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## XIV. Mathematics, Grade 8

## Grade 8 Mathematics Test

The spring 2014 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](http://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.

The use of bilingual word-to-word dictionaries was allowed for current and former English language learner students only, during both Mathematics test sessions. 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, two short-answer questions, and one open-response question. Mark your answers to these questions in the spaces provided in your Student Answer Booklet.

- 1 What is the value of the expression below?

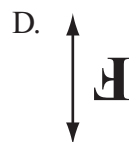
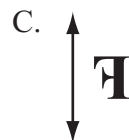
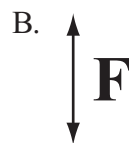
$$\frac{2^6}{2^2}$$

- A. 8
- B. 16
- C. 256
- D. 4096

- 2 Frank wrote his initial to the left of a line, as shown below.



Then he reflected his initial over the line. Which of the following shows Frank's initial after the reflection?



3 The volume of a cube is 64 cubic inches. What is the length of one edge of the cube?

- A. 4 inches
- B. 8 inches
- C. 21 inches
- D. 32 inches

4 Which ordered pair is the solution of the system of equations below?

$$\begin{aligned}x + 2y &= 6 \\3x + 8y &= 4\end{aligned}$$

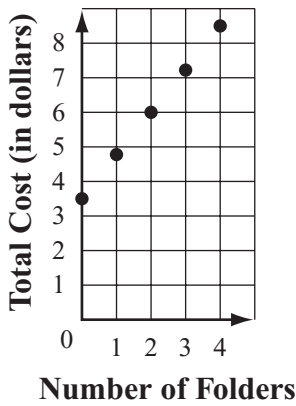
- A. (2, 2)
- B. (4, 10)
- C. (10, -2)
- D. (20, -7)

- 5 Juan purchased one binder for \$3.50 and  $f$  folders for \$1.25 each. The total cost,  $C$ , in dollars, of Juan’s purchase is represented by the equation below.

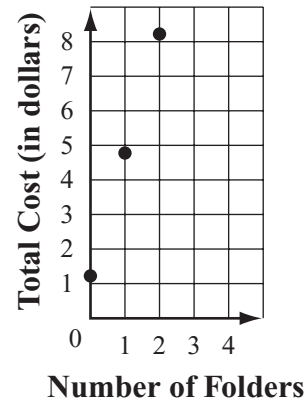
$$C = 3.50 + 1.25f$$

Which of the following graphs represents  $C$ , the total cost of Juan’s purchase if he buys different numbers of folders?

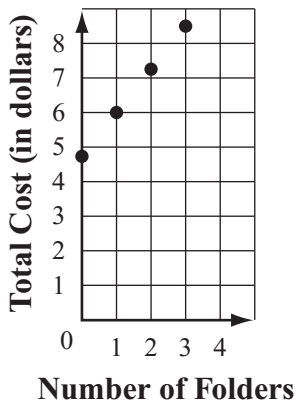
A. Juan’s Purchase



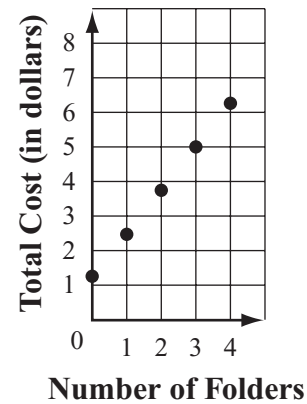
C. Juan’s Purchase



B. Juan’s Purchase



D. Juan’s Purchase



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 List the following expressions in order from least to greatest value.

$$\sqrt{5}, \pi, \sqrt{3}$$

Mark your answer to multiple-choice question 7 in the space provided in your Student Answer Booklet. Do not write your answer in this test booklet. You may do your figuring in the test booklet.

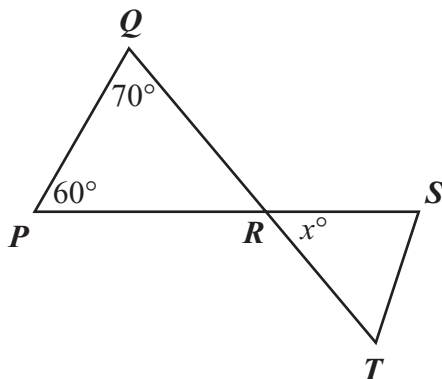
- 7 The average distance between planet Neptune and the Sun is about  $4 \times 10^9$  kilometers.

What is  $4 \times 10^9$  written in standard notation?

- A. 0.0000000004
- B. 0.000000004
- C. 400,000,000
- D. 4,000,000,000

Question 8 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.

- 8 Triangle  $PQR$ , triangle  $RST$ , and two angle measures are shown below.



Line segment  $QT$  intersects line segment  $PS$  at point  $R$ .

What is the value of  $x$ ?



Mark your answers to multiple-choice questions 9 and 10 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.

- 9 Which of the following equations represents a linear function?

A.  $y = 3x^2$

B.  $y = 2 - \frac{6}{x}$

C.  $y = \sqrt{x} + 6$

D.  $y = \frac{1}{2}x + 3$

- 10 What is the value of the expression below?

$$\sqrt{25} - 9 \cdot 2^3$$

A.  $-67$

B.  $-48$

C.  $24$

D.  $32$

Question 11 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 11 in the space provided in your Student Answer Booklet.

- 11** A principal surveyed 75 seventh-grade and eighth-grade students. She asked them if they prefer to obtain the news from the Internet or to obtain the news from television. She created a table to display the data, as shown below.

		News Preference	
		Internet	Television
Students	Seventh Grade	16	34
	Eighth Grade	10	15

- a. How many seventh-grade students responded to the survey? Show or explain how you got your answer.
- b. What is the relative frequency of seventh-grade students who prefer to obtain the news from the Internet to all the seventh-grade students surveyed? Show or explain how you got your answer.
- c. What is the relative frequency of eighth-grade students who prefer to obtain the news from the Internet to all the eighth-grade students surveyed? Show or explain how you got your answer.
- d. Is there evidence in the principal’s survey that eighth-grade students prefer to obtain the news from the Internet more than seventh-grade students do? Explain your reasoning.

# 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.

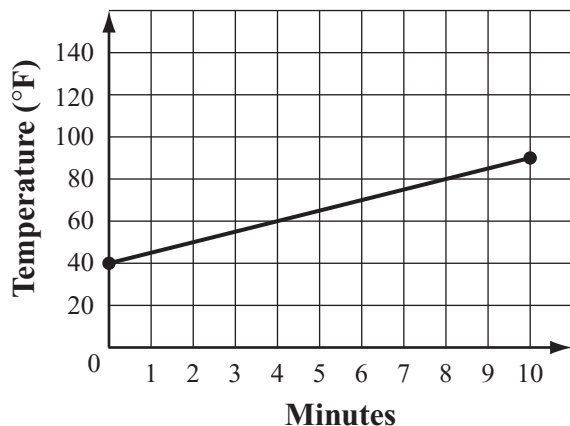


### DIRECTIONS

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

- 12 The graph below shows the temperature, in degrees Fahrenheit, of a liquid for the first ten minutes of a heating experiment.

Heating Experiment



Based on the graph, which expression could be used to calculate the temperature of the liquid after  $m$  minutes?

- A.  $5m + 40$
- B.  $-5m - 40$
- C.  $10m + 40$
- D.  $-10m - 40$

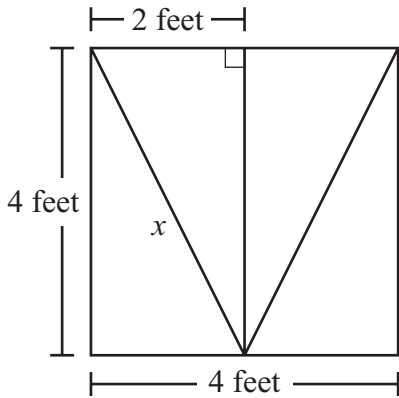
- 13 Ted has some red blocks and some green blocks.

- Each red block weighs the same number of ounces.
- Each green block weighs the same number of ounces.
- The total weight of 2 red blocks and 6 green blocks is 23 ounces.
- The total weight of 3 red blocks and 4 green blocks is 22 ounces.

What is the total weight of 1 red block and 1 green block?

- A. 3 ounces
- B. 6 ounces
- C. 6.5 ounces
- D. 13.5 ounces

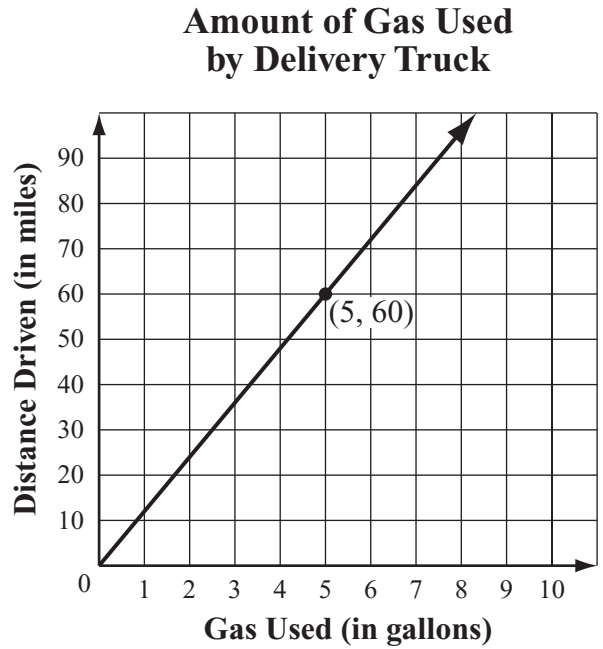
- 14 A stained glass window is in the shape of a square. A sketch of the window, with some of its dimensions, is shown below.



What is the length, to the nearest tenth of a foot, of the line segment labeled  $x$ ?

- A. 5.7 feet
- B. 4.5 feet
- C. 3.5 feet
- D. 2.4 feet

- 15 The graph below shows the relationship between the distance a delivery truck is driven and the amount of gas the truck uses.

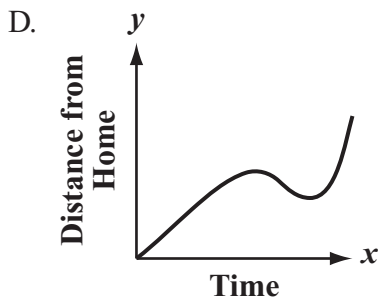
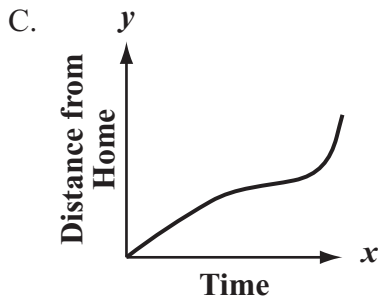
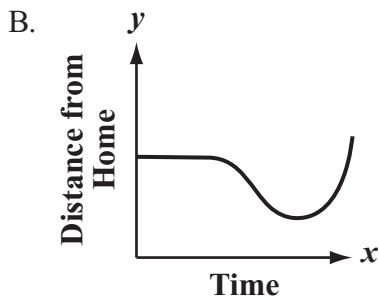
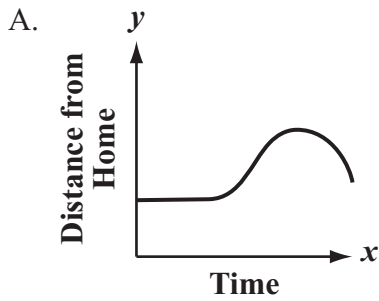


Based on the graph, what is the average distance, in miles, the truck can be driven using 1 gallon of gas?

- A. 10
- B. 12
- C. 14
- D. 16

- 16 Kiki is taking a bicycle ride. During the ride, Kiki is always traveling **away** from the starting point.

Which of the following graphs of distance and time could model Kiki's ride?



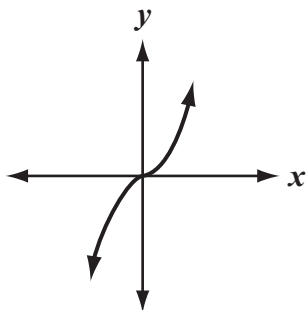
- 17 Which statement is true about the equation below?

$$3(2 - k) = -3k + 2$$

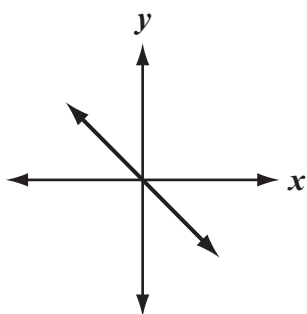
- A. The equation has no solution.
- B. The equation has one solution.
- C. The equation has two solutions.
- D. The equation has infinitely many solutions.

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

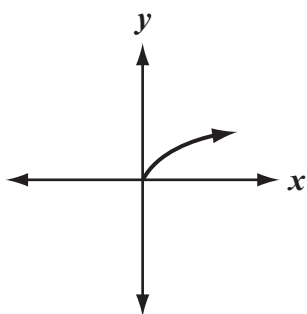
A.



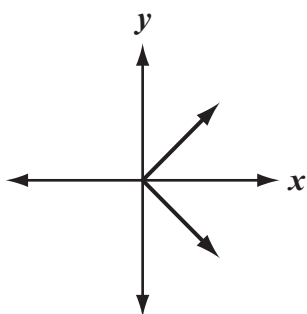
B.



C.



D.



Question 19 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.

- 19 The table below shows a relationship between  $x$  and  $y$  that is **not** a function.

$x$	$y$
3	6
4	6
5	7
5	8
6	10
10	9
11	11

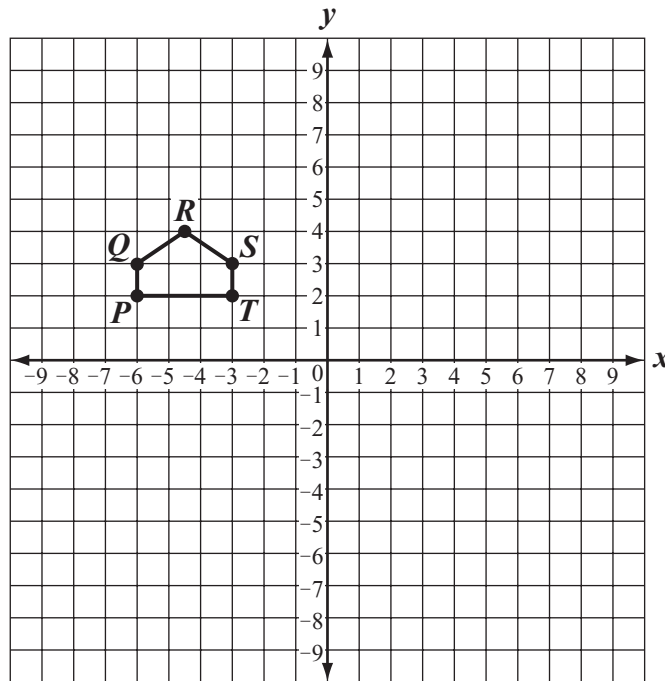
Write one ordered pair that can be removed from the table to make the relationship between  $x$  and  $y$  a function.

Question 20 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 20 in the space provided in your Student Answer Booklet.

- 20 Pentagon  $PQRST$  is shown on the coordinate grid below.



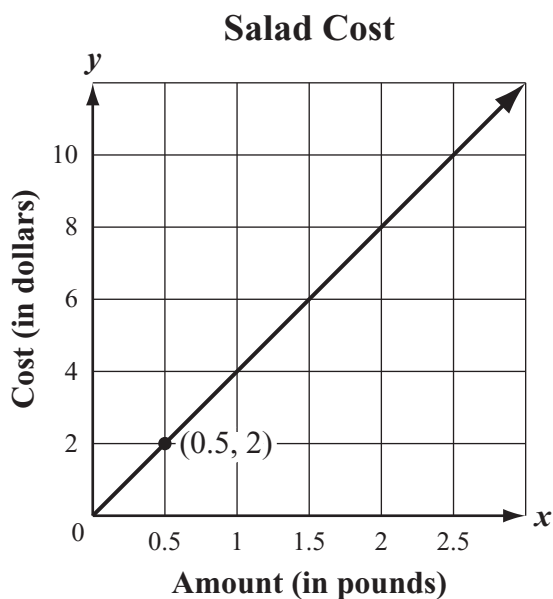
On the grid in your Student Answer Booklet, copy the  $x$ -axis, the  $y$ -axis, and pentagon  $PQRST$  exactly as shown.

- What are the coordinates of vertex  $T$ ?
- On the grid in your Student Answer Booklet, draw the image of pentagon  $PQRST$  after it has been translated 6 units to the right. Label the image  $P'Q'R'S'T'$ .
- What are the coordinates of vertex  $T'$ ?
- On the grid in your Student Answer Booklet, draw the image of pentagon  $P'Q'R'S'T'$  after it has been rotated  $180^\circ$  clockwise about vertex  $T'$ .



Mark your answer to multiple-choice question 21 in the space provided in your Student Answer Booklet. Do not write your answer in this test booklet. You may do your figuring in the test booklet.

- 21 The graph below represents  $y$ , the cost in dollars of  $x$  pounds of salad at a salad bar.



What is the unit rate for the cost of a salad at the salad bar?

- A. \$0.50 per pound
- B. \$1.00 per pound
- C. \$2.00 per pound
- D. \$4.00 per pound

**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 . . . . .  $V = \pi r^2 h$

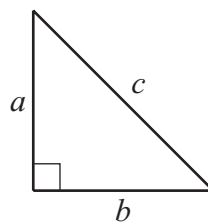
sphere . . . . .  $V = \frac{4}{3}\pi r^3$

**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 2014 Released Items:**  
**Reporting Categories, Standards, and Correct Answers\***

Item No.	Page No.	Reporting Category	Standard	Correct Answer (MC/SA)*
1	220	<i>Expressions and Equations</i>	EE.1	B
2	220	<i>Geometry</i>	G.2	C
3	221	<i>Expressions and Equations</i>	EE.2	A
4	221	<i>Expressions and Equations</i>	EE.8	D
5	222	<i>Functions</i>	F.4	A
6	223	<i>The Number System</i>	NS.2	$\sqrt{3}, \sqrt{5}, \pi$
7	224	<i>Expressions and Equations</i>	EE.4	D
8	225	<i>Geometry</i>	G.5	50° or 50
9	226	<i>Functions</i>	F.3	D
10	226	<i>Expressions and Equations</i>	EE.2	A
11	227	<i>Statistics and Probability</i>	SP.4	
12	228	<i>Functions</i>	F.4	A
13	228	<i>Expressions and Equations</i>	EE.8	C
14	229	<i>Geometry</i>	G.7	B
15	229	<i>Functions</i>	F.4	B
16	230	<i>Functions</i>	F.5	C
17	230	<i>Expressions and Equations</i>	EE.7	A
18	231	<i>Functions</i>	F.3	B
19	232	<i>Functions</i>	F.1	(5, 7) or (5, 8)
20	233	<i>Geometry</i>	G.3	
21	234	<i>Expressions and Equations</i>	EE.5	D

\* 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 2014 Unreleased Common Items:**  
**Reporting Categories and Standards**

<b>Item No.</b>	<b>Reporting Category</b>	<b>Standard</b>
22	<i>The Number System</i>	NS.2
23	<i>Geometry</i>	G.5
24	<i>Expressions and Equations</i>	EE.6
25	<i>Expressions and Equations</i>	EE.3
26	<i>Expressions and Equations</i>	EE.7
27	<i>Expressions and Equations</i>	EE.5
28	<i>Functions</i>	F.4
29	<i>Expressions and Equations</i>	EE.8
30	<i>Geometry</i>	G.5
31	<i>The Number System</i>	NS.2
32	<i>Geometry</i>	G.9
33	<i>Functions</i>	F.1
34	<i>Geometry</i>	G.9
35	<i>Geometry</i>	G.4
36	<i>Statistics and Probability</i>	SP.1
37	<i>Statistics and Probability</i>	SP.3
38	<i>Geometry</i>	G.7
39	<i>Geometry</i>	G.7
40	<i>Geometry</i>	G.4
41	<i>Geometry</i>	G.5
42	<i>Functions</i>	F.4