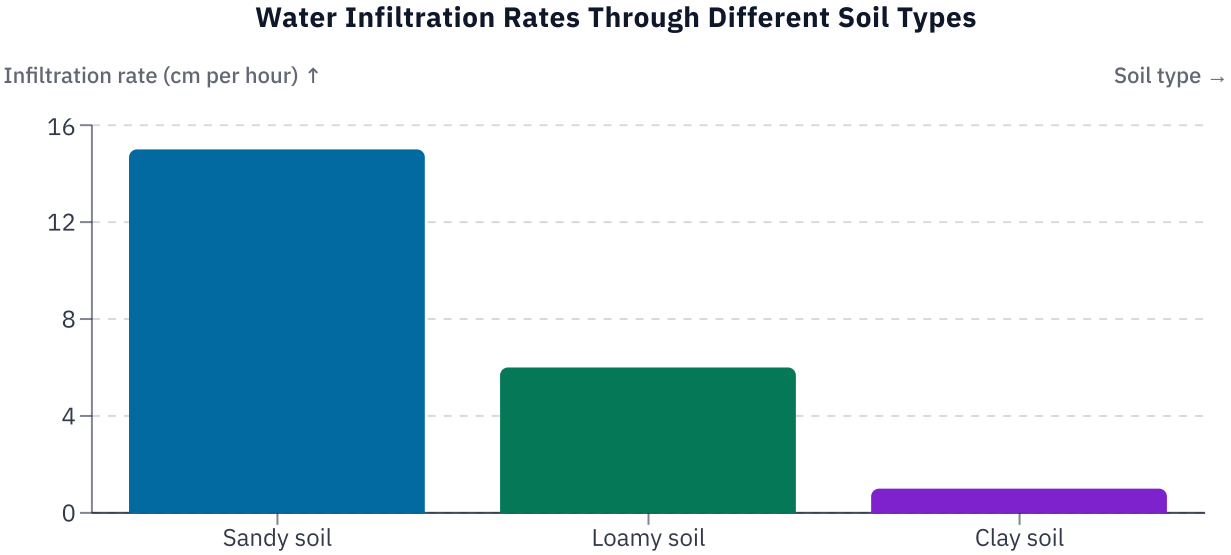
Create questions › Earth Science › HS Earth Science › ESS2 › ESS2-5 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret a bar graph and connect the pattern to soil grain spacing, explaining a relationship between material and water flow.

A student investigates how the structure of different soils affects how quickly water soaks in. The graph shows the infiltration rate for three soils. Which statement best explains the pattern in the data?



- ◯ Sand has larger spaces between grains, so water moves in faster than through clay's tiny spaces. ✓
- ◯ Clay is denser and harder than sand, so the water cannot push its way into clay as easily.
- ◯ Clay grains are larger and block the water, while small sand grains let the water slip past.
- ◯ Sand grains soak water up inside themselves, while clay grains repel water so it runs off.

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS2 › ESS2-5 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students design a complete investigation, choosing variables, controls, repeated trials and a prediction, which takes planning.

A student wants to find out whether water temperature affects how fast limestone dissolves in slightly acidic water. Design an investigation. Include the independent and dependent variables, at least two controlled variables, how you will make the results reliable, and the result you would expect if warmer water dissolves limestone faster.

Model response: I would put limestone chips of the same size and mass in slightly acidic water at 5 °C, 20 °C, and 40 °C. The independent variable is water temperature, and the dependent variable is mass lost. I would keep the water's pH, the volume of water, and the number of days the same. I would use three chips at each temperature and average the mass lost. If warmer water dissolves limestone faster, the 40 °C chips would lose the most mass and the 5 °C chips the least.

Rubric: 2 points: The response includes all required elements: Names temperature as the independent variable and mass lost as the dependent variable, gives at least two controls, includes repeated trials or averaging, and states the expected result.
1 point: The response includes one, two, or three of the four required elements above, but not all four.
0 points: No valid design. No correct required element; the response is incorrect, too vague to earn credit, irrelevant, blank, or only copies the prompt without answering.

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS2 › ESS2-5 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · EARTH & SPACE SCIENCE · ESS2 EARTH'S SYSTEMS

HS-ESS2-6 Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall **Why DOK 1:** Students recall which reservoir in the carbon cycle stores the most carbon.

A model of Earth's carbon cycle lists how much carbon each reservoir stores. Which reservoir stores the most carbon?

- ○ The deep ocean below 1,000 meters
- ○ The atmosphere as carbon dioxide gas
- ○ Sedimentary rocks such as limestone ✓
- ○ Forests and other land plants

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS2 › ESS2-6 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students apply the carbon cycle to a new case, explaining the process and tracing carbon through three Earth systems.

A gardener plows her garden every year. After each harvest, she leaves the soil bare with no plants until the next planting season. Over several years, she notices the soil has less carbon in it. Use the carbon cycle to explain what is causing this carbon loss and which Earth systems the carbon moves through as it leaves the soil.

Model response: The soil loses carbon mainly through decomposition. When the soil is bare and plowed, air reaches the dead plant matter more easily. Bacteria and fungi break down that matter faster, and their respiration releases carbon dioxide gas into the air. Because no plants are growing, photosynthesis cannot pull that carbon dioxide back out of the air and put it back into the soil. So the carbon moves from the geosphere (soil) through the biosphere (decomposers) into the atmosphere (carbon dioxide gas), instead of cycling back into the ground.

Rubric: 2 points: Names decomposition (respiration by soil bacteria and fungi) as the cause, and traces carbon from the soil through decomposers into the atmosphere as carbon dioxide, noting that no plants take it back in. 1 point: Names decomposition or respiration, or traces the path from soil to air, but not both. 0 points: Names no valid process and gives no correct path, or says the carbon is destroyed.

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS2 › ESS2-6 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students use the numbers to show carbon lost from plants matches carbon gained by air, and justify which process explains the change.

A student models carbon in a forest watershed before and after a wildfire. The table shows carbon in two pools. Soil and stream carbon stayed about the same. Answer both parts.

Carbon in a Forest Watershed (metric tons)

Carbon pool	Before fire	After fire
Trees and plants	850	300
CO_2 in the air above the forest	120	670

Part A: Which process best explains the change shown in the table?

Choose one answer.

- [x] Combustion released carbon from plant tissue into the air
- [ ] Respiration by trees released stored carbon into the air
- [ ] Decomposition of dead leaves moved carbon into the soil
- [ ] Volcanism released geosphere carbon into the air

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- [ ] Plant carbon was 850 tons before the fire.
- [ ] Soil and stream carbon stayed about the same.
- [x] Plant carbon fell by 550 tons, and air carbon rose by 550 tons.
- [ ] Air carbon above the forest rose to 670 tons after the fire.

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS2 › ESS2-6 › DOK 3 › Generate

Test Bank question

HS-ESS2-7 Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall basic facts about how photosynthetic microbes changed oxygen in Earth's air.

Scientists studied oxygen levels and fossils of photosynthetic organisms over Earth's history. Select True or False for each statement.

	True	False
Photosynthetic microorganisms in the oceans gradually changed the air by releasing oxygen.	☑	☐
The amount of oxygen in the air has stayed about the same for 4.6 billion years.	☐	☑
Before photosynthetic organisms spread, the air had about as much oxygen as today.	☐	☑
Fossils of oxygen-making cyanobacteria are evidence that life changed the air.	☑	☐

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS2 › ESS2-7 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret a timeline of evidence to link the spread of life to a rise in oxygen, a basic cause and effect relationship.

Use the drop-down menus to complete the statement.

Rock layers show that 2.5 billion years ago, oxygen in the air was less than 1 percent of today's level. Photosynthetic microorganisms first appeared around 3.5 billion years ago, and oxygen began rising a great deal about 2.4 billion years ago. This evidence suggests that [the spread of photosynthetic organisms ▾] caused [a gradual rise in oxygen ▾] in the air over time. The low-oxygen conditions of early Earth [ended as life changed the air ▾].

Drop-down 1 choices: changes in Earth's distance from the Sun; **the spread of photosynthetic organisms ✓**; volcanic eruptions

Drop-down 2 choices: a rise in carbon dioxide; a drop in nitrogen; **a gradual rise in oxygen ✓**

Drop-down 3 choices: ended because the Sun grew hotter; **ended as life changed the air ✓**; stayed the same

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS2 › ESS2-7 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must reason about which new findings would break the link between cause and effect, critiquing a scientific claim.

Scientists claim that cyanobacteria caused oxygen to build up in the air about 2.4 billion years ago. Which new findings would weaken this claim? Select all that apply.

- [x] A nonliving process is found that could release that much oxygen.
- [ ] Banded iron formations are found in rocks older than 2.4 billion years.
- [x] The oldest signs of cyanobacteria turn out to be younger than 2.0 billion years.
- [ ] Red, rusted soils are found only in rocks younger than 2.3 billion years.
- [ ] Stromatolites are found in rocks 3.5 billion years old.
- [x] Oxygen stayed flat during the times when cyanobacteria spread the fastest.

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS2 › ESS2-7 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · EARTH & SPACE SCIENCE · ESS3 EARTH AND HUMAN ACTIVITY

HS-ESS3-1 Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students sort items using the definition of a natural hazard versus a natural resource, which is recall and classification.

California has many natural hazards and many natural resources. Which items are natural hazards that affect where and how people live? Select all that apply.

- [ ] Gold deposits in the Sierra Nevada
- [x] Wildfires in dry hills ✓
- [x] Earthquakes along the San Andreas Fault ✓
- [ ] Fertile soil in the Central Valley
- [x] Winter floods in river valleys ✓

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS3 › ESS3-1 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret a two-variable table and calculate a percent change to decide which statements about rainfall and population are supported.

The table shows rainfall and population for a farming county over five decades. Sort each statement by whether the data support it.

Farming County Records

Decade	Average rainfall (cm per year)	Population
1900s	55	12,000
1910s	52	13,000
1920s	50	13,500
1930s	32	8,000
1940s	48	9,500

	Supported	Not supported
Population did not fully recover by the 1940s.	☑	☐
Rainfall had no link to population in any decade.	☐	☑
Population rose during the drought decade.	☐	☑
Population grew while rainfall stayed near 50 cm.	☑	☐
Population fell by about 40% in the drought decade.	☑	☐

FIND MORE LIKE THIS

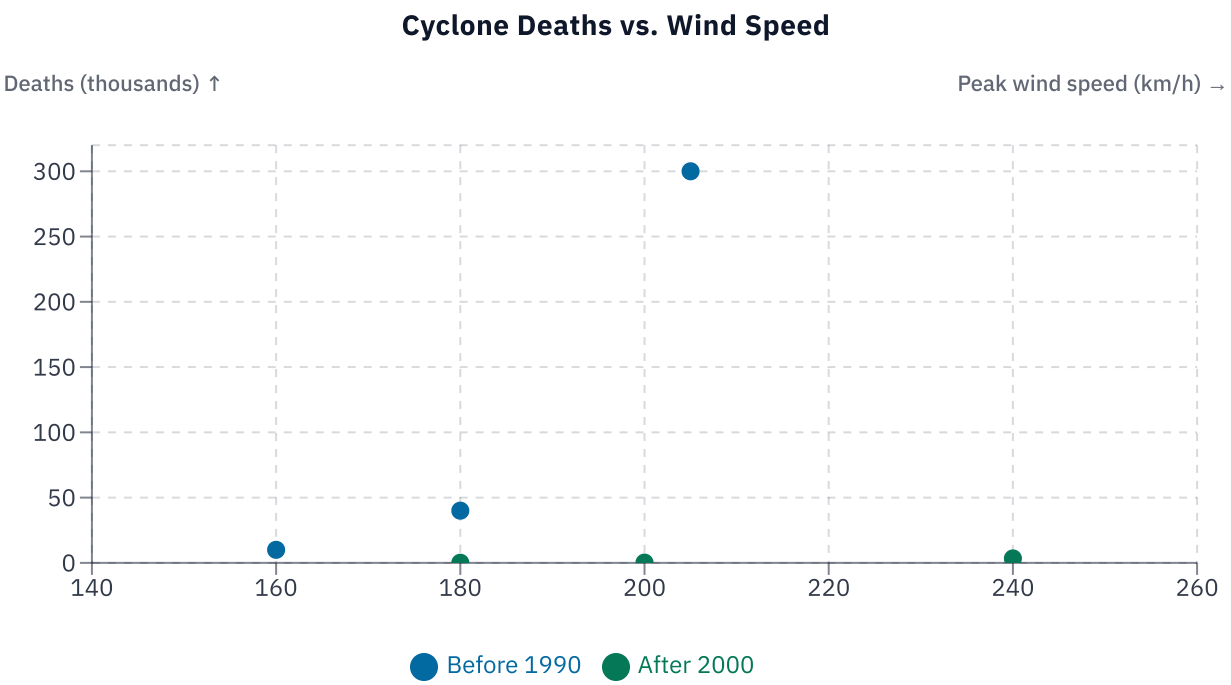
Create questions › Earth Science › HS Earth Science › ESS3 › ESS3-1 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students combine graph data with information about shelters to rule out a tempting explanation and draw a supported conclusion.

The graph shows cyclone strength and deaths for several storms in Bangladesh. Shelters were rare before 1990 and common after 2000. Which conclusion is best supported by the graph?



- ○ Deaths rose after shelters became common.
- ○ After 2000, even strong storms killed far fewer people. ✓
- ○ After 2000, storms were weaker, so fewer people died.
- ○ Wind speed alone explains the number of deaths.

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS3 › ESS3-1 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · EARTH & SPACE SCIENCE · ESS3 EARTH AND HUMAN ACTIVITY

HS-ESS3-2 Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall a basic fact about mineral resources: recycling aluminum avoids the energy needed to extract metal from new ore.

Aluminum can be made from newly mined bauxite ore or from recycled aluminum cans. Compared with making aluminum from new ore, recycling aluminum cans

- [x] uses much less energy, because the metal does not have to be extracted from ore again.
- [ ] uses much more energy, because the cans must be melted.
- [ ] creates new aluminum atoms, increasing the total amount of aluminum on Earth.
- [ ] requires mining more bauxite ore than making new aluminum does.

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS3 › ESS3-2 › DOK 1 › Generate

Written for this guide

DOK 2 · Skills & concepts

Why DOK 2: Students apply a freshwater limit to two lithium plans and judge each statement true or false, comparing cost against a constraint rather than recalling a fact.

Rosa evaluates lithium-resource alternatives. A battery-recovery plan supplies 30 lithium units at cost 75 and freshwater use 5. B uses a new extraction site, supplying 30 at cost 55 and freshwater use 20. The watershed limit is 10 units. Another student argues that the lowest direct cost always gives the best resource-management solution.

Compare two claims. Use the data and the science to decide. Decide whether each statement is justified. Select True or False for each statement.

	True	False
Prefer B solely because its direct price is lower. Failed environmental or social limits can always be offset by savings. Equal service, extraction impacts, resource depletion, safety, reliability and long-term monitoring are irrelevant to the cost–benefit judgment.	☐	☑
Reject every plan that has any tradeoff. A resource-management technology must remove all costs, risks and uncertainty instantly. Meeting required criteria can never justify choosing a plan that needs upkeep or leaves a residual environmental impact.	☐	☑
Recovery can reduce demand for new extraction and associated water withdrawal. Recycling efficiency, battery collection and competing watershed needs limit the benefit.	☑	☐
Prefer A under the freshwater limit. Recovery meets the same lithium demand with lower withdrawal pressure, while collection and processing costs remain tradeoffs.	☑	☐

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS3 › ESS3-2 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must write a recommendation, explain the science linking recycling to lower energy use, and state a limitation, building an evidence-based argument.

Grace evaluates aluminum-resource alternatives. A recycling plan supplies 100 metal units at cost 65 and energy use 20. B uses new ore, supplying 100 at cost 60 and energy use 70. The community requires energy use below 40 units. Another student argues that the lowest direct cost always gives the best resource-management solution.

Compare two claims. Use the data and the science to decide. State your conclusion. Explain the science that connects it to the data. State a limit or assumption.

Model response: Prefer A under the energy limit. Recycling provides the same metal service with lower processing-energy demand, despite a slightly higher direct cost. Recovering metal from used products can avoid some ore extraction and energy-intensive primary processing. Collection and contamination still constrain recovery rates. Compare benefits at the stated service level and enforce the required limits before weighing preferences. Check reliability, environmental and social effects, uncertainty and long-term costs. The recommendation is conditional on these criteria and the supplied evidence.

Rubric: One point each for an evidence-based conclusion, scientific reasoning, and the relevant limitation or assumption.

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS3 › ESS3-2 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · EARTH & SPACE SCIENCE · ESS3 EARTH AND HUMAN ACTIVITY

HS-ESS3-3 Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recognize which line is a rule of a simulation, using the basic meaning of a rule versus a starting value or output.

A student describes a trout simulation. Which line is a rule of the simulation?

- ○ The stream starts with 5,000 trout.
- ✓ Each year, births add 12% to the trout population.
- ○ After 30 years, 2,100 trout remain.
- ○ Trout live in cold, clean mountain streams.

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS3 › ESS3-3 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students explain how one management choice changes both a fish population and a community, relating several parts of a simulation.

A spreadsheet simulation tracks how fishing intensity (the percent of the fish population caught each year) affects a fish population and the fishing community that depends on it over 20 years. At 15% a year, the fish population stays near 10,000. At 25% a year, the fish population falls to 3,000 by Year 20, and the community loses income as some fishers leave the region. Explain how the simulation shows the relationship among fishing intensity, the fish population, and the community, and identify whether raising the intensity to 25% produces a stable or a changing system.

Model response: Fishing intensity is the resource management choice. At 15% a year, the fish reproduce about as fast as they are caught, so the population stays near 10,000 and fishers keep a steady income. At 25%, fish are removed faster than they reproduce, so the population falls to 3,000 by Year 20, and the fishing community loses income and some fishers leave. The increase from 15% to 25% turns a stable system into a changing one, and the drop in fish (biodiversity) directly causes the drop in human sustainability.

Rubric: 2 points: Explains that at 15% the catch is balanced by reproduction so the system is stable, that at 25% the catch exceeds reproduction so the fish decline and the system changes, and connects the fish decline to the community's loss of income. 1 point: Explains why one rate is stable or changing, or links the fish decline to community income, but does not do both. 0 points: Does not correctly relate fishing intensity to the fish population or the community.

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS3 › ESS3-3 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students analyze several years of data to infer how the management rule responds to change and justify classifying it as a balancing feedback.

A park's program sets a deer hunting quota each year based on that year's deer count. It also tracks a plant biodiversity index. Which statement best describes the management program?

Deer Management Program

Year	Deer population	Hunting quota	Biodiversity index
1	500	50	80
2	600	100	75
3	550	60	78
4	520	55	80

- ○ It is a negative feedback that makes the plants decline each year.
- ○ It is a negative feedback that brings the herd and plants back toward balance. ✓
- ○ It is a positive feedback that makes the herd grow larger each year.
- ○ It has no feedback, since the quota never changes with the herd.

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS3 › ESS3-3 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · EARTH & SPACE SCIENCE · ESS3 EARTH AND HUMAN ACTIVITY

HS-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students sort each project by its main goal, a direct classification of familiar solutions.

A county lists projects that reduce human impacts on the environment. Sort each project by its main goal.

	Reduces air pollution	Reduces water pollution	Protects habitat
Electric trucks at the port	☑	☐	☐
Fences keeping cattle out of streams	☐	☑	☐
A wildlife bridge over a freeway	☐	☐	☑
Upgraded sewage treatment	☐	☑	☐
Low-emission burners at a factory	☑	☐	☐
Restoring a tidal marsh	☐	☐	☑

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS3 › ESS3-4 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students compare three designs on several criteria in a table, including a cost-per-benefit comparison, to decide which conclusions hold.

A city compares three ways to reduce stormwater runoff from a 10-hectare neighborhood. Which conclusions are supported by the table? Select all that apply.

Stormwater Designs

Design	Runoff captured (%)	Cost ($ million)	Land needed (hectares)
Green roofs	40	6	0
Bioswales	55	3	1
Detention pond	70	2	3

- [x] The detention pond captures the most runoff. ✓
- [ ] The detention pond needs the least land.
- [x] Green roofs are the only design that needs no land. ✓
- [x] The bioswales cost half as much as the green roofs. ✓
- [ ] The green roofs capture the most runoff per dollar.

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS3 › ESS3-4 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate whether a solution can meet its stated goal by weighing the size of the problem it targets against the whole.

A city bans plastic straws and says this will "solve ocean plastic pollution." Studies estimate that straws make up about 0.03% of the plastic entering the ocean each year, while sources such as lost fishing gear and packaging make up much larger shares. Which evaluation of the city's claim is best supported?

- ✓ Not supported; straws are a tiny share of ocean plastic.
- Supported; straws are among the most common beach litter items.
- Supported; removing any one source stops ocean plastic from growing.
- Not supported; paper straws will add as much ocean waste instead.

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS3 › ESS3-4 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · EARTH & SPACE SCIENCE · ESS3 EARTH AND HUMAN ACTIVITY

HS-ESS3-5 Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth's systems

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall what an emissions scenario means in climate modeling, a single definition.

Climate scientists run their models under several scenarios, such as low emissions and high emissions. What does a scenario describe?

- ○ The exact temperature for a future year
- ○ A record of past weather at one station
- ○ One possible path of future human emissions ✓
- ○ A list of the model's computer programs

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS3 › ESS3-5 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students calculate two rates of glacier loss from data, compare them and project forward, which takes several steps.

Scientists measured the area of a Montana glacier: 3.0 km² in 1966, 2.4 km² in 1998, and 1.6 km² in 2015. Select True or False for each statement.

	True	False
The glacier lost about 0.02 km² per year from 1966 to 1998.	☑	☐
The glacier lost about 0.05 km² per year from 1998 to 2015.	☑	☐
The rate of loss slowed after 1998.	☐	☑
At the 1998–2015 rate, the glacier would be gone about 34 years after 2015.	☑	☐

FIND MORE LIKE THIS

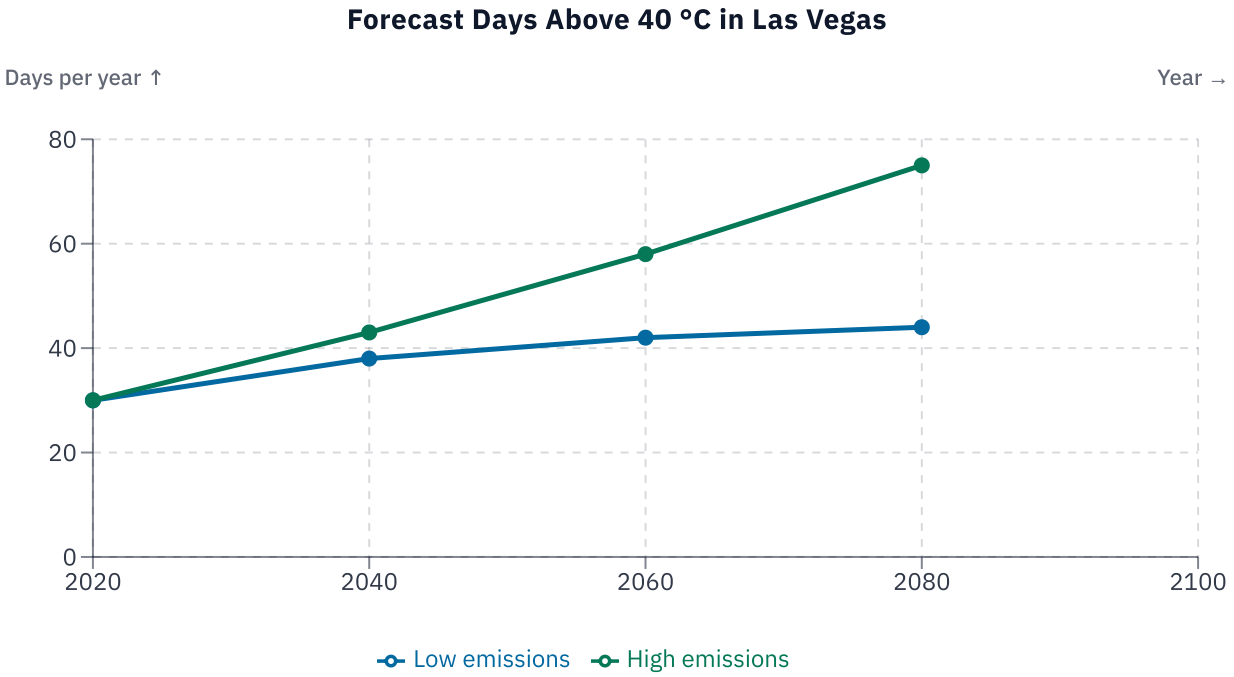
Create questions › Earth Science › HS Earth Science › ESS3 › ESS3-5 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate a claim against model forecasts for two scenarios, using the growing gap between them as evidence.

The graph shows a model forecast of summer days above 40 °C in Las Vegas under two scenarios. A council member claims that emission choices will not matter until after 2080. Which evaluation of the claim is best supported by the graph?



- ○ Not supported; low emissions reduce hot days below 30.
- ○ Supported; the gap first appears only after 2080.
- ○ Supported; both lines start at 30 days in 2020.
- ○ Not supported; the gap is already 16 days by 2060. ✓

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS3 › ESS3-5 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · EARTH & SPACE SCIENCE · ESS3 EARTH AND HUMAN ACTIVITY

HS-ESS3-6 Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall the term for a loop that makes the starting change larger: positive feedback.

A model shows that warming thaws Arctic permafrost. Microbes then break down the thawed soil and release CO_2 and methane, which cause more warming. Which term best describes this part of the model?

- ○ Negative feedback
- ○ Positive feedback ✓
- ○ Steady state
- ○ Carbon sink

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS3 › ESS3-6 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students use a carbon budget in several steps, subtracting two sinks and converting carbon to a CO_2 rise for each decade.

A carbon budget model gives yearly values for three decades. Adding 2.1 billion metric tons (Gt) of carbon to the air raises CO_2 by 1 ppm. Round to one decimal place. Choose the missing values from the drop-down menus.

Decade	Emissions (Gt)	Ocean uptake (Gt)	Land uptake (Gt)	Carbon staying in air (Gt)	CO_2 rise (ppm per year)
1970s	5.0	1.5	1.4	2.1	Blank 1
2000s	8.0	2.2	2.4	Blank 2	Blank 3
2010s	10.8	2.9	3.3	Blank 4	2.2

Blank 1 (Row 1, CO_2 rise (ppm per year)): 1.0 ▾

Blank 2 (Row 2, Carbon staying in air (Gt)): 3.4 ▾

Blank 3 (Row 2, CO_2 rise (ppm per year)): 1.6 ▾

Blank 4 (Row 3, Carbon staying in air (Gt)): 4.6 ▾

Drop-down 1 choices: 0.5 | **1.0 ✓** | 1.1 | 2.0

Drop-down 2 choices: 1.7 | **3.4 ✓** | 3.5 | 6.8

Drop-down 3 choices: 0.8 | **1.6 ✓** | 1.7 | 3.2

Drop-down 4 choices: 2.3 | **4.6 ✓** | 4.7 | 9.2

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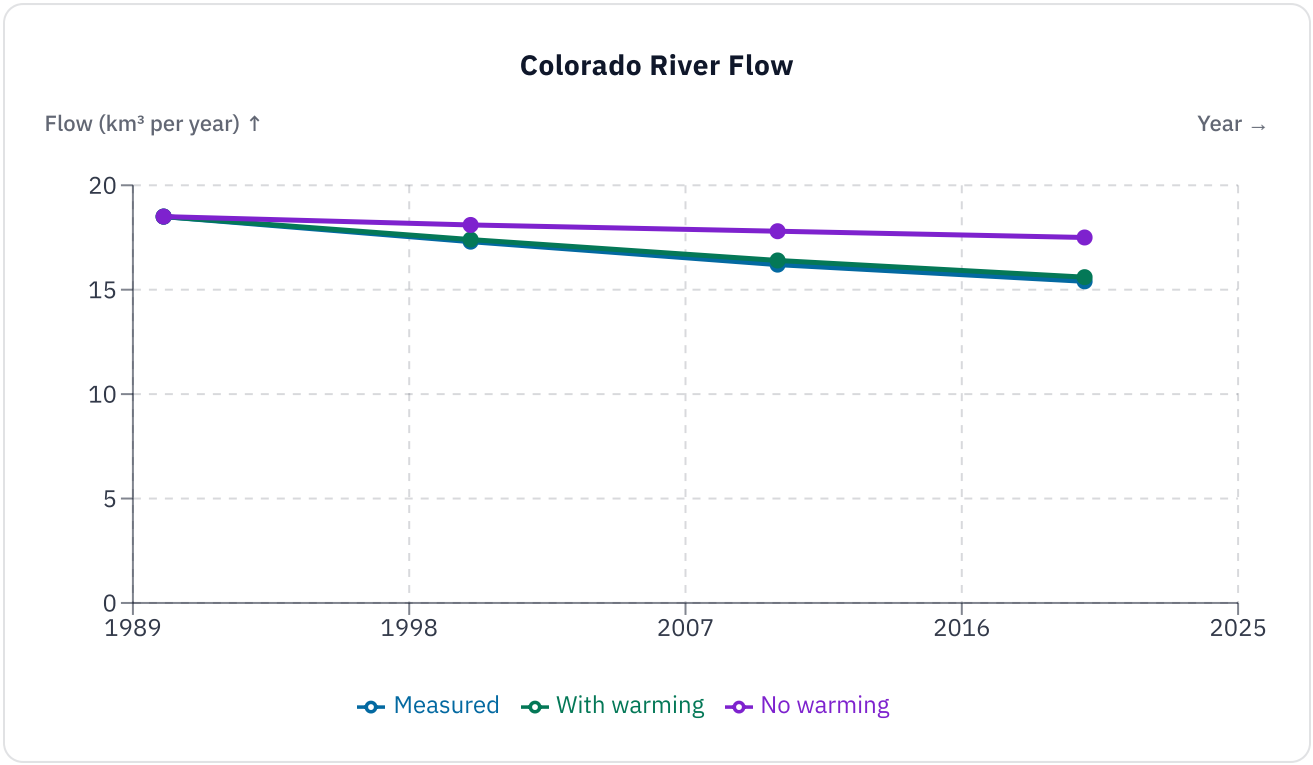
Create questions › Earth Science › HS Earth Science › ESS3 › ESS3-6 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students compare measured data with two model runs to separate the effect of warming from precipitation and estimate its share.

The graph shows measured flow of the Colorado River and two model runs. One run includes the measured warming, and one holds temperature at its 1990 level. Both use measured precipitation. Which conclusion is best supported by the graph?



- ○ Less precipitation explains all of the drop in flow.
- ○ Warming explains none of the drop in flow.
- ○ Warming has raised the river's flow since 1990.
- ○ Warming explains about two-thirds of the drop in flow. ✓

FIND MORE LIKE THIS

Create questions › Earth Science › HS Earth Science › ESS3 › ESS3-6 › DOK 3 › Generate

Test Bank question

NGSS CORE IDEA ETS1

Engineering Design

4 performance expectations, grouped by disciplinary core idea. Engineering Design questions show when Course is set to All.

Create questions › Course: All › HS Engineering Design › Core idea (DCI) › PE › Options: DOK › Generate

HIGH SCHOOL SCIENCE · ENGINEERING DESIGN · ETS1 ENGINEERING DESIGN

HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students identify the problem statement that repeats the stated numbers and community needs, which is recognizing given information rather than reasoning about it.

Aisha defines criteria for a city flood-management challenge. Flood risk is a global challenge with local watershed causes. The plan must retain 500 m³ of runoff in the design storm, cost no more than $200,000, and preserve emergency travel routes. Residents prioritize preventing home flooding and preserving a park used for cultural gatherings. The draft goal says only that the plan should make the city greener.

Specify measurable criteria and constraints that address the documented societal need. Which engineering problem definition is supported?

- ○ Assume the vendor's proposal satisfies every community's needs, then measure an unrelated feature; there is no reason to specify constraints or investigate which people receive the benefits and costs.
- ○ Ask only which design appears largest or most attractive, and accept a preference as proof of performance without measurements of the documented need, reliability or resource use.
- ○ Ask only which design has the smallest cost, ignoring the numerical performance requirement and safety limit; societal and environmental needs can be omitted because price determines success.
- ○ Ask which plan retains at least 500 m³ in the design storm within $200,000, preserves emergency routes, and reduces home flooding while maintaining access to the cultural gathering space. ✓

FIND MORE LIKE THIS

Create questions › Course: All › HS Engineering Design › ETS1 › ETS1-1 › DOK 1 › Generate

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must sort several statements, deciding which ones correctly connect measurable criteria, safety limits and community needs, which takes interpretation beyond recall.

Leila defines criteria for reducing highway air exposure. Air pollution is a global health challenge. Schools near a highway need a design that reduces the specified pollutant exposure by at least 30%, costs no more than $50,000, and does not block emergency access. Residents prioritize reliable reductions at the school entrance and do not want traffic diverted onto another neighborhood's streets. A proposal ranks barriers by height alone.

Specify measurable criteria and constraints that address the documented societal need. Which statements are scientifically justified? Select all that apply.

- [ ] Ask only which design appears largest or most attractive, and accept a preference as proof of performance without measurements of the documented need, reliability or resource use.
- [x] Ask which intervention cuts the specified exposure by at least 30% within $50,000 while preserving emergency access and avoiding transfer of exposure to a neighboring community.
- [x] Prioritize non-negotiable safety and resource limits, document stakeholder needs, and collect comparable evidence before selecting a solution; the cheapest or largest design is not automatically optimal.
- [x] Exposure depends on emissions and pollutant transport, not barrier height alone; a measurable reduction and safety limit must be considered alongside reliability and who bears the remaining exposure.
- [ ] Ask only which design has the smallest cost, ignoring the numerical performance requirement and safety limit; societal and environmental needs can be omitted because price determines success.

FIND MORE LIKE THIS

Create questions › Course: All › HS Engineering Design › ETS1 › ETS1-1 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students calculate a criterion from data, combine numerical and community needs into a problem definition, and justify which requirement cannot be traded off using evidence.

A coastal town is planning a new drinking-water supply. Freshwater shortage is a global challenge, and the town's wells are becoming salty as sea level rises. The town has 20,000 residents who use an average of 150 liters of water per person per day. The town can spend at most $12 million. State law requires drinking water to contain less than 250 mg/L of chloride. One option, a desalination plant, would use large amounts of electricity and would return very salty brine to a bay where local families fish. A community survey shows residents care most about a reliable supply during droughts and affordable water bills.

Write a problem definition for the engineers. In your answer:
(1) State at least two quantitative criteria or constraints, calculating any value you need from the data.
(2) State at least one qualitative criterion based on the community's needs.
(3) Explain which requirement must be treated as non-negotiable and why, using evidence from the scenario.

Model response: The design must supply at least 3,000,000 liters per day (20,000 residents × 150 L), cost no more than $12 million, and deliver water with less than 250 mg/L chloride. Qualitative criteria: the supply should stay reliable during droughts, keep water bills affordable, and avoid harming the bay where families fish (for example, by managing brine). The chloride limit is non-negotiable because it is a legal health standard; a design that fails it cannot be used no matter how cheap it is. Preferences such as lower energy use or lower bills can be traded off against each other once the required limits are met.

Rubric: One point for two correct quantitative criteria or constraints (including 3,000,000 L per day), one point for a qualitative criterion tied to community needs, and one point for justifying which requirement is non-negotiable with evidence.

FIND MORE LIKE THIS

Create questions › Course: All › HS Engineering Design › ETS1 › ETS1-1 › DOK 3 › Generate

Written for this guide

HIGH SCHOOL SCIENCE · ENGINEERING DESIGN · ETS1 ENGINEERING DESIGN

HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall why engineers break a complex problem into smaller parts, a basic fact about the design process with no data to interpret.

Engineers are designing a flood-protection system for a city. They break the large problem into smaller problems, such as storing rainwater upstream, enlarging storm drains and raising emergency roads. Why do engineers break a complex problem into smaller problems?

- ◯ Smaller problems can be solved and tested one at a time, and then the solutions are combined and checked as a whole system. ✓
- ◯ Each smaller problem can ignore the criteria and constraints of the whole project.
- ◯ Once every smaller part works by itself, the combined system never needs to be tested.
- ◯ Breaking a problem into parts removes all trade-offs between cost, safety and reliability.

FIND MORE LIKE THIS

Create questions › Course: All › HS Engineering Design › ETS1 › ETS1-2 › DOK 1 › Generate

Written for this guide

DOK 2 · Skills & concepts

Why DOK 2: Students judge each statement about how bridge subsystems interact, deciding whether a damper can replace supports, which requires applying a concept rather than recalling it.

Maya decomposes a bridge-retrofit challenge. A bridge must support traffic loads, resist wind motion and allow safe evacuation during repair. Deck, supports, dampers and access routes interact.

Break the problem into smaller subproblems. Check how the parts work together against the criteria and constraints. Decide whether each statement is justified. Select True or False for each statement.

	True	False
Break the challenge into load-bearing, vibration-control and safe-access subproblems, then verify that the combined retrofit meets the full traffic and safety criteria.	☑	☐
A damper carries the traffic loads as well as reducing motion, so adding dampers can stand in for supports that are too weak.	☐	☑
Add dampers to stop the swaying in wind, and once the measured motion is low enough, treat the supports and the traffic loads as needing no further check.	☐	☑
Loads transfer through connected structural parts. A damper affects motion but cannot replace adequate supports, and repair closures can change access even when structural tests pass.	☑	☐

FIND MORE LIKE THIS

Create questions › Course: All › HS Engineering Design › ETS1 › ETS1-2 › DOK 2 › Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students choose a decomposition plan and then justify it by reasoning about how intake, reuse, treatment and pipe losses interact within one shared water budget.

Rosa decomposes a sustainable water-supply challenge. A community must provide safe water while preserving river habitat under drought. Supply intake, treatment, reuse and distribution all share the same water budget.

Break the problem into smaller subproblems. Check how the parts work together against the criteria and constraints.

> Part A: Which decomposition plan is supported?
>
> Choose one answer.

- ○ Count reused water as new water from outside the system, so the shared river budget and the pipe losses never need to be checked against demand.
- ○ Design treatment for the best possible water quality, and treat the whole supply challenge as solved once the treated water is safe to drink.
- ○ Take as much river water as the community's demand needs during the drought, since protecting the river habitat is a separate problem for someone else to solve.
- ○ Break the challenge into intake limits, treatment quality, reuse and distribution, then check the combined design against demand and the protected environmental reserve. ✓

Part B: Which reasoning supports that conclusion?

Choose one answer.

- ○ Losses from the distribution pipes are always too small to change a supply budget, so they can be left out of every calculation.
- ○ Treatment adds new water to the supply as it cleans it, so building more treatment capacity means the community has more water to use.
- ○ Withdrawal and reuse affect source demand, while treatment determines safety. Distribution losses can invalidate a supply calculation even when each component meets its local target. ✓
- ○ Reusing treated water increases how much new water must be taken from the river, so reuse makes the shared water budget worse.

FIND MORE LIKE THIS

Create questions › Course: All › HS Engineering Design › ETS1 › ETS1-2 › DOK 3 › Generate

Test Bank question

HIGH SCHOOL SCIENCE · ENGINEERING DESIGN · ETS1 ENGINEERING DESIGN

HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall what a trade-off means in engineering design, a single definition with no data or decision to make.

When engineers evaluate competing solutions to a real-world problem, they often must accept a trade-off. What is a trade-off in engineering design?

- ○ A requirement that every possible design meets at no extra cost.
- ○ Giving up some of one desired quality, such as low cost, to gain more of another, such as safety or reliability. ✓
- ○ A test result showing that a design is perfect on every criterion.
- ○ The rule that the cheapest design should always be chosen.

FIND MORE LIKE THIS

Create questions › Course: All › HS Engineering Design › ETS1 › ETS1-3 › DOK 1 › Generate

Written for this guide

DOK 2 · Skills & concepts

Why DOK 2: Students must rule out the unsafe design, then multiply and add weighted ratings from a table to compare designs, a multistep procedure applied to data.

Engineers rate four designs for a school cooling system from 1 (poor) to 5 (good). They find Design D fails the required safety test. The other three pass. Rule out unsafe designs first. Multiply each rating by its weight and add. The weights show how much each goal matters to the community.

Which safe design has the best weighted score?

Design A, Design B, Design C, and Design D by Criterion

Criterion (weight)	Design A	Design B	Design C	Design D
Cost (1)	2	5	4	3
Durability (1)	3	5	3	1
Ease of repair (4)	3	4	2	5

- ○ Design C
- ○ Design D
- ○ Design A
- ○ Design B ✓

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students weigh a cheaper, higher-output dam against a required fish-passage limit and must justify their recommendation with the science of energy and river habitat.

Carlos uses a stormwater-network simulation. The model uses rainfall timing, storage and drain capacity as inputs. It reports peak flow and emergency-route inundation. Added upstream storage reduces peak flow, but one longer storm still floods an escape route.

Use the model’s rules. Check its assumptions.

Part A: Which model prediction is supported?

Choose one answer.

- Test only the short storm in the model, because the length of a storm does not change how much water reaches the drains or the escape routes.
- Reject upstream storage completely, since any flood design that fails in one storm is useless, whatever it does to peak flow in the other storms.
- ✓ Use the simulation to compare peak flow and route safety across storms, and refine the design for the longer-storm failure.
- Use the simulation to choose the added storage now, because it lowers peak flow in the 2-hour storm, so the longer storm and the escape routes need no more study.

Part B: Which reasoning supports that conclusion?

Choose one answer.

- Peak flow depends only on how much rain falls in total, not on how the rain and the stored water are timed during a storm.
- ✓ Storage delays runoff but has finite capacity. Storm duration and connected flow paths determine whether retained water reduces or merely postpones downstream flooding.
- Water released from upstream storage cannot reach the downstream drains or the emergency routes, whatever the flow paths.
- Upstream storage removes runoff from the system for good, so the storage can never fill up, however long the storm lasts.

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Test Bank question

HIGH SCHOOL SCIENCE · ENGINEERING DESIGN · ETS1 ENGINEERING DESIGN

HS-ETS1-4 Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem

Examples at: DOK 1 DOK 2 DOK 3 ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students identify which quantity a simulation calculates, a direct reading of the model's description with no interpretation of results.

A city uses a computer simulation to study traffic pollution near schools. The model takes the number of vehicles per hour, the emission rate of each vehicle type, and wind speed and direction. It then calculates the air-pollution level at each school. Which of these is an output of the simulation?

- ○ Number of vehicles per hour
- ○ Wind speed and direction
- ○ Air-pollution level at each school ✓
- ○ Emission rate of each vehicle type

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DOK 2 · Skills & concepts

Why DOK 2: Students interpret a table of simulation outputs, comparing each area to the limit to see that a low city average hides one neighborhood that fails.

Tyler uses a transit-and-exposure simulation. The model uses travel demand, vehicle emissions and street airflow as inputs. Its outputs are access and pollution exposure. A transit plan lowers average exposure but leaves one neighborhood above the required limit.

Use the model's rules. Check its assumptions. Which model prediction is supported?

Transit-plan model outputs

Area	Pollution exposure (µg/m³)	Required limit (µg/m³)
City average	28	40
Neighborhood A	35	40
Neighborhood B	46	40

- ◯ Use neighborhood exposure and access outputs to refine the plan; a lower average alone does not show that all required community limits are met. ✓
- ◯ Leave the neighborhood above the limit out of the comparison, because one area with high exposure is an outlier that does not reflect the plan.
- ◯ Use the model to adopt the transit plan now, because the citywide average exposure falls below the required limit, so each neighborhood does not need to be checked.
- ◯ Reject the simulation and the transit plan, since no model can predict exactly what one person breathes, so its neighborhood outputs cannot guide the design.

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students decide how to use simulation results across different storms and justify it by reasoning that finite storage only delays runoff in longer storms.

Carlos uses a stormwater-network simulation. The model uses rainfall timing, storage and drain capacity as inputs. It reports peak flow and emergency-route inundation. Added upstream storage reduces peak

flow, but one longer storm still floods an escape route.

Use the model's rules. Check its assumptions.

Part A: Which model prediction is supported?

Choose one answer.

- ○ Test only the short storm in the model, because the length of a storm does not change how much water reaches the drains or the escape routes.
- ○ Reject upstream storage completely, since any flood design that fails in one storm is useless, whatever it does to peak flow in the other storms.
- ○ Use the simulation to compare peak flow and route safety across storms, and refine the design for the longer-storm failure. ✓
- ○ Use the simulation to choose the added storage now, because it lowers peak flow in the 2-hour storm, so the longer storm and the escape routes need no more study.

Part B: Which reasoning supports that conclusion?

Choose one answer.

- ○ Peak flow depends only on how much rain falls in total, not on how the rain and the stored water are timed during a storm.
- ○ Storage delays runoff but has finite capacity. Storm duration and connected flow paths determine whether retained water reduces or merely postpones downstream flooding. ✓
- ○ Water released from upstream storage cannot reach the downstream drains or the emergency routes, whatever the flow paths.
- ○ Upstream storage removes runoff from the system for good, so the storage can never fill up, however long the storm lasts.

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Test Bank question

Sources

- Performance expectations and disciplinary core ideas: NGSS Lead States (2013), Next Generation Science Standards: For States, By States. https://www.nextgenscience.org

- State science test (CAST) item specifications: these describe PEs and item clusters but do not assign DOK levels.
- DOK level definitions: Webb Depth of Knowledge, as used by Smarter Balanced, summarised on the "How to use" page.
- Example questions: the AchieveMetrics Test Bank, reviewed for this guide.

AchieveMetrics Test Bank · DOK Progression Guide · High School Science · October 2026 edition.