
XIV. Mathematics, Grade 8

Grade 8 Mathematics Test

The spring 2015 grade 8 Mathematics test was based on standards in the five domains for grade 8 in the *Massachusetts Curriculum Framework for Mathematics* (March 2011). The grade 8 standards can be found on pages 65–69 in the *Framework*, and the five domains are listed below.

- The Number System
- Expressions and Equations
- Functions
- Geometry
- Statistics and Probability

The *Massachusetts Curriculum Framework for Mathematics* is available on the Department website at www.doe.mass.edu/frameworks/current.html.

Mathematics test results are reported under five MCAS reporting categories, which are identical to the five framework domains listed above.

The tables at the conclusion of this chapter indicate each released and unreleased common item's reporting category and the framework standard it assesses. The correct answers for released multiple-choice and short-answer questions are also displayed in the released item table.

Test Sessions

The grade 8 Mathematics test included two separate test sessions. Each session included multiple-choice, short-answer, and open-response questions. Approximately half of the common test items are shown on the following pages as they appeared in test booklets.

Reference Materials and Tools

Each student taking the grade 8 Mathematics test was provided with a plastic ruler and a grade 8 Mathematics Reference Sheet. A copy of the reference sheet follows the final question in this chapter. An image of the ruler is not reproduced in this publication.

During Session 2, each student had sole access to a calculator with at least four functions and a square root key. Calculator use was not allowed during Session 1.

During both Mathematics test sessions, the use of bilingual word-to-word dictionaries was allowed for current and former English language learner students only. No other reference tools or materials were allowed.

Grade 8 Mathematics

SESSION 1

You may use your reference sheet and MCAS ruler during this session.
You may **not** use a calculator during this session.



DIRECTIONS

This session contains eight multiple-choice questions, one short-answer question, and one open-response question. Mark your answers to these questions in the spaces provided in your Student Answer Booklet.

- 1 A store sells white scarves and red scarves.

- A white scarf costs \$3.
- A red scarf costs \$5.

On Monday, the store sold 12 scarves for a total of \$50.

What is the total number of red scarves that the store sold on Monday?

- A. 4
- B. 5
- C. 6
- D. 7

- 2 Which of the following tables shows a relationship that is **not** a function?

A.

| Input | Output |
|-------|--------|
| 3 | 6 |
| 4 | 6 |
| 5 | 7 |
| 6 | 7 |

B.

| Input | Output |
|-------|--------|
| 3 | 0 |
| 4 | 0 |
| 5 | 0 |
| 6 | 0 |

C.

| Input | Output |
|-------|--------|
| 3 | 3 |
| 4 | 4 |
| 5 | 5 |
| 6 | 6 |

D.

| Input | Output |
|-------|--------|
| 3 | 4 |
| 3 | 8 |
| 4 | 12 |
| 4 | 16 |

- 3 Which of the following numbers is irrational?

A. -5
B. $\frac{2}{3}$
C. $\sqrt{7}$
D. $\sqrt{9}$

- 4 A tree in Oakland has a mass of approximately 3×10^6 kilograms. A tree in Mapleville has a mass of approximately 6×10^4 kilograms. The mass of the tree in Oakland is about how many times the mass of the tree in Mapleville?

A. 20
B. 50
C. 200
D. 500

- 5 Richard wants to purchase one large pizza and some soft drinks for a club meeting. He compares the prices at two restaurants.

Each soft drink at the first restaurant has the same price. The table below shows y , the total price of one large pizza and x soft drinks at the first restaurant.

**Prices at the
First Restaurant**

| x | y |
|-----|---------|
| 1 | \$19.25 |
| 2 | \$20.50 |
| 3 | \$21.75 |
| 4 | \$23.00 |
| 5 | \$24.25 |

At the **second** restaurant, the total price, y , of one large pizza and x soft drinks can be represented by the equation below.

$$y = 1.5x + 18$$

Which of the following statements is true?

- A. The price of one large pizza is more at the second restaurant than at the first restaurant.
B. The price of one large pizza is more at the first restaurant than at the second restaurant.
C. The price of one soft drink is more at the second restaurant than at the first restaurant.
D. The price of one soft drink is more at the first restaurant than at the second restaurant.

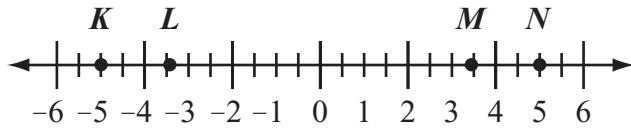
Question 6 is a short-answer question. Write your answer to this question in the box provided in your Student Answer Booklet. Do not write your answer in this test booklet. You may do your figuring in the test booklet.

- 6 What value of x makes the equation below true?

$$x^2 = 169$$

Mark your answers to multiple-choice questions 7 through 9 in the spaces provided in your Student Answer Booklet. Do not write your answers in this test booklet. You may do your figuring in the test booklet.

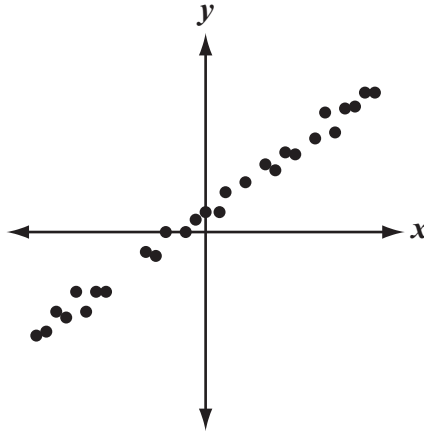
- 7 Points K , L , M , and N are shown on the number line below.



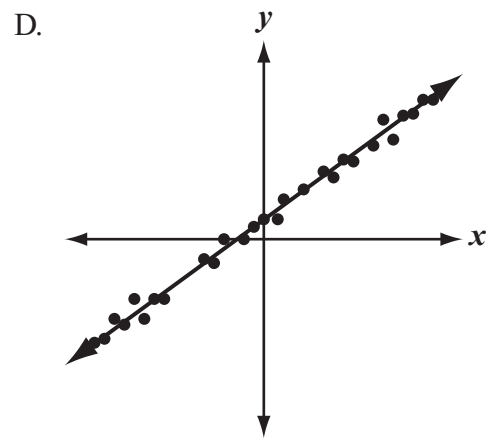
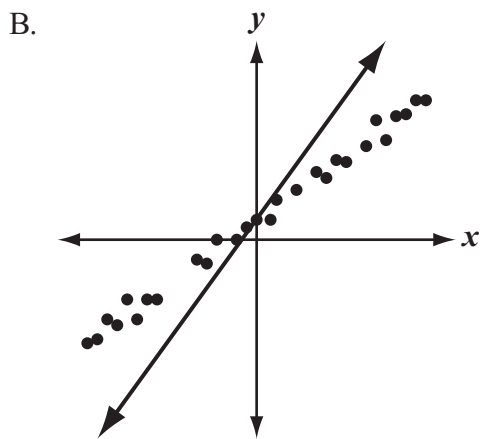
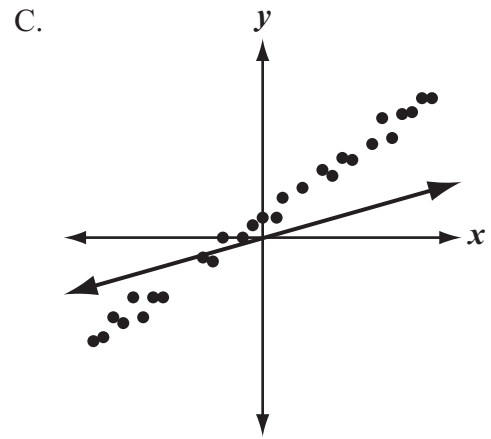
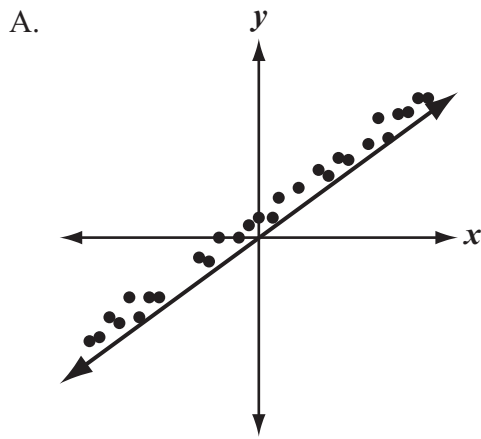
Which point on the number line best approximates the location of $-2\sqrt{3}$?

- A. point K
- B. point L
- C. point M
- D. point N

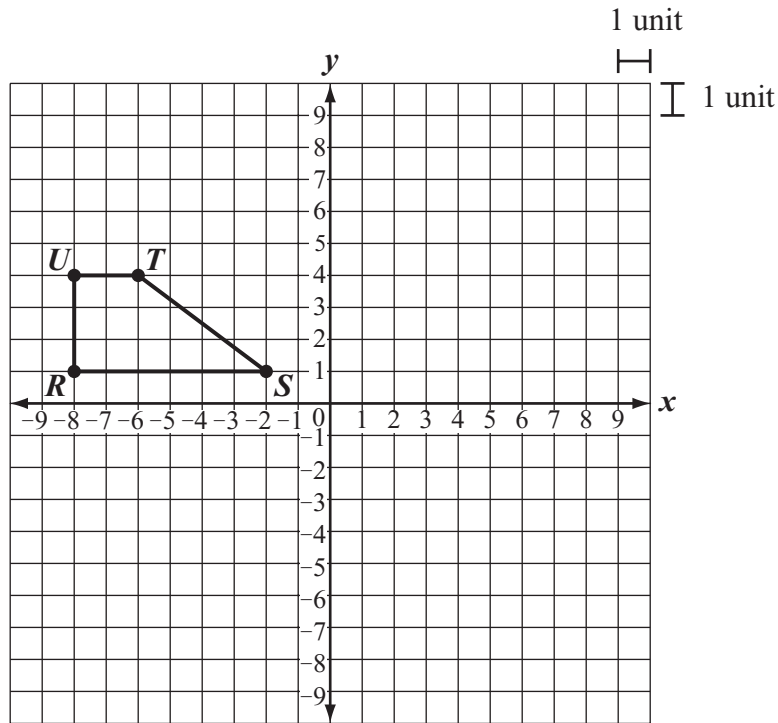
8 A scatterplot is shown below.



Which of the following **most** closely approximates the line of best fit for the data in the scatterplot?



- 9 Quadrilateral $RSTU$ is shown on the coordinate grid below.



The quadrilateral will be reflected over the y -axis. What will be the length, in units, of the image of \overline{TU} after the reflection?

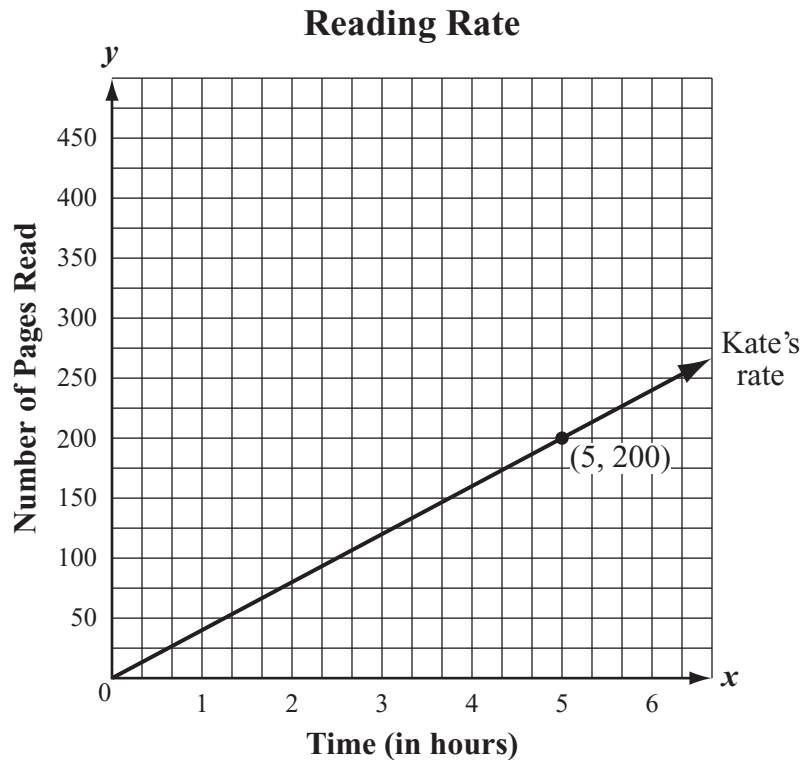
- A. 2
- B. 3
- C. 5
- D. 6

Question 10 is an open-response question.

- **BE SURE TO ANSWER AND LABEL ALL PARTS OF THE QUESTION.**
- **Show all your work (diagrams, tables, or computations) in your Student Answer Booklet.**
- **If you do the work in your head, explain in writing how you did the work.**

Write your answer to question 10 in the space provided in your Student Answer Booklet.

- 10 Kate is reading a 500-page book. The graph below represents the relationship between the number of hours Kate has spent reading and the number of pages she has read.



On the grid in your Student Answer Booklet, copy the x -axis, the y -axis, and the line representing Kate’s reading rate exactly as shown. Be sure to label the line “Kate’s rate.”

- At what rate, in pages per hour, is Kate reading? Show or explain how you got your answer.
- What is the total amount of time, in hours, it will take Kate to read the entire 500-page book? Show or explain how you got your answer.

Edward is reading the same 500-page book. The equation below represents the relationship between y , the number of pages he has read, and x , the number of hours he has spent reading.

$$y = 50x$$

- On your grid, graph the equation that represents the number of hours that Edward has spent reading and the number of pages he has read. Label the line “Edward’s rate.”
- Edward thinks he will finish reading the book in less time than Kate. Is he correct? Show or explain how you got your answer.

Grade 8 Mathematics

SESSION 2

You may use your reference sheet and MCAS ruler during this session.

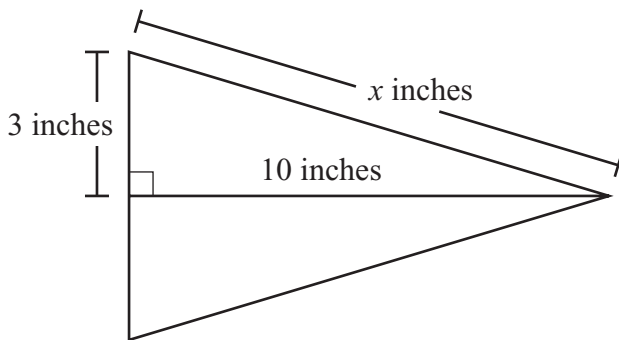


You may use a calculator during this session.

DIRECTIONS

This session contains eight multiple-choice questions, two short-answer questions, and one open-response question. Mark your answers to these questions in the spaces provided in your Student Answer Booklet.

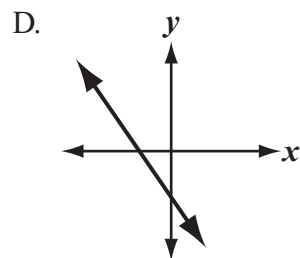
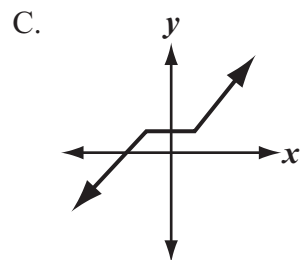
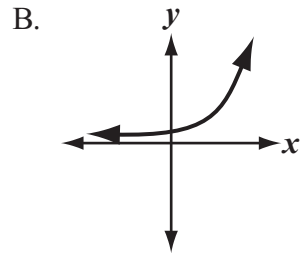
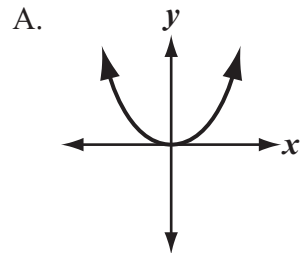
- 11 Dustin made a flag in the shape of a triangle, with the dimensions shown below.



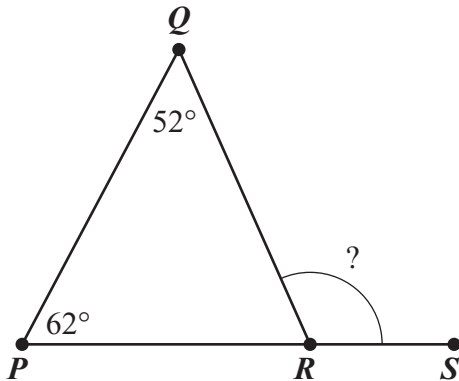
Which of the following is closest to the value of x ?

- A. 9.5
- B. 10.4
- C. 11.5
- D. 13.0

- 12 Which of the following graphs shows a linear function?



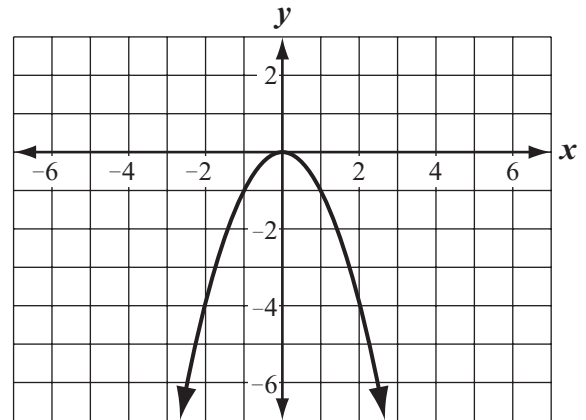
- 13 The diagram below shows $\triangle PQR$, where $\angle QRS$ is an exterior angle.



Based on the given angle measures, what is the measure of $\angle QRS$?

- A. 57°
- B. 66°
- C. 114°
- D. 118°

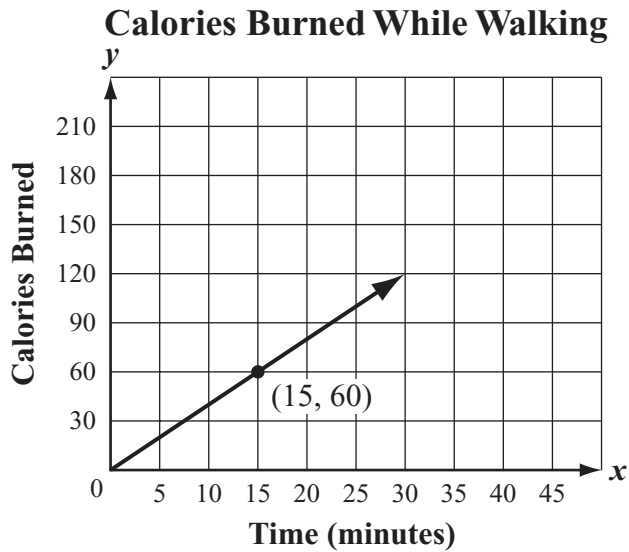
- 14 A function is graphed on the coordinate grid below.



Which of the following statements best describes the function?

- A. As the value of x increases, the value of y increases for all values of x .
- B. As the value of x increases, the value of y decreases for all values of x .
- C. As the value of x increases, the value of y increases for positive values of x only.
- D. As the value of x increases, the value of y decreases for positive values of x only.

- 15 The graph below shows the number of calories Benjamin will burn over time while walking at a constant rate.



Based on the graph, what is the number of calories Benjamin will burn after walking at a constant rate for 42 minutes?

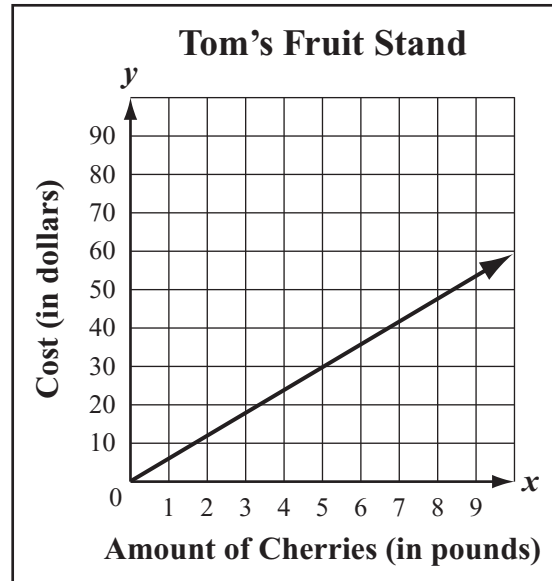
- A. 132
- B. 162
- C. 168
- D. 210

- 16 Julia and Tom each have a fruit stand. The information in the boxes below can be used to determine the costs, in dollars, of cherries at the two fruit stands.

Julia's Fruit Stand

$y = 4.5x$,

where y equals the total cost, in dollars, of x pounds of cherries



Based on the information, which of the following statements **best** compares the costs of cherries at the two fruit stands?

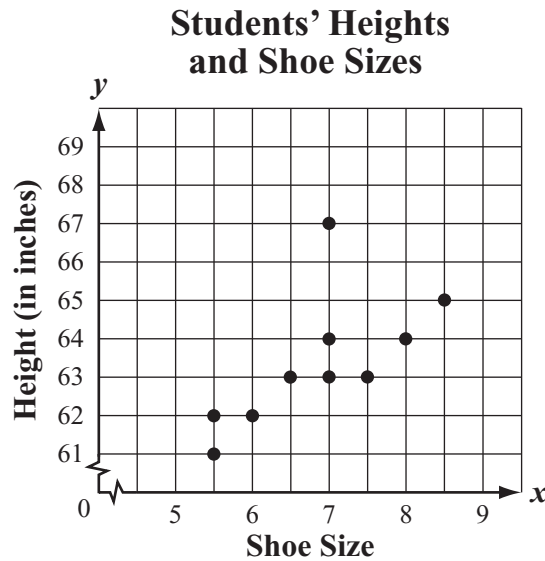
- A. Cherries cost \$1.50 more per pound at Julia's Fruit Stand than at Tom's Fruit Stand.
- B. Cherries cost \$2.50 more per pound at Julia's Fruit Stand than at Tom's Fruit Stand.
- C. Cherries cost \$1.50 more per pound at Tom's Fruit Stand than at Julia's Fruit Stand.
- D. Cherries cost \$2.50 more per pound at Tom's Fruit Stand than at Julia's Fruit Stand.

Questions 17 and 18 are short-answer questions. Write your answers to these questions in the boxes provided in your Student Answer Booklet. Do not write your answers in this test booklet. You may do your figuring in the test booklet.

- 17 A company makes hats with custom designs. For each custom order, the company charges a one-time fee of \$25.00 for the design and \$12.50 for each hat made.

Write an equation that can be used to find c , the total cost, in dollars, of a custom order, in terms of h , the number of hats made.

- 18 The scatterplot below shows the relationship between the height, in inches, and the shoe size of each of 10 students in a class.



Based on the scatterplot, what ordered pair represents the outlier in the data?

Mark your answers to multiple-choice questions 19 and 20 in the spaces provided in your Student Answer Booklet. Do not write your answers in this test booklet. You may do your figuring in the test booklet.

- 19 The formula for the volume of a cone is shown in the box below.

$$V = \frac{\pi r^2 h}{3}$$

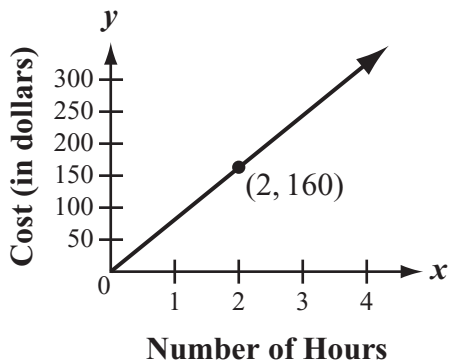
In the formula, r is the radius of the base of the cone and h is the height of the cone.

Which of the following is closest to the volume of a cone that has a height of 3.5 inches and a base with a diameter of 1.5 inches? (Use 3.14 for π .)

- A. 2 cubic inches
- B. 5 cubic inches
- C. 6 cubic inches
- D. 8 cubic inches

- 20 The students at a middle school want to hire a DJ for an end-of-the-year dance. The information below can be used to find the total cost of hiring a DJ at each of four different companies.

Awesome Entertainers



Turntable Tunes

| Number of Hours | Cost (in dollars) |
|-----------------|-------------------|
| 1 | 200 |
| 2 | 240 |
| 3 | 280 |
| 4 | 320 |

Cool Beats

\$300 plus
an additional
\$35 per hour

Rock-N-Sounds

The cost of hiring a DJ is
represented by the equation

$$c = 45h + 250,$$

where c is the total cost, in dollars,
and h is the number of hours
the DJ works.

Which company's cost has the greatest rate of change?

- A. Awesome Entertainers
- B. Cool Beats
- C. Turntable Tunes
- D. Rock-N-Sounds

Question 21 is an open-response question.

- **BE SURE TO ANSWER AND LABEL ALL PARTS OF THE QUESTION.**
- **Show all your work (diagrams, tables, or computations) in your Student Answer Booklet.**
- **If you do the work in your head, explain in writing how you did the work.**

Write your answer to question 21 in the space provided in your Student Answer Booklet.

- 21 An art museum gift shop has rectangular posters that are similar to actual rectangular paintings. One poster that is 18 inches long is similar to a painting that is 45 inches long and 30 inches wide.
- What is the scale factor used to reduce the size of the actual painting to the size of the poster? Express the scale factor as a fraction in simplest form. Show or explain how you got your answer.
 - What is the width, in inches, of the poster that is 18 inches long? Show or explain how you got your answer.
 - All the posters are sized using the same scale factor. A second poster is 16 inches long and 14 inches wide. What are the dimensions, in inches, of the actual painting? Show or explain how you got your answer.

PERIMETER FORMULAS

square $P = 4s$

rectangle $P = 2b + 2h$
OR
 $P = 2l + 2w$

triangle $P = a + b + c$

AREA FORMULAS

square $A = s^2$

rectangle $A = bh$
OR
 $A = lw$

parallelogram $A = bh$

triangle $A = \frac{1}{2}bh$

trapezoid $A = \frac{1}{2}h(b_1 + b_2)$

circle $A = \pi r^2$

TOTAL SURFACE AREA FORMULAS

rectangular prism $SA = 2(lw) + 2(hw) + 2(lh)$

cylinder $SA = 2\pi r^2 + 2\pi rh$

sphere $SA = 4\pi r^2$

VOLUME FORMULAS

rectangular prism $V = lwh$
OR
 $V = Bh$
(B = area of a base)

cube $V = s^3$
(s = length of an edge)

cylinder $V = \pi r^2 h$

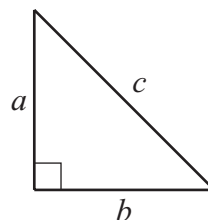
sphere $V = \frac{4}{3}\pi r^3$

CIRCLE FORMULAS

$C = 2\pi r$
OR
 $C = \pi d$

$A = \pi r^2$

PYTHAGOREAN THEOREM



$a^2 + b^2 = c^2$

Grade 8 Mathematics
Spring 2015 Released Items:
Reporting Categories, Standards, and Correct Answers*

| Item No. | Page No. | Reporting Category | Standard | Correct Answer (MC/SA)* |
|----------|----------|-----------------------------------|----------|-------------------------|
| 1 | 222 | <i>Expressions and Equations</i> | EE.8 | D |
| 2 | 222 | <i>Functions</i> | F.1 | D |
| 3 | 223 | <i>The Number System</i> | NS.1 | C |
| 4 | 223 | <i>Expressions and Equations</i> | EE.3 | B |
| 5 | 223 | <i>Functions</i> | F.2 | C |
| 6 | 224 | <i>Expressions and Equations</i> | EE.2 | $x = -13$ or 13 |
| 7 | 225 | <i>The Number System</i> | NS.2 | B |
| 8 | 226 | <i>Statistics and Probability</i> | SP.2 | D |
| 9 | 227 | <i>Geometry</i> | G.1 | A |
| 10 | 228 | <i>Expressions and Equations</i> | EE.5 | |
| 11 | 229 | <i>Geometry</i> | G.7 | B |
| 12 | 229 | <i>Functions</i> | F.3 | D |
| 13 | 230 | <i>Geometry</i> | G.5 | C |
| 14 | 230 | <i>Functions</i> | F.5 | D |
| 15 | 231 | <i>Functions</i> | F.4 | C |
| 16 | 232 | <i>Expressions and Equations</i> | EE.5 | C |
| 17 | 233 | <i>Functions</i> | F.4 | $c = 25 + 12.5h$ |
| 18 | 233 | <i>Statistics and Probability</i> | SP.1 | (7, 67) |
| 19 | 234 | <i>Geometry</i> | G.9 | A |
| 20 | 235 | <i>Functions</i> | F.2 | A |
| 21 | 236 | <i>Geometry</i> | G.4 | |

* Answers are provided here for multiple-choice and short-answer items only. Sample responses and scoring guidelines for open-response items, which are indicated by the shaded cells, will be posted to the Department's website later this year.

Grade 8 Mathematics
Spring 2015 Unreleased Common Items:
Reporting Categories and Standards

| Item No. | Reporting Category | Standard |
|-----------------|-----------------------------------|-----------------|
| 22 | <i>Expressions and Equations</i> | EE.2 |
| 23 | <i>Geometry</i> | G.3 |
| 24 | <i>Expressions and Equations</i> | EE.1 |
| 25 | <i>Expressions and Equations</i> | EE.4 |
| 26 | <i>Expressions and Equations</i> | EE.8 |
| 27 | <i>Expressions and Equations</i> | EE.7 |
| 28 | <i>The Number System</i> | NS.2 |
| 29 | <i>Geometry</i> | G.5 |
| 30 | <i>Expressions and Equations</i> | EE.1 |
| 31 | <i>Statistics and Probability</i> | SP.1 |
| 32 | <i>Functions</i> | F.4 |
| 33 | <i>Geometry</i> | G.9 |
| 34 | <i>Geometry</i> | G.2 |
| 35 | <i>Geometry</i> | G.3 |
| 36 | <i>Geometry</i> | G.7 |
| 37 | <i>Geometry</i> | G.3 |
| 38 | <i>Expressions and Equations</i> | EE.8 |
| 39 | <i>Functions</i> | F.1 |
| 40 | <i>Expressions and Equations</i> | EE.5 |
| 41 | <i>Geometry</i> | G.8 |
| 42 | <i>Functions</i> | F.4 |