

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.

DOK 1 Recall

DOK 2 Skills & concepts

DOK 3 Strategic thinking

DOK 4 Extended thinking

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

achievetricstestbank.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.

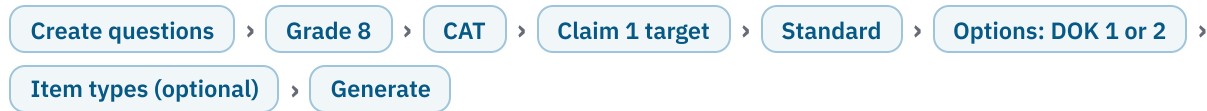
Which DOK levels each target is assessed at comes from the official Smarter Balanced test blueprint for this grade (2015–16 Summative Technical Report, Appendix 2.A). Every example was checked by hand against the DOK definitions above, not just its Test Bank tag. A few targets had no Test Bank question 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)

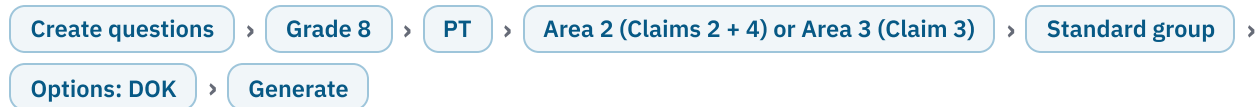
Claim 1 questions are filed by target and standard.



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.



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.



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.

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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 $0.8333\ldots$ repeats. Convert this repeating decimal into a fraction in simplest form.

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

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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.	☐	☒

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Test Bank question

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

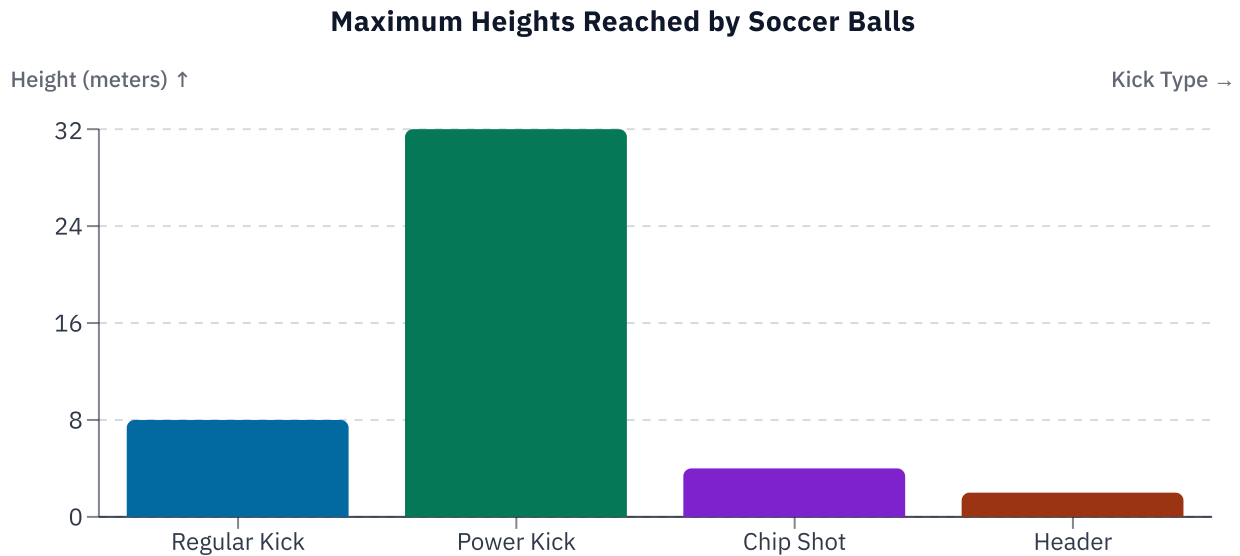
☐ When multiplying powers with the same base, subtract the exponents

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Test Bank question

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 $2^5 - 2^3 = 2^1$

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Test Bank question

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

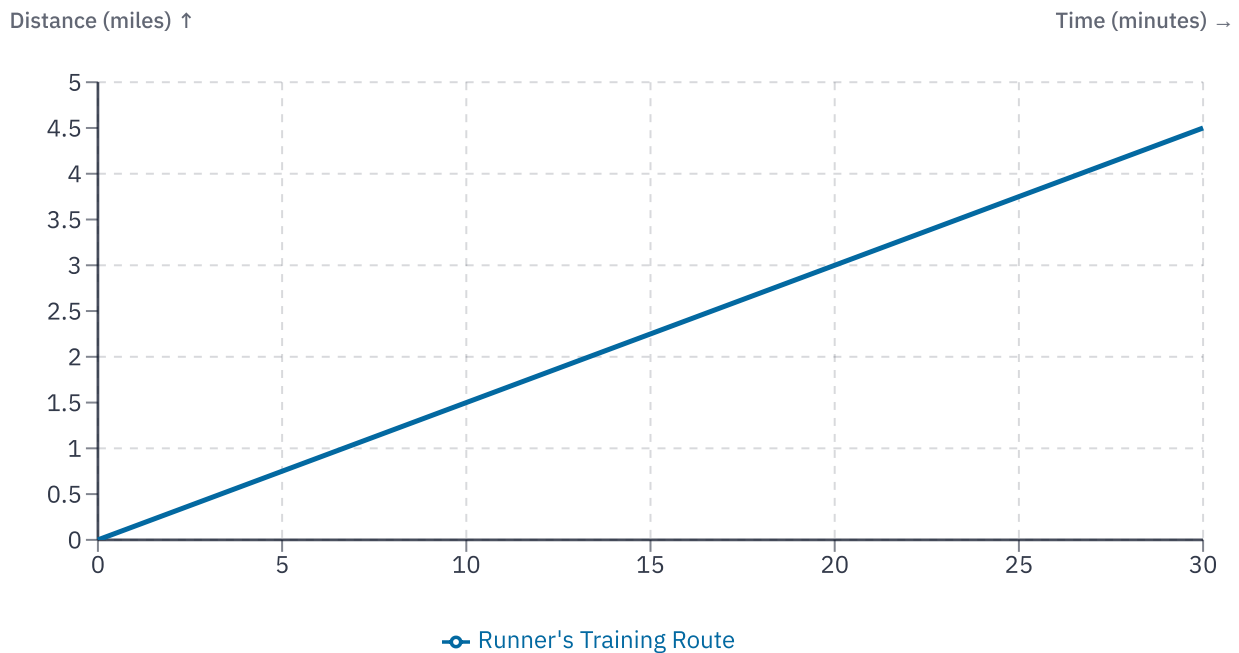
DOK 4

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?

Training Run Distance Over Time



☐ 0.25 miles per minute

☐ 0.20 miles per minute

☒ 0.15 miles per minute ✓

☐ 0.10 miles per minute

FIND MORE LIKE THIS

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.

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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**

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Test Bank question

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

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Test Bank question

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.

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Test Bank question

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.

- ☐ 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.
- ☐ Player B's total points after 5 games would be 40 points. ✓
- ☐ Player A's scoring pattern is a linear function. ✓

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Test Bank question

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

, and the function the point $(0, 5)$.

Drop-down 1 choices: Drop-down 2 choices:

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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?

☐ $C = 7h + 21$

☐ $C = 15h + 5$

☐ $C = 12h + 11$

☒ $C = 8h + 19$

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Test Bank question

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.

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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

☐ Rotate Triangle A 90 degrees counterclockwise about the origin ✓

☐ Reflect Triangle A across the x -axis ✓

☐ Translate Triangle A 5 units right and 2 units up ✓

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Test Bank question

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.

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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**

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Test Bank question

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

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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.	☒	☐

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Test Bank question

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

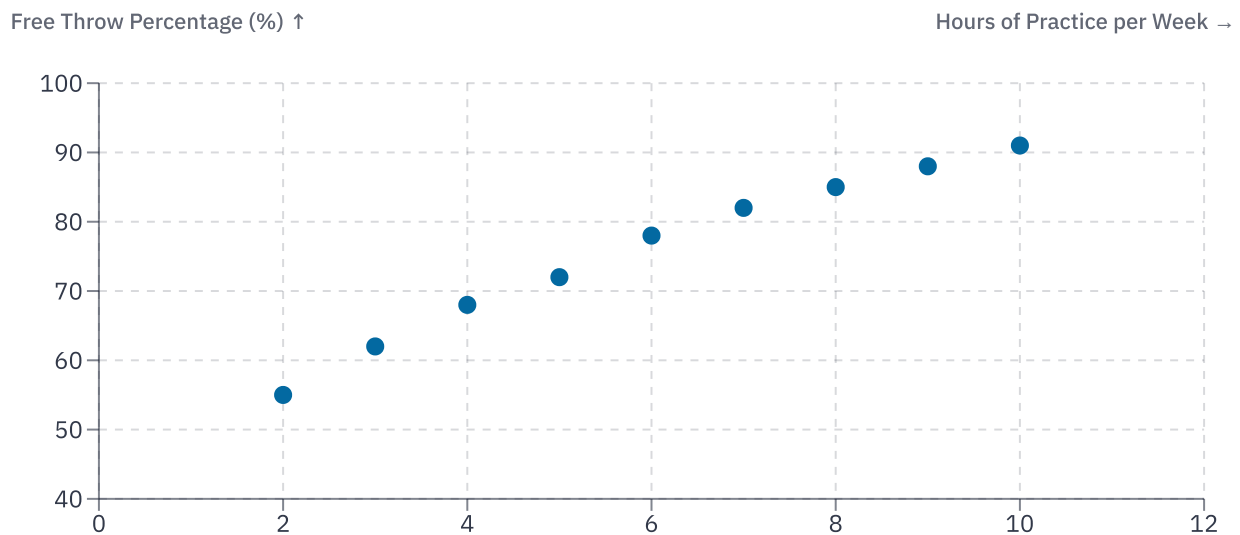
Assessed at: **DOK 1** **DOK 2** DOK 3 DOK 4

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?

Hours of Practice vs. Free Throw Percentage for Basketball Players



- ☐ 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. ✓

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Test Bank question

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.

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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.

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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 ✓

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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.

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Written for this guide

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
- ☒ A spreadsheet application to create columns for each game and calculate total points ✓
- ☒ A calculator or computer program to find the average points per game ✓
- ☒ A data table or chart to display the points scored in each game ✓

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Test Bank question

A basketball coach is analyzing player performance. Player A's free throw percentage is $0.\overline{83}$ (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 $0.\overline{83}$ equals approximately 0.833, while Player B's percentage is 0.64, so Player B is more accurate.
- ☒ Player A's percentage of $0.\overline{83}$ equals approximately 0.833, while Player B's percentage is 0.8, so Player A is more accurate. ✓
- ☐ Player A's percentage of $0.\overline{83}$ equals approximately 0.833, while Player B's percentage is 0.9, so Player B is more accurate.
- ☐ Player A's percentage of $0.\overline{83}$ equals approximately 0.888, while Player B's percentage is 0.8, so both players are equally accurate.

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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.

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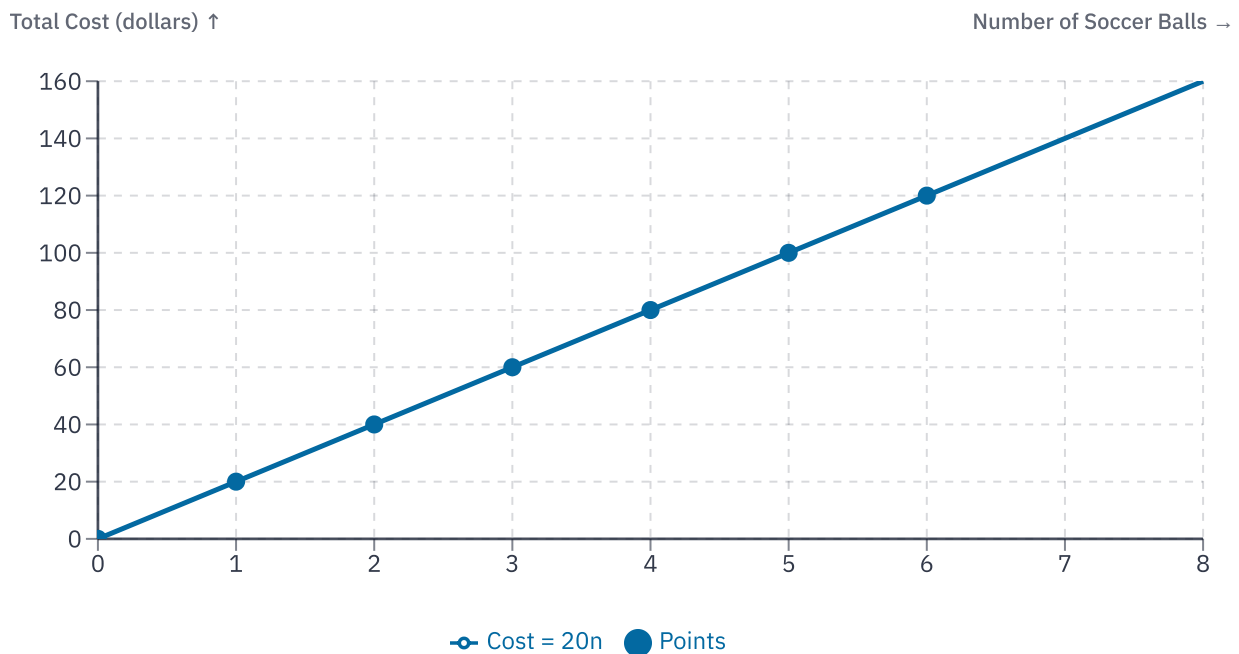
2C Interpret results in the context of a situation

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?

Soccer Ball Sales at the School Store

☐ 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.

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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.

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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.

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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.

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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.

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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

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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.

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Test Bank question

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

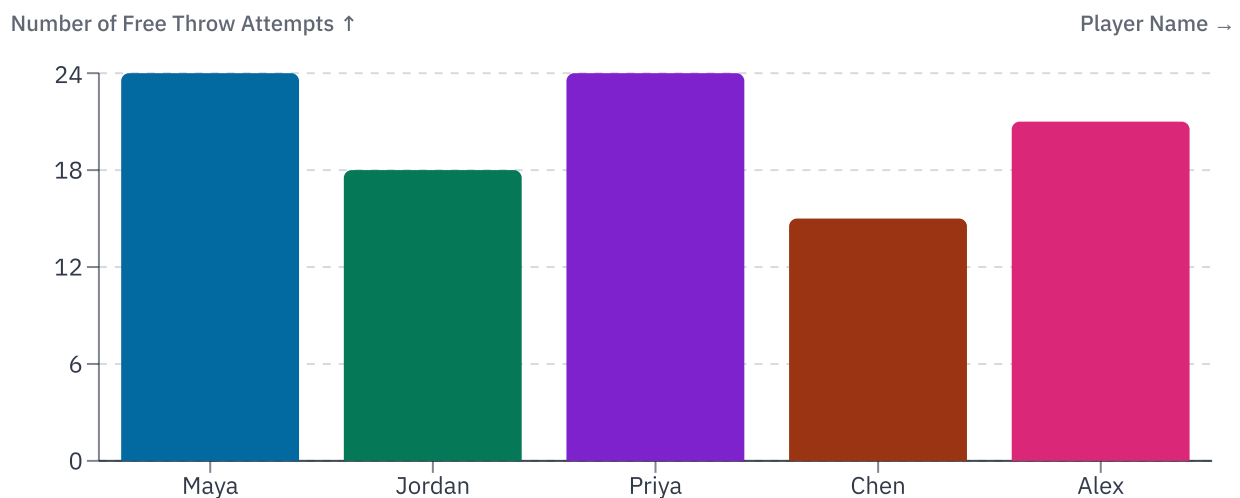
Assessed at: **DOK 1** **DOK 2** **DOK 3** **DOK 4** DOK 4 is assessed only in the performance task.

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?

Basketball Free Throw Attempts by Player



- ☐ 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.

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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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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.

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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.

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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 $180^\circ - 40^\circ - 65^\circ = 75^\circ$. 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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3D Use the technique of breaking an argument into casesAssessed 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.

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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.

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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: $x = 14$

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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. ✓

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

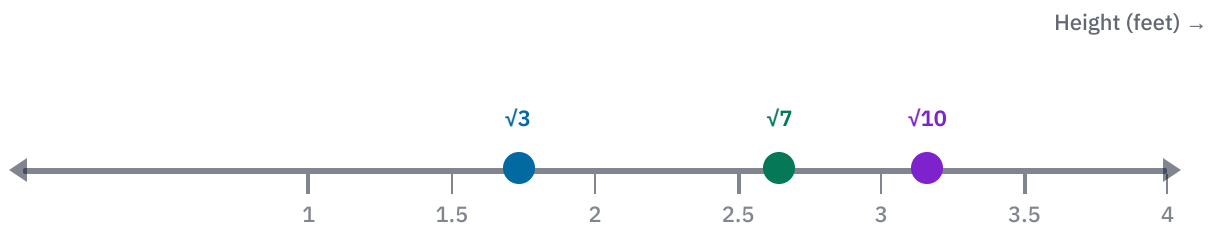
Assessed at: DOK 1 **DOK 2** DOK 3 DOK 4

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.

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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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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.

☐ $a = -2$ ☒ $a = 0$ ✓☒ $a = \frac{1}{2}$ ✓☒ $a = 1$ ✓☐ $a = 3$

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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.

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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.

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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.

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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.

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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.

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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.

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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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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

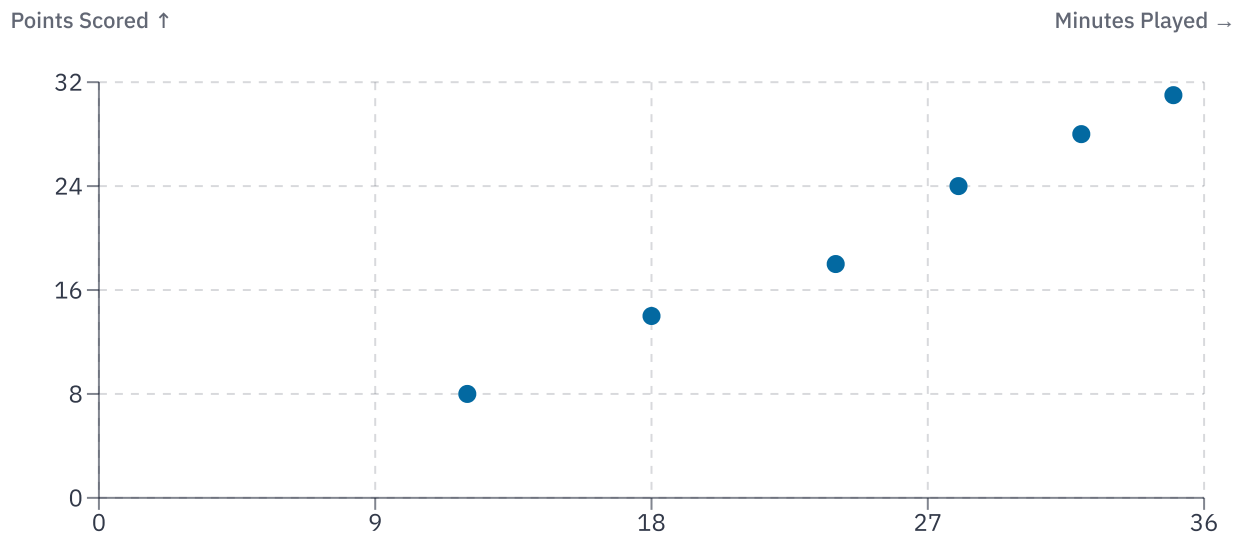
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Test Bank question

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?

Basketball Player Performance: Points Scored vs. Minutes Played



- ☐ 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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Test Bank question

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

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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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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.

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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

- Compare Devon's model to the measurements. Describe how well the model fits.
- Write an improved model and explain why it is better.
- 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.

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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.

- 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.
- Build an improved linear model using the data. Explain what each part of your model represents in the situation.
- Test your new model on all four events and explain how well it fits.
- 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.
- 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.

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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

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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.

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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.

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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.

- Identify which information in the resources you need and which you do not need.
- Decide how many shirts the club should order and which vendor to use. Show your work.
- 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.

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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.

- Find how many gallons of water the roof collects in a typical June week.
- Find the capacity of each barrel in gallons.
- 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.
- 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.

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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.

