
XIV. Mathematics, Grade 8

Grade 8 Mathematics Test

The spring 2013 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 *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.

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.

Cross-Reference Information

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.

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

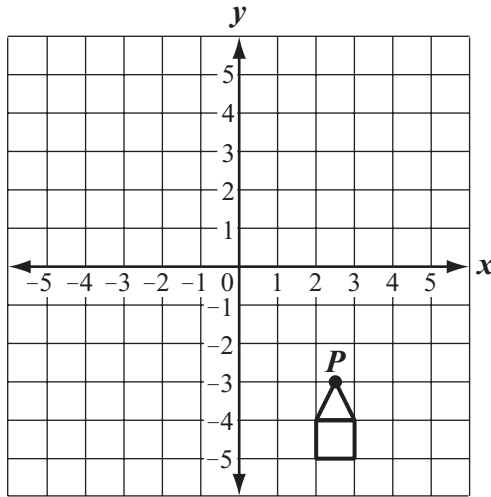
This session contains eight multiple-choice questions, two short-answer questions, and one open-response question. Mark your answers to these questions in the spaces provided in your Student Answer Booklet.

- 1** What is the value of the expression below?

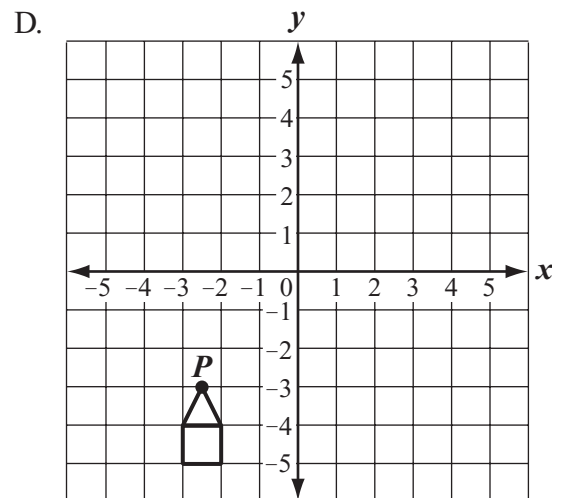
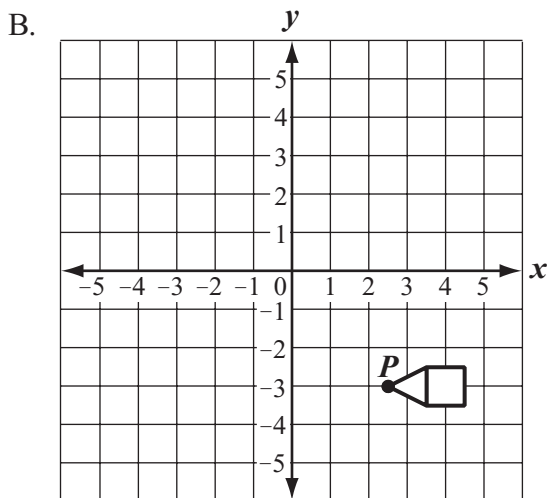
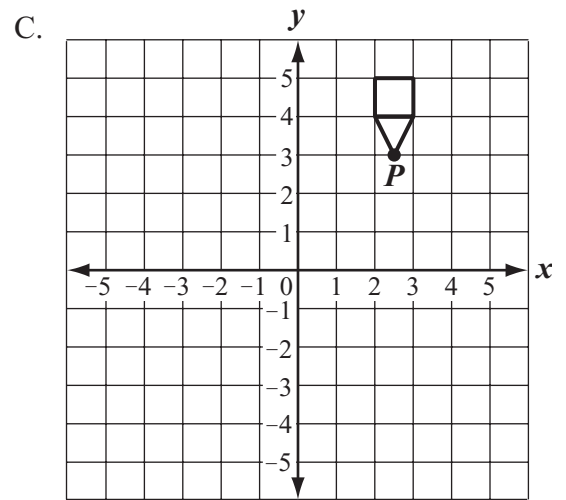
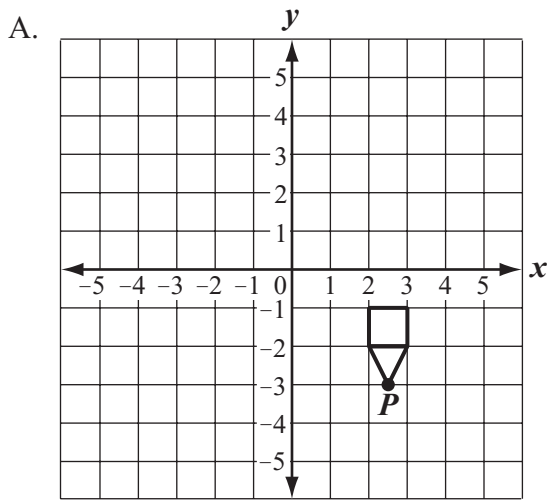
$$(\sqrt{9})^2 + 10$$

- A. 13
- B. 16
- C. 19
- D. 28

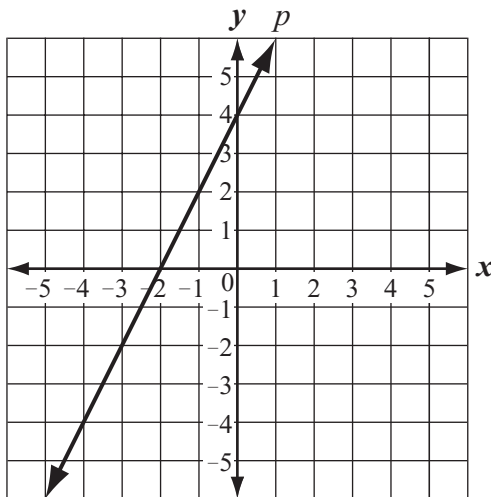
- 2 Seth drew a figure on a coordinate grid and labeled one point P , as shown below.



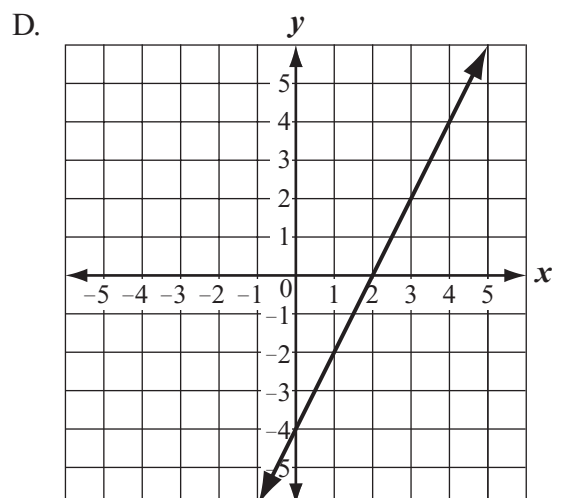
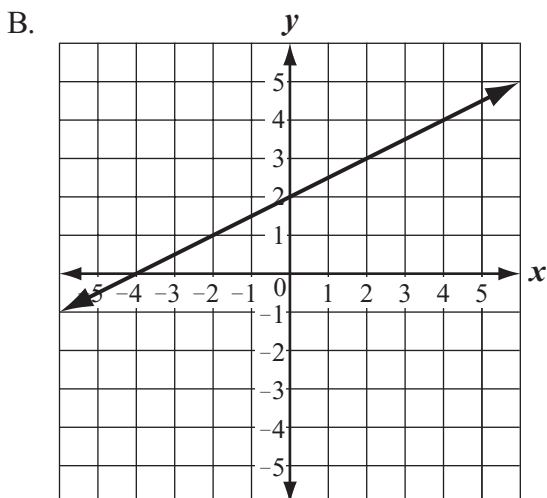
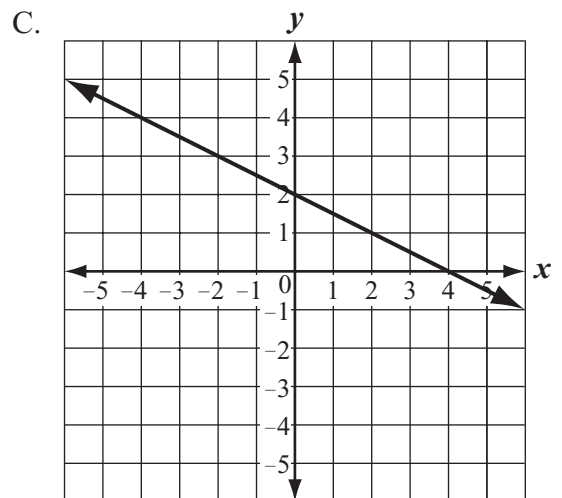
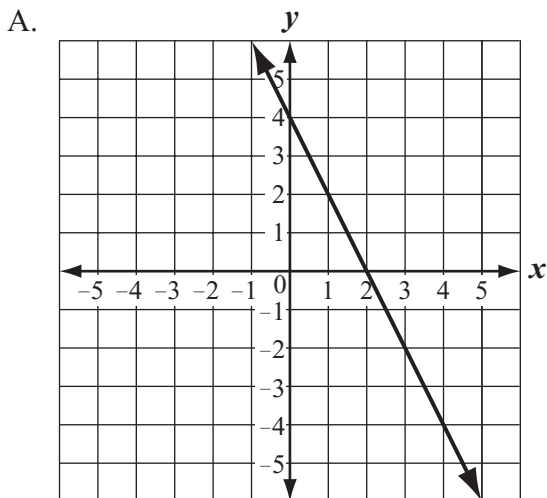
He then rotated the figure 180° clockwise around point P . Which of the following shows the figure after Seth rotated it?



- 3 Carmella graphed line p on the coordinate grid shown below.



Which of the following lines appears to have the same slope as line p ?



- 4 The total cost in dollars, y , of a membership at each of four health clubs is represented below in terms of x , the number of months of the membership.

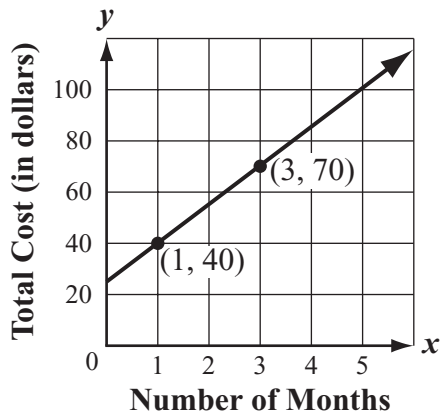
- Health Club A:

$$y = 12x + 60$$

- Health Club B:

x	y
0	\$ 0
1	\$21
2	\$42
3	\$63
4	\$84

- Health Club C:



- Health Club D:

A customer pays a one-time fee of \$20 plus \$20 each month for x months.

Which representation has the greatest rate of change?

- A. Health Club A
- B. Health Club B
- C. Health Club C
- D. Health Club D

- 5 In 2005, the U.S. Mint in Denver produced 4.04×10^8 Oregon state quarters. What is 4.04×10^8 written in standard notation?

- A. 40,400,000
- B. 404,000,000
- C. 4,040,000,000
- D. 40,400,000,000

Question 6 is a short-answer question. Write your answer to question 6 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 is the solution of the equation below?

$$3x + 7 = 1$$

Mark your answers to multiple-choice questions 7 and 8 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 Which of the following equations has infinitely many solutions?

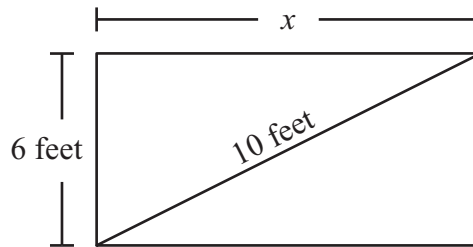
- A. $2x + 3 = 5 + 2x$
- B. $2x + 3 = 5 + 3x$
- C. $3x - 5 = -5 + 2x$
- D. $3x - 5 = -5 + 3x$

8 Which of the following numbers is **not** a rational number?

- A. -3
- B. 2.7
- C. $\sqrt{4}$
- D. $\sqrt{5}$

Question 9 is a short-answer question. Write your answer to question 9 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.

- 9 The students in a science club planted a rectangular flower garden in front of their school. The garden is 6 feet wide and has a diagonal length of 10 feet.



What is x , the length in feet of the garden?

Mark your answer to multiple-choice question 10 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.

- 10 What is the value of the expression below?

$$(-2)^3 (-2)^2$$

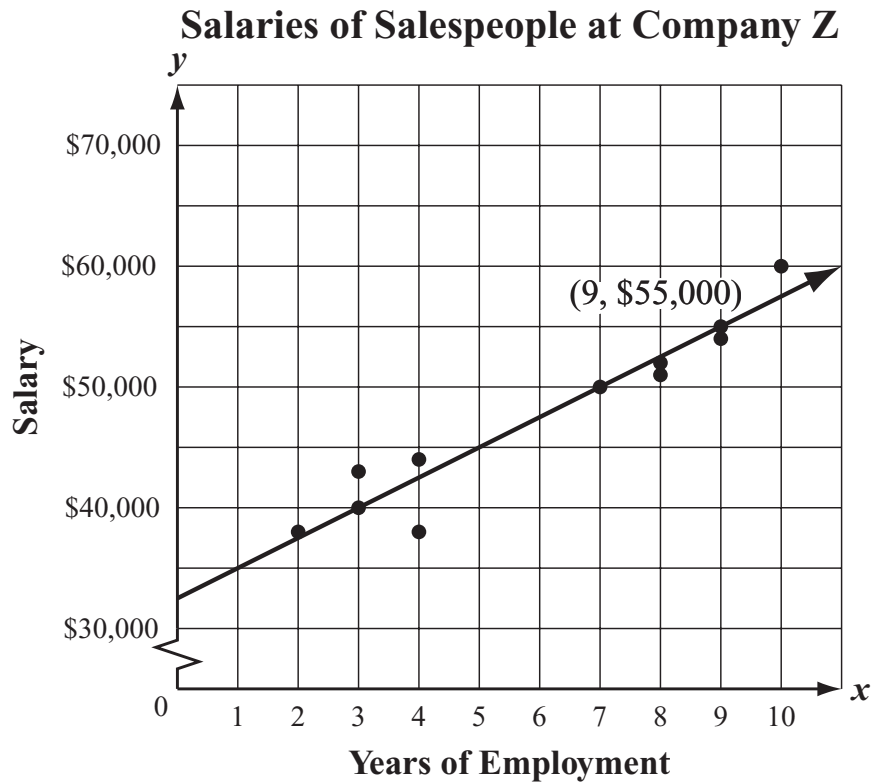
- A. -64
- B. -32
- C. 32
- D. 64

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** Tony collected data on the years of employment and the annual salaries of the salespeople at Company Z. He made a scatterplot and drew a trend line that approximated the line of best fit for the data, as shown below.



- Based on the trend line drawn for the data, what is the salary a salesperson with 3 years of employment at Company Z can expect to earn? Show or explain how you got your answer.
- What is the slope of the trend line that Tony drew? Show or explain how you got your answer.
- What does the slope mean in this situation?

Tony expects his salary to be about \$70,000 after he has been employed as a salesperson at Company Z for 15 years.

- Use the trend line and your answer from part (b) to explain why Tony’s salary expectation is reasonable.

Grade 8 Mathematics

SESSION 2

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

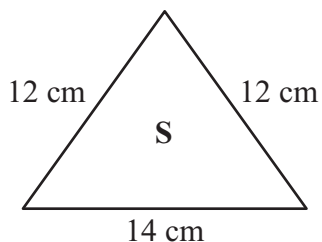
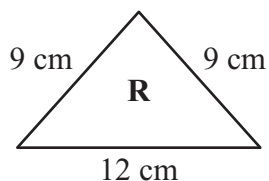
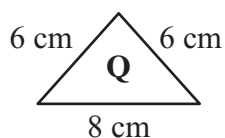
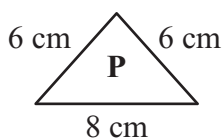
You may use a calculator during this session.



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** A mathematical puzzle uses four triangles with the dimensions shown below.



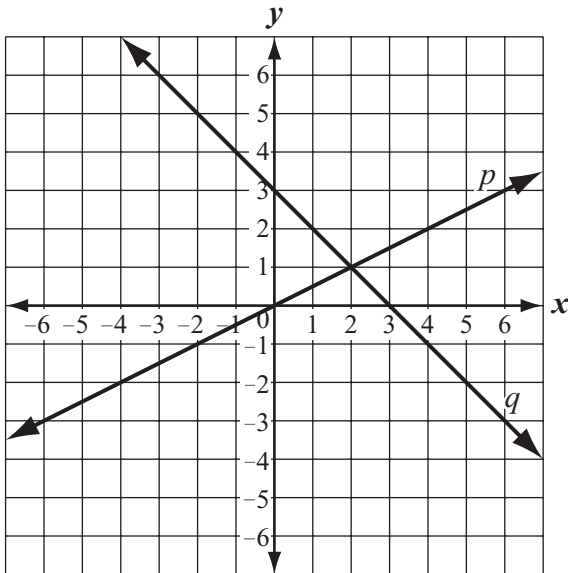
Which of the following triangles are congruent?

- A. P and Q
- B. Q and R
- C. R and S
- D. S and P

- 13** A candy is in the shape of a sphere. The candy has a radius of 1.5 centimeters. Which of the following is closest to the volume of the candy? (Use 3.14 for π .)

- A. 113 cm³
- B. 19 cm³
- C. 14 cm³
- D. 2 cm³

- 14 The system of equations represented by lines p and q is shown on the graph below.



Based on the graph, what is the solution of the system of equations?

- A. $(0, 0)$
- B. $(0, 3)$
- C. $(2, 1)$
- D. $(4, 2)$

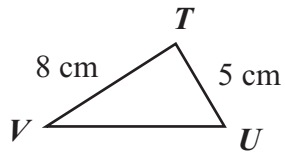
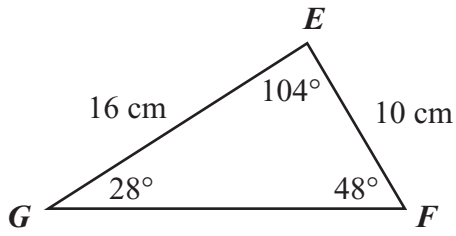
- 15 Barb purchased a loaf of bread for \$2 and p pounds of sliced ham at \$5 per pound for a total of \$13.25. The relationship between what she purchased and her total purchase price is represented by the equation below.

$$5p + 2 = 13.25$$

What was the total number of pounds of ham that Barb purchased?

- A. 2.25 pounds
- B. 2.65 pounds
- C. 3.05 pounds
- D. 4.65 pounds

- 16 Triangle EFG is similar to triangle TUV , as shown below.



Based on the measurements of the triangles, what is the measure of angle U ?

- A. 24°
- B. 28°
- C. 48°
- D. 52°

Question 17 is a short-answer question. Write your answer to question 17 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.

- 17 A mailing tube in the shape of a cylinder has a height of 24 inches and a radius of 3 inches. What is the volume, in cubic inches, of the mailing tube? (Use 3.14 for π .)

Mark your answers to multiple-choice questions 18 and 19 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.

18 Which of the following tables does **not** represent a function?

A.

x	y
-3	5
-2	5
-1	5
0	5

B.

x	y
-1	-1
0	0
1	1
2	2

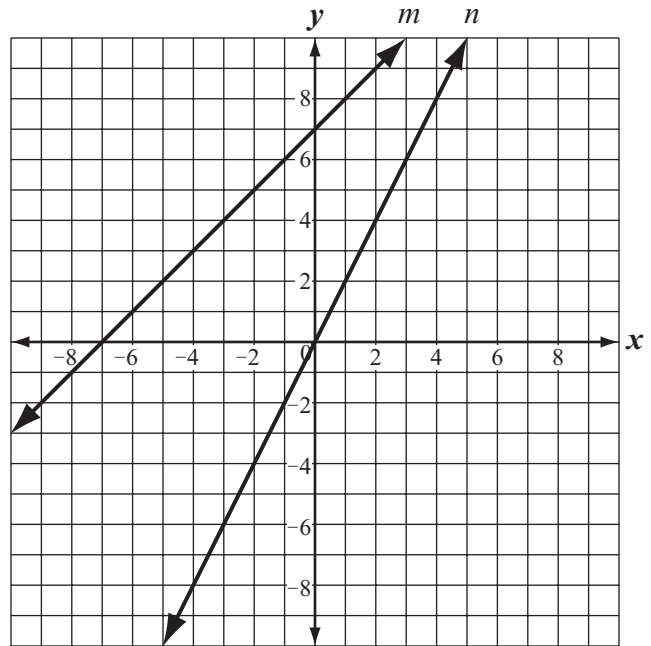
C.

x	y
3	0
4	1
5	2
5	3

D.

x	y
2	8
4	6
6	4
8	2

19 Amanda graphed line m and line n on a coordinate plane, as shown below.



Which of the following statements is true?

- A. The slope of line m is greater than the slope of line n .
- B. The slope of line n is greater than the slope of line m .
- C. The x -intercept of line m is greater than the x -intercept of line n .
- D. The y -intercept of line n is greater than the y -intercept of line m .

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 Some of the students from Eastwood School are taking a trip to a museum. In all, fewer than 60 students will go on the trip. The cost for food and admission to the museum is \$18 per student.

a. What is the total cost for food and admission to the museum for 15 students? Show or explain how you got your answer.

The students will travel on one bus to the museum. The cost of the bus is \$800.

b. In your Student Answer Booklet, copy and complete the table below to show the total cost for food, admission, and the bus for different numbers of students to go to the museum. Show or explain how you got your answers.

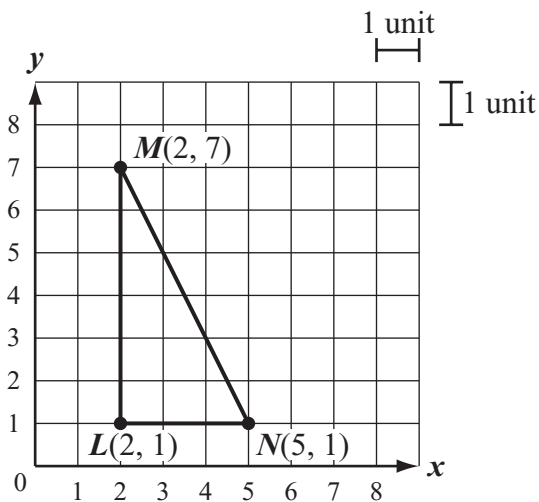
**Student Trip
to the Museum**

Number of Students	Total Cost for Food, Admission, and the Bus
0	\$ 800
20	\$1160
30	
40	
50	

- c. Write an expression that can be used to find the total cost for food, admission, and the bus for n students from Eastwood School to go to the museum.
- d. A total of 44 students go to the museum. What is the total cost, for food, admission, and the bus, **per student** to go to the museum? Show or explain how you got your answer.

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 Right triangle LMN is shown on the coordinate grid below.



Which of the following is the length, in units, of line segment MN ?

- A. 18^2
- B. $\sqrt{18}$
- C. 45^2
- D. $\sqrt{45}$

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

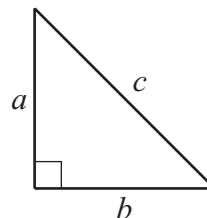
$C = 2\pi r$

OR

$C = \pi d$

$A = \pi r^2$

PYTHAGOREAN THEOREM



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

Grade 8 Mathematics
Spring 2013 Released Items:
Reporting Categories, Standards, and Correct Answers*

Item No.	Page No.	Reporting Category	Standard	Correct Answer (MC/SA)*
1	241	<i>Expressions and Equations</i>	EE.2	C
2	242	<i>Geometry</i>	G.3	A
3	243	<i>Functions</i>	F.4	D
4	244	<i>Functions</i>	F.2	B
5	244	<i>Expressions and Equations</i>	EE.4	B
6	245	<i>Expressions and Equations</i>	EE.7	$x = -2$
7	246	<i>Expressions and Equations</i>	EE.7	D
8	246	<i>The Number System</i>	NS.1	D
9	247	<i>Geometry</i>	G.7	8 feet
10	248	<i>Expressions and Equations</i>	EE.1	B
11	249	<i>Statistics and Probability</i>	SP.1	
12	250	<i>Geometry</i>	G.2	A
13	250	<i>Geometry</i>	G.9	C
14	251	<i>Expressions and Equations</i>	EE.8	C
15	251	<i>Expressions and Equations</i>	EE.7	A
16	252	<i>Geometry</i>	G.4	C
17	253	<i>Geometry</i>	G.9	678.24 cubic inches
18	254	<i>Functions</i>	F.1	C
19	254	<i>Expressions and Equations</i>	EE.5	B
20	255	<i>Functions</i>	F.4	
21	256	<i>Geometry</i>	G.8	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 2013 Unreleased Common Items:
Reporting Categories and Standards

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