

BENCHMARK MA.C.2.4.2**Strand**

C Geometry and Spatial Sense

Standard

2 The student visualizes and illustrates ways in which shapes can be combined, subdivided, and changed.

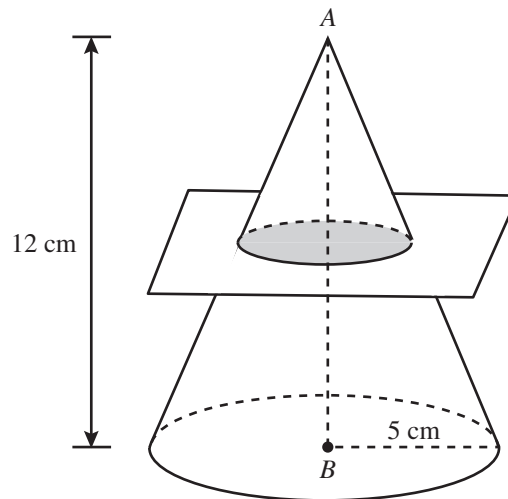
Benchmark**MA.C.2.4.2 The student analyzes and applies geometric relationships involving planar cross-sections (the intersection of a plane and a three-dimensional figure).**

This benchmark is not assessed at Grade 9.

Item Type	At Grade 10, this benchmark will be assessed using MC items.
Benchmark Clarification	Students will analyze and apply geometric properties to solve problems involving planar cross-sections.
Content Limit	Items should include only right circular cylinders, right circular cones, right square pyramids, spheres, or rectangular prisms.
Stimulus Attributes	Items may be set in either real-world or mathematical contexts. Graphics should be used in all of these items.

Sample MC Item

The right circular cone in the figure below is intersected halfway between point A and point B by a plane parallel to the base of the cone. The height of the cone is 12 centimeters (cm) and the radius of the base is 5 centimeters.



A smaller cone is created by the intersection of the cone and the plane. Which is closest to the area of the base of the smaller cone?

- A. 7.9 square centimeters
- B. 15.7 square centimeters
- ★ C. 19.6 square centimeters
- D. 39.3 square centimeters

Item Context Mathematics

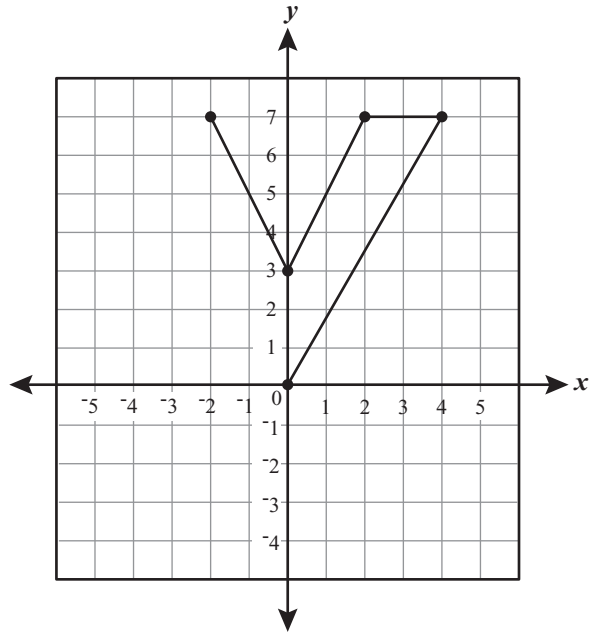
BENCHMARK MA.C.3.4.1

Strand	C Geometry and Spatial Sense
Standard	3 The student uses coordinate geometry to locate objects in both two and three dimensions and to describe objects algebraically.
Benchmark	<p>MA.C.3.4.1 The student represents and applies geometric properties and relationships to solve real-world and mathematical problems including ratio, proportion, and properties of right triangle trigonometry.</p> <p>Also assesses MA.C.2.4.1 The student understands geometric concepts such as perpendicularity, parallelism, tangency, congruency, similarity, reflections, symmetry, and transformations including flips (reflections), slides (translations), turns (rotations), enlargements, rotations, and fractals.</p>

Item Types	At Grade 9, this benchmark will be assessed using MC and GR items.
Benchmark Clarification	Students will apply geometric properties, formulas, and relationships in the coordinate plane to solve real-world and mathematical problems, including ratio, proportion, and right triangle geometry.
Content Limit	Items should not assess trigonometric functions.
Stimulus Attributes	<p>Items may be set in either real-world or mathematical contexts.</p> <p>Items may assess right-triangle geometry. Methods of solving may include the Pythagorean theorem, and should not rely exclusively on the 30-60-90 or 45-45-90 triangle relationships.</p> <p>Items may assess properties and relationships pertaining to regular and irregular two-dimensional shapes, and the concepts of symmetry, reflections, congruency, similarity, perpendicularity, parallelism, and transformations.</p> <p>Rectangular coordinate planes should be used in all items.</p>

Sample MC Item

Tila is creating the letters for a “Value Day Sale” sign for her store on a coordinate grid.



What should the missing coordinate be on the graph to make the letter “V” symmetric about the y -axis?

- A. (4, 7)
- B. (7, 4)
- ★ C. (-4, 7)
- D. (7, -4)

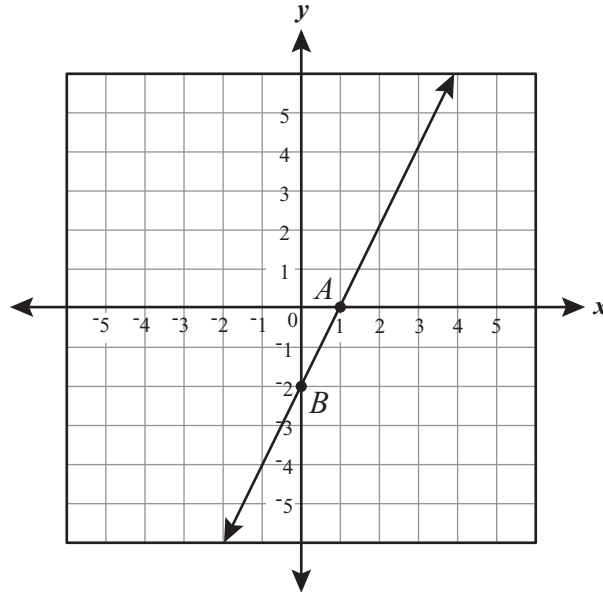
Item Context

Workplace

Sample GR Item



The graph of \overleftrightarrow{AB} below represents the equation $y = 2x - 2$.



If \overleftrightarrow{AB} is reflected once over the x -axis, what would be the new value of y when $x = 0$?

	○	○	○	
○	○	○	○	○
0	0	0	0	0
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6
7	7	7	7	7
8	8	8	8	8
9	9	9	9	9

Sample Response

2

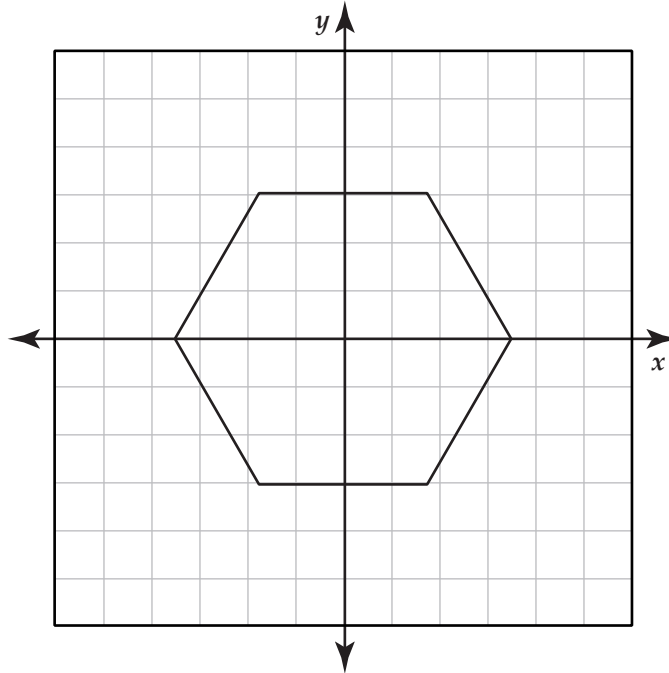
Item Context

Mathematics

Item Types	At Grade 10, this benchmark will be assessed using MC and GR items.
Benchmark Clarification	Students will represent, apply, and/or explain geometric properties, formulas, and relationships to solve a problem.
Content Limit	Items should not assess trigonometric functions.
Stimulus Attributes	<p>Items may be set in either real-world or mathematical contexts.</p> <p>Items may assess right-triangle geometry. Methods of solving may include the Pythagorean theorem, and should not rely exclusively on the 30-60-90 or 45-45-90 triangle relationships.</p> <p>Items may assess properties of and relationships pertaining to regular and irregular two- and three-dimensional shapes, and the concepts of symmetry, reflections, congruency, similarity, perpendicularity, parallelism, and transformations.</p> <p>Rectangular coordinate planes should be used in all items.</p>

Sample MC Item

The figure below is a regular hexagon.



Which of the following transformations of the hexagon above will change the appearance of the hexagon on the grid?

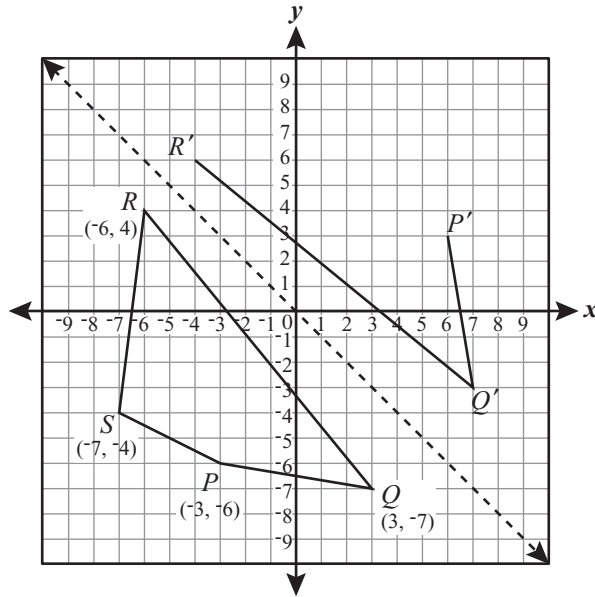
- A. reflection across the x -axis
- B. reflection across the y -axis
- C. rotation of 60° counterclockwise
- ★ D. rotation of 90° clockwise

Item Context

Mathematics

Sample GR Item 

Miguel is designing a mosaic. He is reflecting quadrilateral $PQRS$ over the dashed diagonal line shown on the coordinate plane below to create quadrilateral $P'Q'R'S'$.



To complete his design, what should be the **y-coordinate** of S' ?

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<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6
7	7	7	7	7
8	8	8	8	8
9	9	9	9	9

Sample Response 7

Item Context The Arts

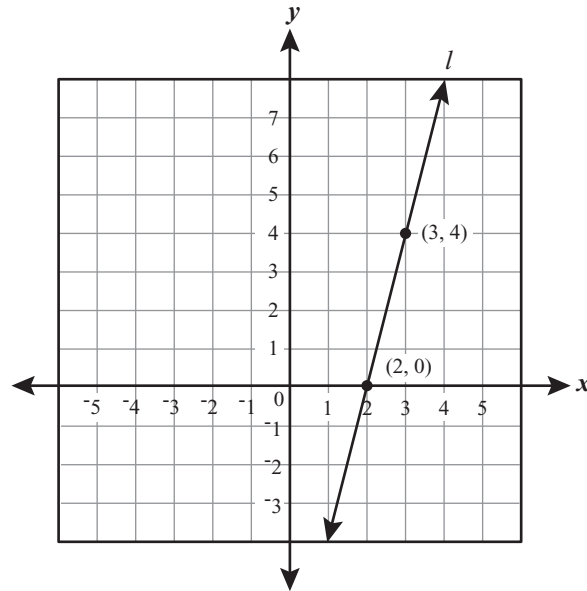
BENCHMARK MA.C.3.4.2

Strand	C Geometry and Spatial Sense
Standard	3 The student uses coordinate geometry to locate objects in both two and three dimensions and to describe objects algebraically.
Benchmark	MA.C.3.4.2 The student, using a rectangular coordinate system (graph), applies and algebraically verifies properties of two- and three-dimensional figures, including distance, midpoint, slope, parallelism, and perpendicularity. Also assesses MA.C.3.3.2 The student identifies and plots ordered pairs in all four quadrants of a rectangular coordinate system (graph) and applies simple properties of lines. Also assesses MA.D.2.4.1 The student represents real-world problem situations using finite graphs, matrices, sequences, series, and recursive relations.

Item Types	At Grade 9, this benchmark will be assessed using MC and GR items.
Benchmark Clarification	Students will apply algebraic properties, including distance, midpoint, slope, parallelism, and perpendicularity, to interpret graphs or solve problems in a rectangular coordinate system.
Content Limits	Parabolic relations will not be used. Three-dimensional figures in a coordinate system will not be assessed.
Stimulus Attributes	Items may include linear equations in various forms, including standard, slope-intercept, and point-slope forms. Items may be set in either real-world or mathematical contexts. Rectangular coordinate planes should be used in all items.

Sample MC Item

The graph of line l is shown below.



Which of the following is an equation of a line that is parallel to line l in the graph?

- A. $y = -\frac{1}{4}x + 2$
- B. $y = \frac{1}{4}x + 2$
- C. $y = -4x + 2$
- ★ D. $y = 4x + 2$

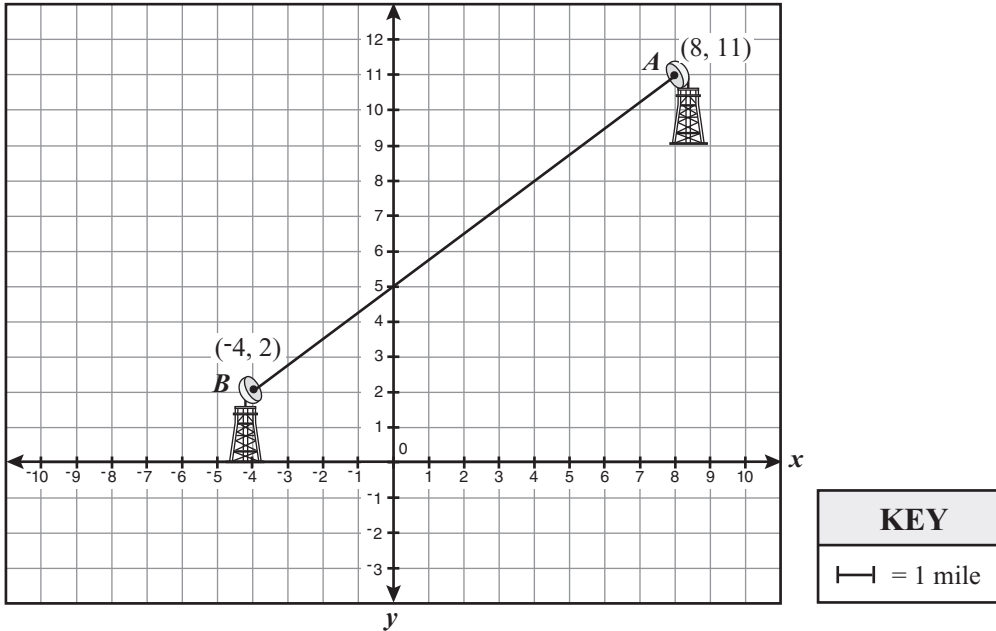
Item Context

Mathematics

Sample GR Item 

The graph below shows the path of a microwave signal transmitted from point *A* at the top of a mountain to point *B* in the valley.

Microwave Transmitter/Receiver Locations



Each grid square measures 1 mile by 1 mile. What is the distance, in miles, between points *A* and *B*?

	○	○	○	
○	○	○	○	○
0	0	0	0	0
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6
7	7	7	7	7
8	8	8	8	8
9	9	9	9	9

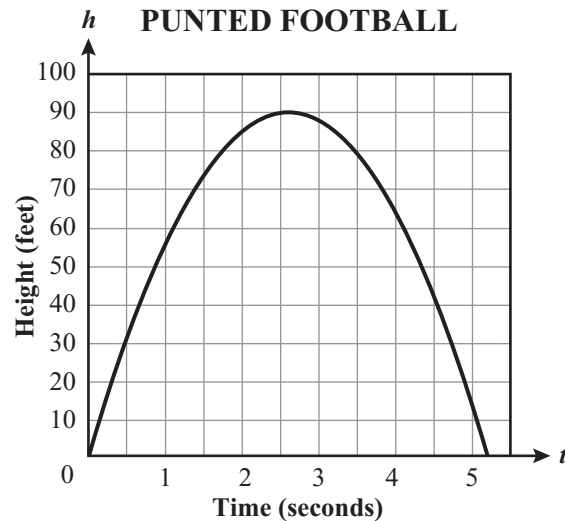
Sample Response 15

Item Context Science

Item Types	At Grade 10, this benchmark will be assessed using MC, GR, and SR items.
Benchmark Clarification	Students will interpret graphs and solve problems by applying, verifying, and/or explaining algebraic properties in a rectangular coordinate system.
Content Limits	Items that involve parabolas should include reading and interpreting graphics only. Three-dimensional figures in a coordinate system will not be assessed.
Stimulus Attributes	Items may include linear equations in various forms, including standard, slope-intercept, and point-slope forms. Items may be set in either real-world or mathematical contexts. Linear and parabolic relations will be used, although most of the items for this benchmark should emphasize linear relations. Verification and explanation of algebraic properties will be assessed only in SR items. Rectangular coordinate planes should be used in all items.

Sample MC Item

The graph on the coordinate grid below represents the height of a football kicked by a football team's punter and the number of seconds the football is in the air.



The stands at the football field are 50 feet in height. Based on the graph, when is the football at a height greater than the stands?

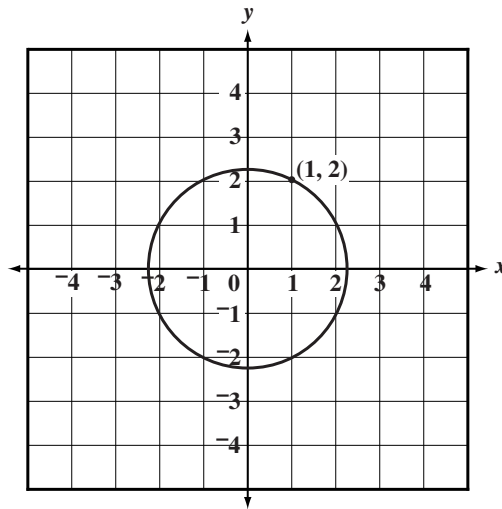
- A. at no time throughout the football's path
- ★ B. from about 0.8 seconds until about 4.2 seconds
- C. from about 4.3 seconds until the ball hits the ground
- D. from the time the football is kicked until about 0.7 seconds

Item Context Mathematics

Sample GR Item



The circle shown is centered at the origin and contains the point $(1, 2)$.



To the nearest hundredth, what is the length of the radius of the circle?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0	0	0	0	0
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6
7	7	7	7	7
8	8	8	8	8
9	9	9	9	9

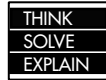
Sample Response

2.24

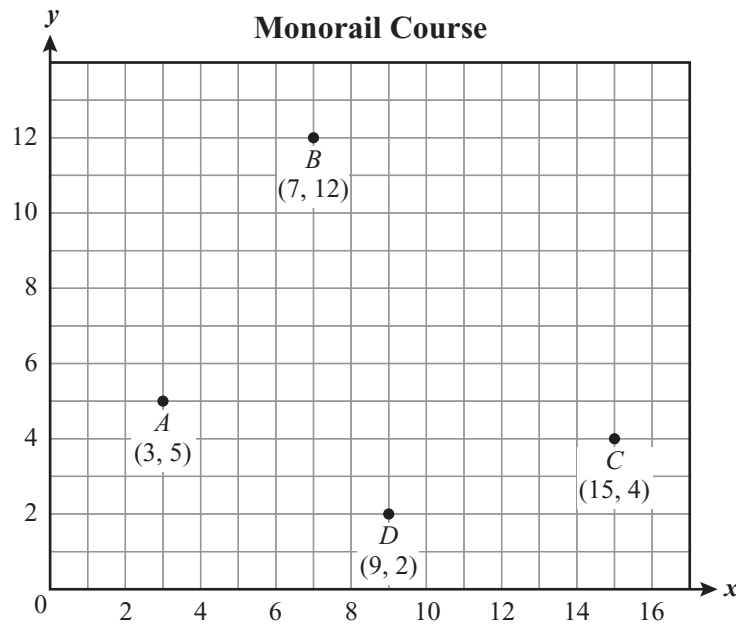
Item Context

Mathematics

Sample SR Item



The course of the monorail at an amusement park must be changed to make room for a new parking lot. Engineers have decided that only the main supporting column located at point C on the grid below should be relocated. They have also decided that the rebuilt course should be in the shape of a parallelogram.



Part A On the grid, plot the new location of the supporting column and write its coordinates below. Label the new location as C' .

Coordinates of C' _____

Part B In the space below, use the definition or properties of a parallelogram to verify that the new monorail course is a parallelogram. You must use the slopes of the sides, the lengths of the sides, or both, to help verify your answer.

Top-Score Response

A top-score response includes Point C' plotted and labeled correctly on the coordinate grid and the correct coordinates of C' (Part A) and an explanation of how the monorail course is a parallelogram (Part B) as shown below.

Part A

Point C' should be plotted and labeled at (13, 9) on the coordinate grid

Coordinates of C' _____ (13, 9) _____

Part B

- Show \overline{AB} and $\overline{DC'}$ have equal slopes (parallel) and lengths (congruent)

$$\frac{12-5}{7-3} = \frac{9-2}{13-9} = \frac{7}{4} \text{ slope of both line segments}$$

$$\sqrt{(7-3)^2 + (12-5)^2} = \sqrt{65}$$

$$\sqrt{(13-9)^2 + (9-2)^2} = \sqrt{65}$$

OR

- Show \overline{AD} and $\overline{BC'}$ have equal slopes (parallel) and lengths (congruent)

$$\frac{5-2}{3-9} = \frac{12-9}{7-13} = \frac{3}{-6} = -\frac{1}{2}$$

$$\sqrt{(3-9)^2 + (5-2)^2} = \sqrt{45}$$

$$\sqrt{(7-13)^2 + (12-9)^2} = \sqrt{45}$$

OR

- Both pairs of opposite sides are parallel

OR

- Both pairs of opposite sides are congruent

Scoring Rubric

See Appendix D for the Short-Response Scoring Rubric.

BENCHMARK MA.D.1.4.1**Strand****D** Algebraic Thinking**Standard****1** The student describes, analyzes, and generalizes a wide variety of patterns, relations, and functions.**Benchmark****MA.D.1.4.1** The student describes, analyzes, and generalizes relationships, patterns, and functions using words, symbols, variables, tables, and graphs.

Item Types	At Grade 9, this benchmark will be assessed using MC and GR items.
Benchmark Clarification	Students will analyze, identify, and/or generalize relationships or functions to solve problems or continue patterns.
Content Limits	Items should include no more than three variables. Items should not require the use of formulas for arithmetic and geometric sequences or series.
Stimulus Attributes	Items may be set in either real-world or mathematical contexts. Graphics should be used in some of these items, as appropriate.

Sample MC Item

Many authors and publishers charge fees for the rights to produce their plays. One community theater is being charged \$1500 plus 6.5% of the ticket sales. If s = ticket sales, and c = total charges, which of the following equations shows how to determine the total charges?

- ★ A. $c = 0.065s + 1500$
- B. $c = -0.065s - 1500$
- C. $c = -0.065s + 1500$
- D. $c = 0.065s - 1500$

Item Context The Arts

Sample GR Item 

The table shows values of x and y for the equation $2x^2 - y = 0$.

x	y
-2	8
-1	2
0	0
1	2
2	8
3	?

What value of y makes this equation true when $x = 3$?

	7	7	7	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0	0	0	0	0
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6
7	7	7	7	7
8	8	8	8	8
9	9	9	9	9

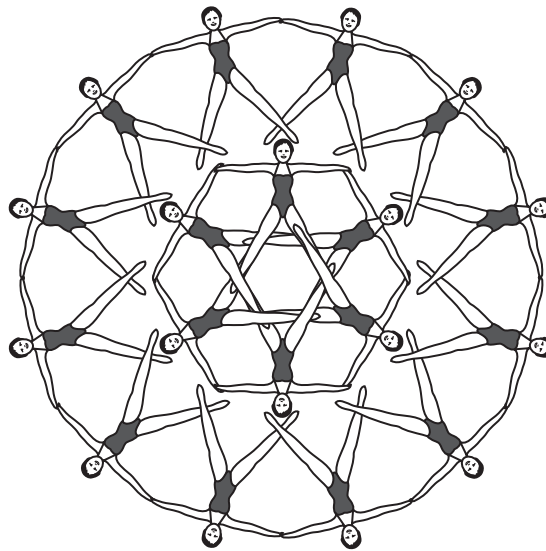
Sample Response 18

Item Context Mathematics

Item Types	At Grade 10, this benchmark will be assessed using MC and GR items.
Benchmark Clarification	Students will analyze, identify, and/or generalize relationships or functions to solve problems or continue patterns.
Content Limits	Items should include no more than three variables. Items should not require the use of formulas for arithmetic and geometric sequences or series.
Stimulus Attributes	Items may be set in either real-world or mathematical contexts. Graphics should be used in some of these items, as appropriate.

Sample MC Item

Alexi is planning the finale of a synchronized swimming show. The figure below represents a pattern he wants to create. The pattern has an innermost ring of 6 swimmers. Each additional ring will need 2 swimmers for each swimmer in the previous ring.



If the finale consists of 4 rings formed according to this pattern, what will be the total number of swimmers needed to form all 4 rings?

- A. 36
- B. 48
- ★ C. 90
- D. 96

Item Context Health/Physical Education

Sample GR Item 

What is the next number in this geometric sequence?

0.7, 3.5, 17.5, 87.5, ____

	/	/	/	
•	•	•	•	•
0	0	0	0	0
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6
7	7	7	7	7
8	8	8	8	8
9	9	9	9	9

Sample Response 437.5

Item Context Mathematics

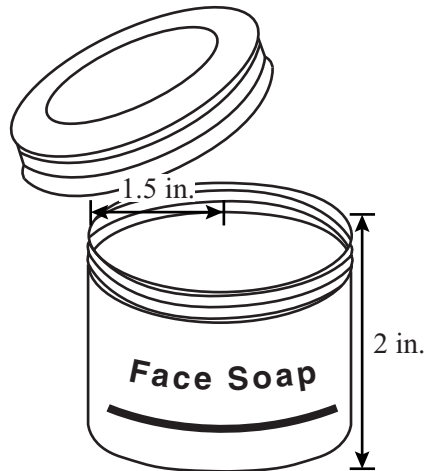
BENCHMARK MA.D.1.4.2

Strand	D Algebraic Thinking
Standard	1 The student describes, analyzes, and generalizes a wide variety of patterns, relations, and functions.
Benchmark	MA.D.1.4.2 The student determines the impact when changing parameters of given functions.

Item Types	At Grade 9, this benchmark will be assessed using MC and GR items.
Benchmark Clarification	Students will determine the result of changing a parameter in a given situation or function, or determine the required change in a parameter to achieve the desired outcome.
Content Limits	<p>Item may involve, explicitly and/or implicitly, no more than four parameters.</p> <p>One or two parameters may be changed, resulting in the change of another parameter. Three parameters may be changed in one item only if all three are changed by a constant factor.</p>
Stimulus Attributes	<p>Items may be set in either real-world or mathematical contexts.</p> <p>Parameters such as dimension, capacity, cost, and relationships between variables may be used.</p> <p>Geometric concepts of two- and three-dimensional shapes may be assessed.</p> <p>Graphics should be used in some of these items, as appropriate.</p>

Sample MC Item

A cosmetic company currently sells its face soap in cylindrical jars that have a height of 2 inches (in.) and a radius of 1.5 inches.



The company wants to enlarge its jars to put more face soap in each jar. They want the new jar to have exactly twice the volume of the current jar. Which change in dimensions will achieve this goal?

- A. double the radius
- ★ B. double the height
- C. double the diameter
- D. double the radius and the height

Item Context

Workplace

Sample GR Item 

The telephone company that Deon uses for long-distance calls charges a flat fee of \$10.00 per month plus \$0.25 per minute of usage. Deon's long-distance bill for February was \$22.25. The charge per minute was changed to \$0.20 for March. If Deon used the same number of minutes in March as he did in February, what will Deon's **savings** be, in dollars, for his total long-distance bill?

	⊘	⊘	⊘	
⊙	⊙	⊙	⊙	⊙
0	0	0	0	0
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6
7	7	7	7	7
8	8	8	8	8
9	9	9	9	9

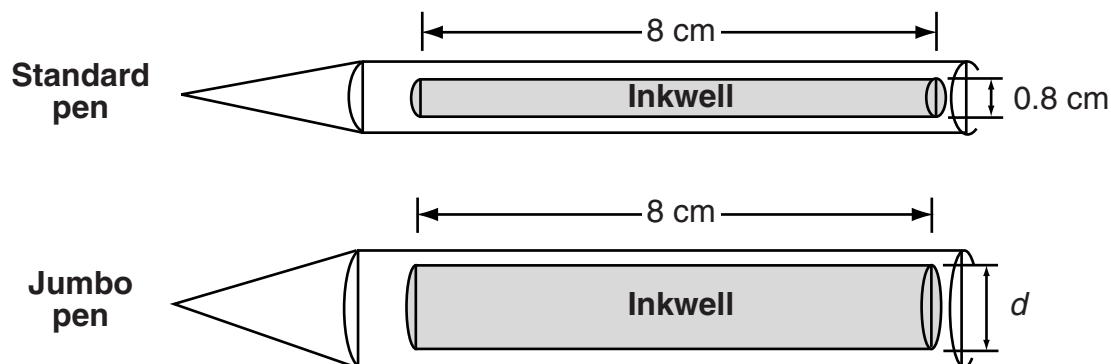
Sample Response 2.45

Item Context Mathematics

Item Types	At Grade 10, this benchmark will be assessed using MC, GR, and SR items.
Benchmark Clarification	Students will determine and/or explain the result of changing a parameter in a given situation or function or determine the required change in a parameter to achieve the desired outcome.
Content Limits	<p>Items may involve, explicitly and/or implicitly, no more than four parameters.</p> <p>One or two parameters may be changed, resulting in the changing of another parameter.</p> <p>Three parameters may be changed in one item only if all three are changed by a constant factor.</p>
Stimulus Attributes	<p>Items may be set in either real-world or mathematical contexts.</p> <p>Parameters such as dimension, capacity, cost, and relationships between variables may be used.</p> <p>Geometric concepts of two- and three-dimensional shapes may be assessed.</p> <p>Graphics should be used in some of these items, as appropriate.</p>

Sample MC Item

A company produces two types of pens, a standard pen and a jumbo pen. The inkwell in each pen is in the shape of a right circular cylinder with the dimensions shown below.



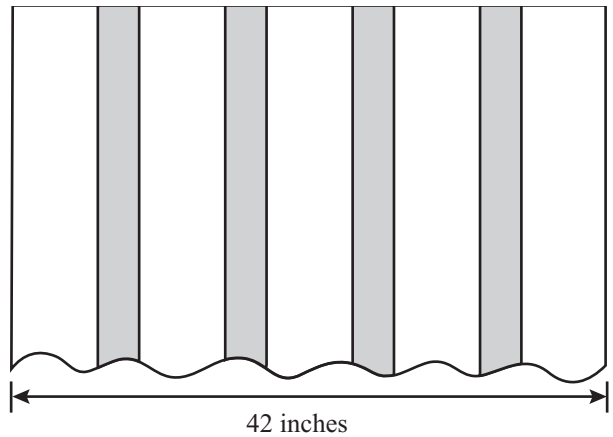
The inkwell of the jumbo pen has 3 times the volume of the inkwell of the standard pen. Which of the following is closest to the **inkwell diameter**, d , of the jumbo pen?

- A. 0.69 cm
- ★ B. 1.39 cm
- C. 1.92 cm
- D. 2.40 cm

Item Context Workplace

Sample GR Item 

A fabric store sells 42-inch-wide striped fabric with green stripes 3 inches wide and white stripes 6 inches wide. The fabric starts and ends with white stripes and has 4 green stripes, as shown below.



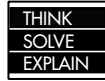
The store sells a second fabric with 4 green stripes that are each 4 inches wide. Like the pattern above, the green stripes alternate with white stripes, and the fabric starts and ends with white stripes. All of the white stripes on the second fabric are equal to each other in width, and this fabric is the same total width as the fabric in the diagram. What is the width, in inches, of 1 of the white stripes in the second fabric?

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<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

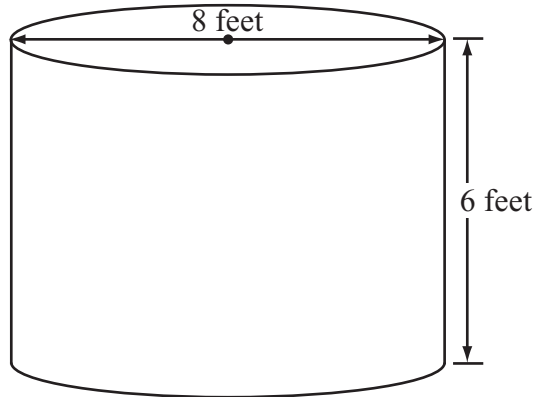
Sample Response 5.2

Item Context Workplace

Sample SR Item



The Avilas' water-storage tank is shown below. It is in the shape of a right circular cylinder with a diameter of 8 feet and a height of 6 feet.



The family wants a new storage tank with a larger capacity. They may increase either the diameter by 1 foot or the height by 1 foot. What is the **difference**, in cubic feet, in the capacity obtained by increasing the diameter 1 foot and the capacity obtained by increasing the height 1 foot? Show your computations of the two new capacities or give a complete explanation with numerical support to justify your answer.

Difference, in cubic feet _____

Item Context

Mathematics

Top-Score Response

A top-score response includes the correct difference in the two volumes and valid work to support the answer, as shown below.

Volume if height is increased by 1 foot

Radius = 4 and height = 7

$$\pi(4^2)(7) :$$

$$3.14(4^2)(7) = 351.68 \quad \text{OR}$$

$$\frac{22}{7}(4^2)(7) = 352 \quad \text{OR}$$

$$\pi(4^2)(7) = 112\pi$$

Volume if diameter is increased by 1 foot

Radius = 4.5 and height = 6

$$\pi(4.5^2)(6):$$

$$3.14(4.5^2)(6) = 381.51 \quad \text{OR}$$

$$\frac{22}{7}(4.5^2)(6) = 381.86 \quad \text{OR}$$

$$\pi(4.5^2)(6) = 121.5\pi$$

Difference, in cubic feet (possible acceptable range) 29.83 to 29.86,
or 9.5π

Scoring Rubric

See Appendix D for the Short-Response Scoring Rubric.

BENCHMARK MA.D.2.4.2

Strand	D Algebraic Thinking
Standard	2 The student uses expressions, equations, inequalities, graphs, and formulas to represent and interpret situations.
Benchmark	MA.D.2.4.2 The student uses systems of equations and inequalities to solve real-world problems graphically, algebraically, and with matrices. Also assesses MA.D.2.3.1 The student represents and solves real-world problems graphically, with algebraic expressions, equations, and inequalities. Also assesses MA.D.2.3.2 The student uses algebraic problem-solving strategies to solve real-world problems involving linear equations and inequalities. Also assesses MA.D.2.4.1 The student represents real-world problem situations using finite graphs, matrices, sequences, series, and recursive relations.

Item Types At Grade 9, this benchmark will be assessed using MC and GR items.

Benchmark Clarification Students will interpret and/or solve real-world problems involving expressions, linear equations, linear inequalities, or manipulating literal equations.

Content Limits In items that require the solving of equations or inequalities, the equation or inequality should be linear. Items in which students are not solving equations and/or inequalities may be nonlinear.

Systems of linear equations or inequalities will not be assessed.

Matrices, sequences, series, and recursive relations will not be assessed.

Items involving graphs using discrete data, such as bar graphs or scatter plots, should contain no more than 15 data points.

Stimulus Attributes Items should be set in a real-world context.

Items should use methods that are graphical and/or algebraic.

Graphics should be used in some of these items, as appropriate.

Sample MC Item

To get the full benefit from aerobic exercise, an athlete's heart rate should reach a target rate. To figure the appropriate target heart rate, the formula $198 - 0.9a = T$ may be used, where T represents the target heart rate and a represents the athlete's age. Which of the following equations is equivalent to $198 - 0.9a = T$?

A. $T - 0.9a = -198$

B. $T - 0.9a = 198$

C. $T + 0.9a = -198$

★ D. $T + 0.9a = 198$

Item Context Health/Physical Education

Sample GR Item

At Mathematics Field Day, the mathematics club plans to give each participant a math pin. The company that manufactures the pins charges \$1.10 per pin and a one-time design fee of \$45. Because the club is sponsored by the school, no tax will be added. If the club spends no more than \$150 on the pins, what is the greatest number of math pins the club can order?

○	○	○	○	○
●	●	●	●	●
0	0	0	0	0
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6
7	7	7	7	7
8	8	8	8	8
9	9	9	9	9

Sample Response

95

Item Context

Social Studies/Consumerism

Item Types	At Grade 10, this benchmark will be assessed using MC, GR, and SR items.
Benchmark Clarification	Students will manipulate, interpret and/or solve real-world problems involving expressions, equations, inequalities, and/or systems of linear equations or linear inequalities by formulating, solving, and/or graphing equations and/or inequalities.
Content Limits	<p>In items that require the solving of equations or inequalities, the equation or inequality should be linear. Items in which students are not solving equations and/or inequalities may be nonlinear.</p> <p>Matrices, sequences, series, and recursive relations will not be assessed.</p> <p>Items involving graphs using discrete data, such as bar graphs or scatter plots, should contain no more than 15 data points.</p>
Stimulus Attributes	<p>Items should be set in a real-world context.</p> <p>Items should use methods that are graphical and/or algebraic.</p> <p>Graphics should be used in some of these items, as appropriate.</p>

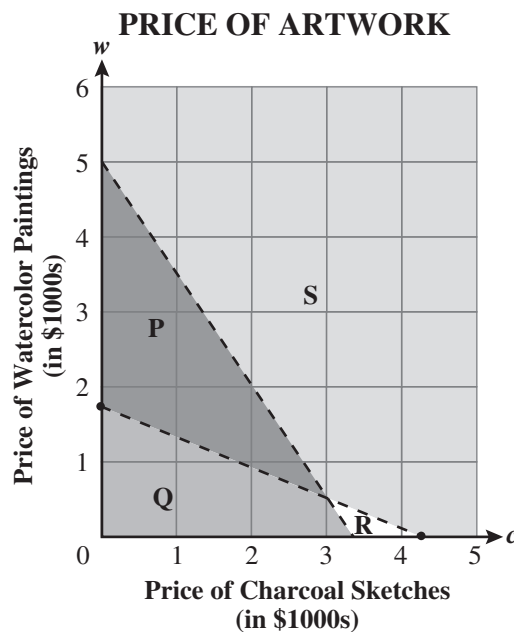
Sample MC Item

An artist sold 2 charcoal sketches and 5 watercolor paintings for more than \$8,500 in January. In February, the same artist sold 3 charcoal sketches and 2 watercolor paintings for less than \$10,000. This information can be represented by the following inequalities, where c represents the selling price of a charcoal sketch and w represents the selling price of a watercolor painting.

$$2c + 5w > 8,500$$

$$3c + 2w < 10,000$$

These inequalities are shown in the graph below.



Which region of the graph represents the possible selling prices of both the charcoal sketches and the watercolor paintings?

- ★ A. P
- B. Q
- C. R
- D. S

Item Context

Workplace

Sample GR Item

A baseball player's batting average equals the number of hits divided by the number of times at bat, expressed in decimal form. One player had the results shown below.

- First year batting average: 0.300
- Second year batting average: 0.400
- Combined 2-year batting average 0.360

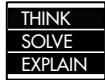
If he was at bat a total of 450 times for both years combined, what was the total number of times he was at bat the **second year**?

	○	○	○	
●	●	●	●	●
0	0	0	0	0
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6
7	7	7	7	7
8	8	8	8	8
9	9	9	9	9

Sample Response 270

Item Context Health/Physical Education

Sample SR Item



Last year, Regina invested a total of \$4,000 in two savings accounts. One account earned 6% simple interest per year, and the other earned 7% simple interest per year. Last year, she earned a total of \$267 in interest from the two accounts. Determine how much money Regina invested in each account. Show work or provide an explanation, with numerical support, to justify your answer.

Invested in 6% account _____ *Invested in 7%* _____

Item Context

Social Studies/Consumerism

Top-Score Response

The top-score response includes a system of two equations and solutions for both variables, as shown below:

System of two equations, with x = amount at 6% and
 y = amount at 7%

$$x + y = 4000$$

$$0.06x + 0.07y = 267$$

Solution of system of equations:

$$x = 4000 - y$$

$$0.06(4000 - y) + 0.07y = 267$$

$$240 - 0.06y + 0.07y = 267$$

$$0.01y = 27$$

$$y = 2700$$

$$x = 4000 - 2700$$

$$x = 1300$$

OR Valid work that leads to correct solutions

Invested in 6% account _____ \$1300 _____

Invested in 7% account _____ \$2700 _____

Scoring Rubric

See Appendix D for the Short-Response Scoring Rubric.

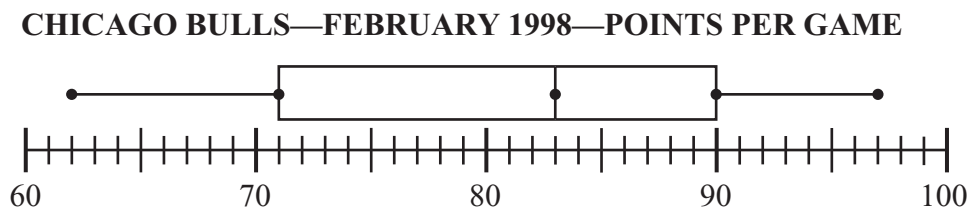
BENCHMARK MA.E.1.4.1

Strand	E Data Analysis and Probability
Standard	1 The student understands and uses the tools of data analysis for managing information.
Benchmark	MA.E.1.4.1 The student interprets data that has been collected, organized, and displayed in charts, tables, and plots. Also assesses MA.E.1.3.1 The student collects, organizes, and displays data in a variety of forms, including tables, line graphs, charts, bar graphs, to determine how different ways of presenting data can lead to different interpretations. Also assesses MA.E.1.4.3 The student analyzes real-world data and makes predictions of larger populations by applying formulas to calculate measures of central tendency and dispersion using the sample population data, and using appropriate technology, including calculators and computers.

Item Types	At Grade 9, this benchmark will be assessed using MC and GR items.
Benchmark Clarification	Students will analyze, interpret, and/or make predictions based on displayed data or identify accurate displays of given data.
Content Limit	Items should contain no more than 15 unorganized data points and no more than 30 organized data points.
Stimulus Attributes	<p>Items should be set in a real-world context.</p> <p>Displays of data within the stem should be complete and correct.</p> <p>Items may assess the interpretation of data in the following forms: circle graphs, single- and multiple-line graphs and bar graphs, scatter plots, tables, Venn diagrams, step-function graphs, stem-and-leaf plots, histograms, or box-and-whisker plots.</p> <p>Items may assess the interpretation or predictions based on multiple displays of data. Items should elicit primarily numerical and/or straightforward responses.</p> <p>Graphics should be used in most of these items, as appropriate.</p>

Sample MC Item

The box-and-whisker plot below shows the number of points the Chicago Bulls scored per game in February 1998.



Which of the following statements is a correct interpretation of the box-and-whisker plot?

- A. The Chicago Bulls' median score per game during February was 80.5.
- B. The Chicago Bulls' median score per game during February was 71.
- C. The Chicago Bulls' highest game score during February was 90.
- ★ D. The Chicago Bulls' highest game score during February was 97.

Item Context Health/Physical Education

Sample GR Item



The following stem-and-leaf plot shows the hourly wages of a group of 25 workers. The workers are performing similar tasks but, because of differences in length of work experience and skill, are paid at different rates.

WORKERS' HOURLY WAGES

Stem	Leaf
16	7 8 8 8 9
17	5 6 6 7 7 8 8 9 9
18	0 0 0 1 1 5
19	0 0 2 3 3

KEY

17 | 5 = \$17.50

What percent of the workers are paid less than \$18 per hour ?

	○	○	○	
●	●	●	●	●
0	0	0	0	0
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6
7	7	7	7	7
8	8	8	8	8
9	9	9	9	9

Sample Response

56

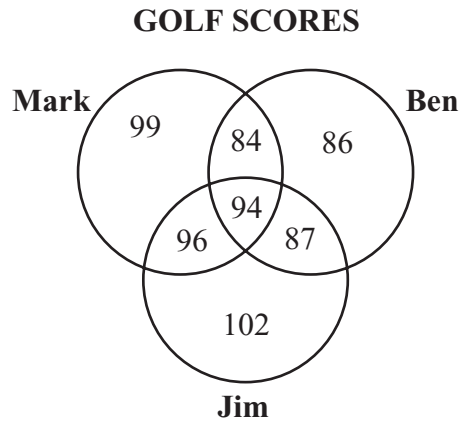
Item Context

Social Studies/Consumerism

Item Types	At Grade 10, this benchmark will be assessed using MC, GR, and ER items.
Benchmark Clarification	Students will analyze, interpret, and/or make predictions based on displayed data, or will display data in an appropriate format and analyze, interpret, and/or make predictions based on results.
Content Limit	Items should contain no more than 15 unorganized data points and no more than 30 organized data points.
Stimulus Attributes	<p>Displays of data within the stem should be complete and correct.</p> <p>Items may assess the interpretation and/or construction of data displays in the following forms: circle graphs, single- and multiple-line graphs, single- and multiple-bar graphs, scatter plots, and tables.</p> <p>Items should assess the interpretation of data in Venn diagrams, step-function graphs, stem-and-leaf plots, histograms, or box-and-whisker plots, but not the construction of data displays in these forms.</p> <p>Items may assess the interpretation of or predictions based on multiple displays of data. MC or GR items should elicit primarily numerical and/or straightforward responses. MC items may require identification of appropriate data displays.</p> <p>ER items may require generalizing, predicting, and/or drawing conclusions.</p> <p>Items should be set in a real-world context.</p> <p>Graphics should be used in most of these items, as appropriate.</p>

Sample MC Item

Jim, Ben, and Mark played in a four-day golf tournament. The four scores for each golfer are shown in the Venn diagram below.



What is the lowest score that Mark and Jim have in common?

- A. 84
- B. 87
- ★ C. 94
- D. 96

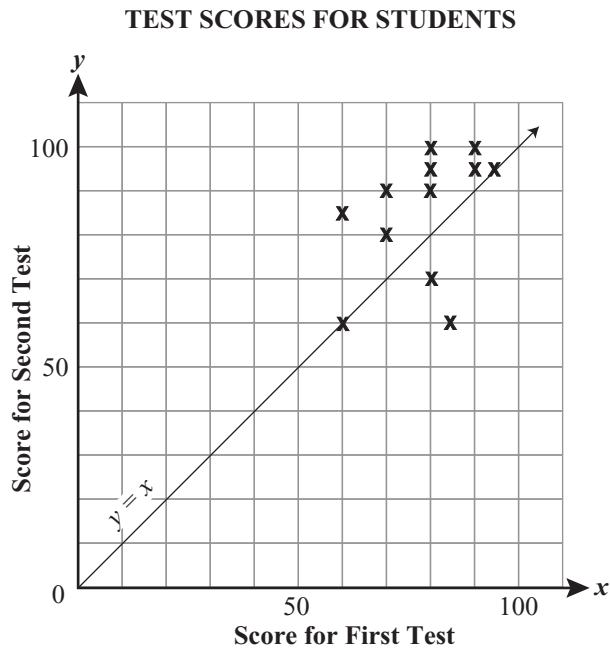
Item Context

Health/Physical Education

Sample ER Item

THINK
SOLVE
EXPLAIN

Ms. Rodriguez wanted to analyze the test scores for 12 students to determine if they were learning. She used a scatter plot to graph each student’s test scores from two tests. The first was given at the beginning of a chapter unit, and the second was given three weeks later. The x’s on the graph represent the scores for each student.



Part A Determine the mean score on the first test. Show or explain how you made your determination.

Mean Score _____

Complete **Part B** and **Part C** on the following page.

Part B The scores for two students appear on the line $y = x$. Explain what must be true about the scores graphed on this line.

Part C Ms. Rodriguez believes that her students have shown improvement on the second test. How could Ms. Rodriguez analyze the graph to determine if her students are learning?

Item Context

Mathematics

Top-Score Response

A top-score response includes a correct solution for finding the mean score on the first test (Part A), an explanation of what the two scores graphed on line $y = x$ mean (Part B), and an explanation of how data in the graph demonstrate that students have shown improvement on the second test (Part C), as shown below:

Part A $2(60) + 2(70) + 4(80) + 85 + 2(90) + 95 = 940$

Sum of scores for first test

$$\frac{940}{12} = 78.3$$

OR Other valid work to show finding mean

Mean Score 78.3

Part B Both of the students whose scores are on line $y = x$ had the same score on each test.

OR Other valid explanation

Part C Of the 12 students who took both tests, 8 had a higher score for the second test, so $\frac{2}{3}$ of the students improved from the first test to the second test.

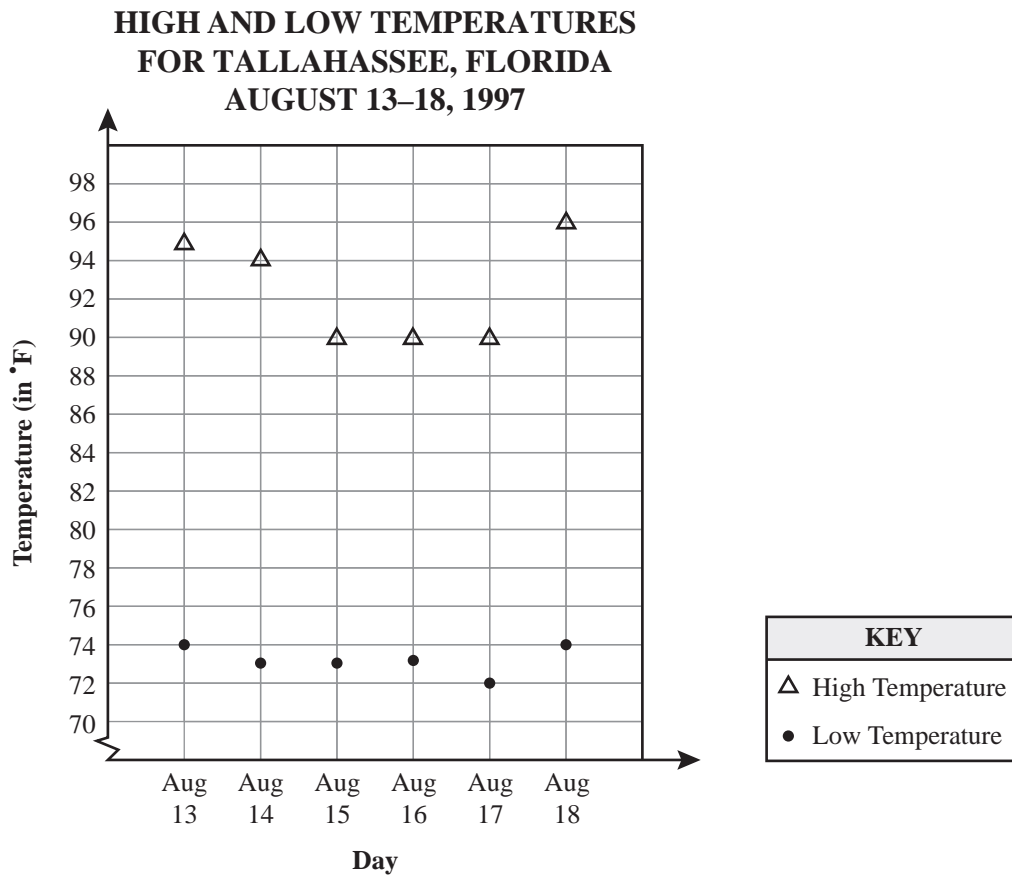
OR Other valid explanation

Scoring Rubric

See Appendix D for the Extended-Response Scoring Rubric.

Sample GR Item 

The scatter plot below shows high and low temperature information for Tallahassee, Florida, for six consecutive days in August 1997.



What fraction of the days shown in the scatter plot had a high temperature that was at least 20°F more than the low temperature on that day in Tallahassee, Florida?

	7	7	7	
0	0	0	0	0
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6
7	7	7	7	7
8	8	8	8	8
9	9	9	9	9

Sample Responses $\frac{3}{6}$, $\frac{1}{2}$, 0.5

Item Context Mathematics

BENCHMARK MA.E.1.4.2

Strand	E Data Analysis and Probability
Standard	1 The student understands and uses the tools of data analysis for managing information.

Benchmark **MA.E.1.4.2** The student calculates measures of central tendency (mean, median, and mode) and dispersion (range, standard deviation, and variance) for complex sets of data and determines the most meaningful measure to describe the data.

Also assesses MA.E.1.4.3 The student analyzes real-world data and makes predictions of larger populations by applying formulas to calculate measures of central tendency and dispersion using the sample population data, and using appropriate technology, including calculators and computers.

Item Types	At Grade 9, this benchmark will be assessed using MC and GR items.
Benchmark Clarification	Students will calculate and/or interpret measures of central tendency and/or range for sets of data or determine the most meaningful measure to describe the data for given situations.
Content Limits	<p>The measures of standard deviation and variance will not be assessed.</p> <p>Items should use the terms mean, median, mode, and range, but should not provide or require a definition of the terms.</p> <p>Items containing single-digit data points should have a maximum of 30 raw, unorganized data points. Items containing raw, unorganized data points with more than one digit should have a maximum of 15 data points.</p> <p>Items that require the determination and comparison of all measures of central tendency and/or range should contain no more than 15 two- or three-digit data points.</p> <p>Data should be limited to a maximum of three unique statistical categories.</p>
Stimulus Attributes	<p>Items may be set in real-world or mathematical contexts.</p> <p>Items should assess understanding of the measures of central tendency.</p> <p>Items should assess the calculation of the measures of central tendency and the most meaningful measure to use for a given situation.</p> <p>Graphics should be used in some of these items, as appropriate.</p>

Sample MC Item

The number of portable buildings produced by Chambers Manufacturing last week was 70 on Monday, 60 on Tuesday, 80 on Wednesday, and 50 on Thursday. After production on Friday, the mean number of buildings produced for the week was 67. What is the **median** number of buildings produced last week by Chambers Manufacturing?

- A. 67
- B. 68
- ★ C. 70
- D. 75

Item Context

Workplace

Sample GR Item

Ed bowled six games at Jordan's Bowlerama. For the first 5 games that Ed bowled, his mean score was 120. He bowled a score of 180 for his 6th game. What was his **mean** bowling score for all 6 games?

○	○	○	○	○
●	●	●	●	●
0	0	0	0	0
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6
7	7	7	7	7
8	8	8	8	8
9	9	9	9	9

Sample Response

130

Item Context

Health/Physical Education

Item Types	At Grade 10, this benchmark will be assessed using MC and GR items.
Benchmark Clarification	Students will calculate and/or interpret measures of central tendency and/or range for sets of data or determine the most meaningful measure to describe the data for given situations.
Content Limits	<p>The measures of standard deviation and variance will not be assessed.</p> <p>Items should use the terms mean, median, mode, and range, but should not provide or require a definition of the terms.</p> <p>Items containing single-digit data points should have a maximum of 30 raw, unorganized data points. Items containing raw, unorganized data points with more than one digit should have a maximum of 15 data points.</p> <p>Items that require the determination and comparison of all measures of central tendency and/or range should contain no more than fifteen two- or three-digit data points.</p> <p>Data should be limited to a maximum of three unique statistical categories.</p>
Stimulus Attributes	<p>Items may be set in real-world or mathematical contexts.</p> <p>Items should assess understanding of the measures of central tendency.</p> <p>Items should assess the calculation of the measures of central tendency and the most meaningful measure to use for a given situation.</p> <p>Graphics should be used in some of these items, as appropriate.</p>

Sample MC Item

The office manager in a small office was asked to reduce fax machine usage. To keep track of the usage, the employees used a log to record the number of faxes sent each day. The data recorded during a 14-day period are shown below.

9, 8, 10, 6, 9, 1, 0, 8, 7, 5, 9, 10, 2, 0

Which of the following results in the lowest value for fax machine usage during the 14-day period?

- ★ A. mean
- B. median
- C. mode
- D. range

Item Context

Workplace

Sample GR Item 

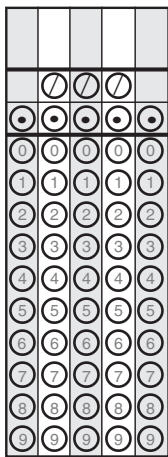
A forester wanted to compare the growth of trees in a tree farm with the growth of trees in a forest. This stem-and-leaf plot lists the yearly growth, in centimeters, of a selection of trees in both the tree farm and the forest.

**YEARLY TREE GROWTH
(in centimeters)**

Tree Farm		Forest
1	1	0 1 3
3 3	2	1 5 7
7 2 1	3	0 1 3 8 9 9
9 8 0	4	2 3 4 4 8
1 0	5	0 1 3 7

KEY
$ 2 5 = 25 \text{ centimeters}$
$5 2 = 25 \text{ centimeters}$

What is the **difference** between the median yearly growth in centimeters of the selection of trees in the tree farm and in the forest?



Sample Response 2

Item Context Science

BENCHMARK MA.E.2.4.1

Strand	E Data Analysis and Probability
Standard	2 The student identifies patterns and makes predictions from an orderly display of data using concepts of probability and statistics.
Benchmark	MA.E.2.4.1 The student determines probabilities using counting procedures, tables, tree diagrams, and formulas for permutations and combinations. Also assesses MA.E.2.4.2 The student determines the probability for simple and compound events as well as independent and dependent events.

Item Types	At Grade 9, this benchmark will be assessed using MC and GR items.
Benchmark Clarification	Students will use a variety of methods, including counting procedures, tables, and tree diagrams, to determine the total number of combinations or permutations possible, or to determine the probability of a given simple event or independent, compound events.
Content Limits	Items should not assess dependent compound events. Items may assess combinations and permutations; however, items should not require the use of the formulas.
Stimulus Attributes	Items assessing probability will only be assessed in MC format. Items may be set in real-world or mathematical contexts. Graphics should be used in some of these items, as appropriate.

Sample MC Item

A fair coin is tossed twice. What is the probability that the coin will show “heads” both times?

- A. $\frac{1}{8}$
- ★ B. $\frac{1}{4}$
- C. $\frac{1}{2}$
- D. $\frac{3}{4}$

Item Context Mathematics

Sample GR Item

Students at Sawgrass High School will begin wearing uniforms in P. E. classes in the fall. Each student will have 3 different-colored shirts, black, red, and white, and 3 different-colored pairs of shorts, black, red, and white. If a student's uniform consists of 1 shirt and 1 pair of shorts, what is the total number of different uniforms the student can wear?

	○	○	○	
●	●	●	●	●
0	0	0	0	0
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6
7	7	7	7	7
8	8	8	8	8
9	9	9	9	9

Sample Response 9

Item Context Mathematics

Item Types	At Grade 10, this benchmark will be assessed using MC and GR items.
Benchmark Clarification	Students will use a variety of methods, including counting procedures, tables, and tree diagrams, to determine the total number of combinations or permutations possible, or to determine the probability of a given event or events.
Content Limits	Items may assess combinations and permutations; however, items should not require the use of the formulas.
Stimulus Attributes	Items should assess simple and compound events and independent and dependent events. Items assessing probability will only be assessed in MC format. Items may be set in real-world or mathematical contexts. Graphics should be used in some of these items, as appropriate.

Sample MC Item

A friend gave Tina 2 boxes of flower seedlings to plant in the garden. One box contains 5 geraniums and 3 marigolds. The other box contains 4 geraniums, 4 marigolds, and 2 pansies. If Tina chooses 1 seedling from each box at random, what is the probability they will both be marigolds?

- A. $\frac{4}{9}$
- B. $\frac{7}{11}$
- ★ C. $\frac{3}{20}$
- D. $\frac{7}{18}$

Item Context Mathematics

Sample GR Item

At an ice cream stand, 6 different flavors of ice cream are available: vanilla, chocolate, strawberry, peach, mint, and banana. A customer wants to order a double-dip ice cream cone with 2 different flavors. Using the 6 flavors listed, what is the total number of different combinations possible for a double-dip cone with 2 different flavors?

	○	○	○	
○	○	○	○	○
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6
7	7	7	7	7
8	8	8	8	8
9	9	9	9	9

Sample Response 15

Item Context Mathematics

BENCHMARK MA.E.3.4.1**Strand****E** Data Analysis and Probability**Standard****3** The student uses statistical methods to make inferences and valid arguments about real-world situations.**Benchmark****MA.E.3.4.1 The student designs and performs real-world statistical experiments that involve more than one variable, then analyzes results and reports findings.**

Also assesses MA.E.3.3.1 The student formulates hypotheses, designs experiments, collects and interprets data, and evaluates hypotheses by making inferences and drawing conclusions based on statistics (range, mean, median, and mode) and tables, graphs, and charts.

Also assesses MA.E.3.4.2 The student explains the limitations of using statistical techniques and data in making inferences and valid arguments.

Item Type	At Grade 9, this benchmark will be assessed using MC items.
Benchmark Clarification	Students will analyze and interpret data and flaws in data that result from statistical experiments or identify design components or flaws in statistical experiments.
Content Limit	Items should include exactly two unique statistical categories.
Stimulus Attributes	Items should be set in a real-world context. Interpretations of data may include making predictions from the data given. Graphics should be used in most of these items, as appropriate.
Response Attributes	Inaccuracies in displayed data should include, but are not limited to, common errors such as scaling inconsistencies, inappropriate inclusion of the origin, failure to include duplicate numbers in stem-and-leaf plots, and misunderstanding of quartiles in box-and-whisker plots. If data display is complete and correct, the response should be a non-numerical conclusion.

Sample MC Item

The table below reports the approximate lowest frequency and the approximate highest frequency of the hearing ranges for humans and five other animals. Frequency is measured in Hertz (Hz), which is 1 vibration per second.

HEARING FREQUENCIES (Hz)

Animal	Lowest Frequency	Highest Frequency
Human	64	23,000
Cat	45	64,000
Dog	67	45,000
Gerbil	100	60,000
Goldfish	20	3,000
Parakeet	200	8,500

Which of the following statements is NOT supported by the data given in the table?

- A. A cat's hearing range is more than twice the hearing range of a human.
- B. A goldfish's hearing range is the smallest of the species in the table.
- C. A gerbil can hear sounds at a lower frequency than a parakeet can.
- ★ D. A dog can hear sounds at a higher frequency than a cat can.

Item Context

Science

Item Type	At Grade 10, this benchmark will be assessed using MC items.
Benchmark Clarification	Students will analyze and interpret data and flaws in data that result from statistical experiments or identify design components or flaws in statistical experiments.
Content Limit	Items should include at least two unique statistical categories.
Stimulus Attributes	Items should be set in a real-world context. Interpretations of data may include making predictions from the data given. Graphics should be used in most of these items, as appropriate.
Response Attributes	Inaccuracies in displayed data should include, but are not limited to, common errors such as scaling inconsistencies, inappropriate inclusion of the origin, failure to include duplicate numbers in stem-and-leaf plots, and misunderstanding of quartiles in box-and-whisker plots. If data display is complete and correct, the response should be a non-numerical conclusion.

Sample MC Item

Four students ran for student government president at Central High School. The results of the election are listed by class below.

CENTRAL HIGH SCHOOL ELECTION RESULTS

Class	Presidential Candidates				Total Number of Votes by Class
	Joe	Alexa	Karen	Sergio	
Freshmen	146	210	100	160	616
Sophomores	60	100	110	60	330
Juniors	80	163	110	65	418
Seniors	190	222	206	218	836
Total By Candidate	476	695	526	503	

Based on the information in the table, which of the following statements can be verified?

- ★ A. Only one candidate received more than one-fourth of the votes.
- B. Alexa received the most senior votes because she is a senior this year.
- C. Karen received more sophomore votes than Sergio and Joe combined.
- D. Fewer freshmen than seniors voted because fewer freshmen were enrolled.

Item Context

Social Studies/Consumerism