
XIV. Mathematics, Grade 8

Grade 8 Mathematics Test

The spring 2008 grade 8 MCAS Mathematics test was based on learning standards in the Massachusetts *Mathematics Curriculum Framework* (2000). The *Framework* identifies five major content strands, listed below.

- Number Sense and Operations
- Patterns, Relations, and Algebra
- Geometry
- Measurement
- Data Analysis, Statistics, and Probability

The grades 7–8 learning standards for each of these strands appear on pages 62–66 of the *Mathematics Curriculum Framework*, which is available on the Department Web site at www.doe.mass.edu/frameworks/current.html.

In *Test Item Analysis Reports* and on the Subject Area Subscore pages of the *MCAS School Reports* and *District Reports*, Mathematics test results are reported under five MCAS reporting categories, which are identical to the five *Framework* content strands listed above.

Test Sessions

The MCAS grade 8 Mathematics test included two separate test sessions. Each session included multiple-choice and open-response questions. Session 1 also included short-answer questions.

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 limited English proficient students only, during both Mathematics test sessions. No other reference tools or materials were allowed.

Cross-Reference Information

The table at the conclusion of this chapter indicates each item's reporting category and the *Framework* learning standard it assesses. The correct answers for multiple-choice and short-answer questions are also displayed in the table.

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 fifteen multiple-choice questions, five short-answer questions, and two open-response questions. Mark your answers to these questions in the spaces provided in your Student Answer Booklet.

- 1 David joined a gym for one month. He paid a monthly fee of \$20 plus \$5 for each visit. The equation below can be used to find c , the total cost of joining the gym for one month and making v visits.

$$c = 20 + 5v$$

Based on the equation, which of the following statements is true?

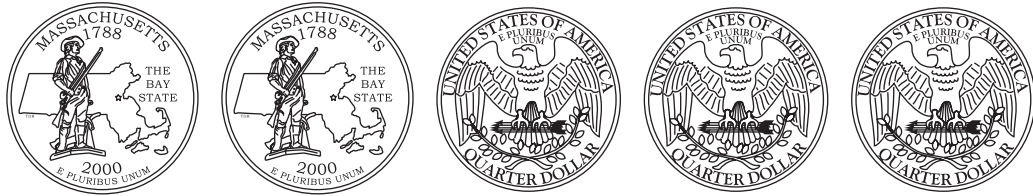
- A. As the total cost increases, the number of visits decreases.
- B. As the total cost decreases, the number of visits stays the same.
- C. As the number of visits increases, the total cost increases.
- D. As the number of visits decreases, the total cost stays the same.

- 2 What is the slope of the line represented by the table of values below?

x	y
0	-20
1	-10
2	0
3	10

- A. 2
- B. 3
- C. 10
- D. 20

- 3 Frank has 2 Massachusetts quarters and 3 “Eagle” quarters in his pocket, as pictured below.



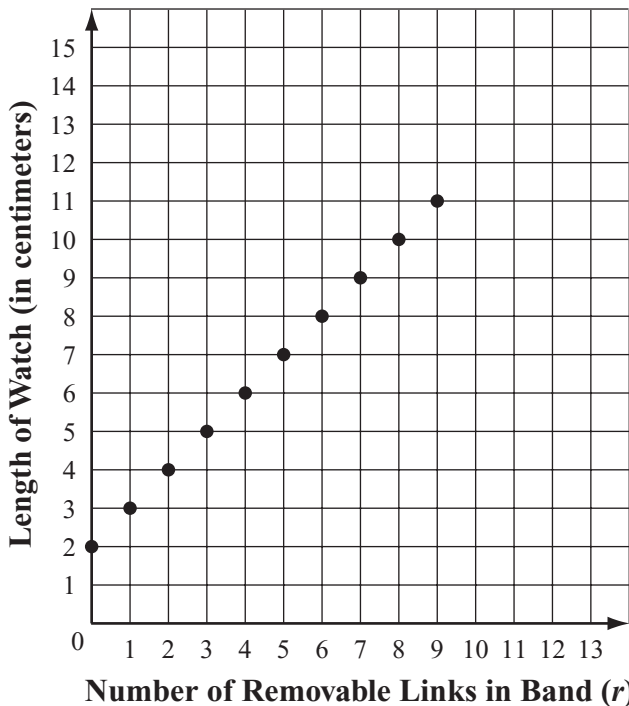
He will select a quarter at random, look at it, and put it back. Then he will select another quarter at random.

What is the probability that Frank will select a Massachusetts quarter both times?

- A. $\frac{2}{25}$
- B. $\frac{4}{25}$
- C. $\frac{1}{4}$
- D. $\frac{1}{2}$

- 4 Linda has a watch with a band made of removable links. All the links are the same size. The length, in centimeters, of the watch with a band made of r removable links is shown in the graph below.

Length of Linda's Watch



What is the length of Linda's watch with 12 links?

- A. 10 centimeters
- B. 12 centimeters
- C. 13 centimeters
- D. 14 centimeters

- 5 The list below shows the interest rates for car loans at four different car dealerships.

$7\frac{1}{2}\%$, 7.4% , $7\frac{3}{8}\%$, 7.2%

Which of the following lists shows the interest rates in order from least to greatest?

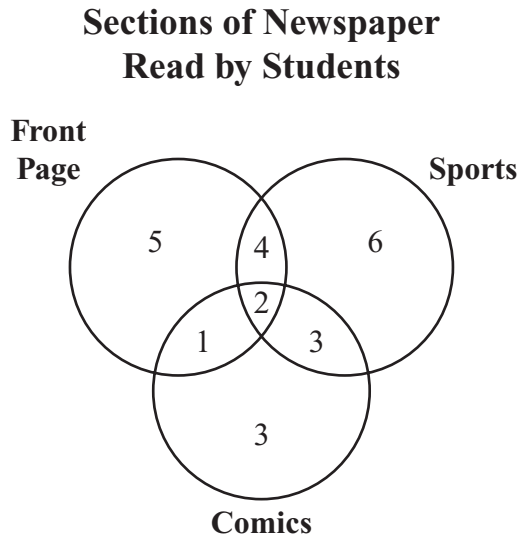
- A. 7.2% , $7\frac{3}{8}\%$, 7.4% , $7\frac{1}{2}\%$
- B. 7.2% , 7.4% , $7\frac{3}{8}\%$, $7\frac{1}{2}\%$
- C. $7\frac{1}{2}\%$, 7.2% , $7\frac{3}{8}\%$, 7.4%
- D. $7\frac{1}{2}\%$, $7\frac{3}{8}\%$, 7.2% , 7.4%

- 6 Which of the following expressions has a value of 16?

- A. $\sqrt{(8)^2}$
- B. $\sqrt{(16)^2}$
- C. $(\sqrt{32})^2$
- D. $(\sqrt{64})^2$

Questions 7 and 8 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.

- 7 Mr. Turner surveyed the students in his class to find out if they had read the front page, the comics, the sports, or any combination of those sections of the previous day’s newspaper. He recorded the results in the Venn diagram below.



Based on the Venn diagram, what was the total number of students who had read the front page of the previous day’s paper?

- 8 The maximum temperature on the planet Mercury is 950°F. The minimum temperature is –346°F. What is the difference, in degrees Fahrenheit, between the maximum and minimum temperatures on Mercury?

Question 9 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 9 in the space provided in your Student Answer Booklet.

- 9 Lisa bought a silver chain. She wants to buy glass beads to put on the chain. The equation below can be used to determine y , Lisa’s total cost, in dollars, to buy a silver chain and x glass beads.

$$y = 2x + 10$$

- a. In your Student Answer Booklet, copy the table below and complete it using the equation. Show or explain how you got each of your answers.

**Total Cost of
Silver Chain and Beads**

Number of Beads (x)	Total Cost (y)
0	\$10
5	\$20
10	
15	
⋮	⋮
25	
⋮	⋮
40	

- b. What does the 2 in the equation represent? Explain your reasoning.
- c. What does the 10 in the equation represent? Explain your reasoning.

Mark your answers to multiple-choice questions 10 through 18 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.

10 Which of the following lists is in order from least to greatest?

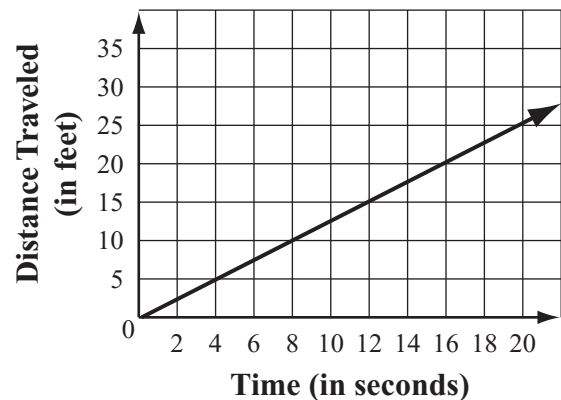
- A. $\sqrt{3}$, π , 3
- B. $\sqrt{3}$, 3, π
- C. 3, π , $\sqrt{3}$
- D. 3, $\sqrt{3}$, π

11 The Adams Middle School girls' basketball team won 5 games and lost 3 games. What percent of all of these games did the team lose?

- A. 30%
- B. 37.5%
- C. 60%
- D. 62.5%

12 The graph below shows the distance that a package travels on a conveyor belt in different numbers of seconds.

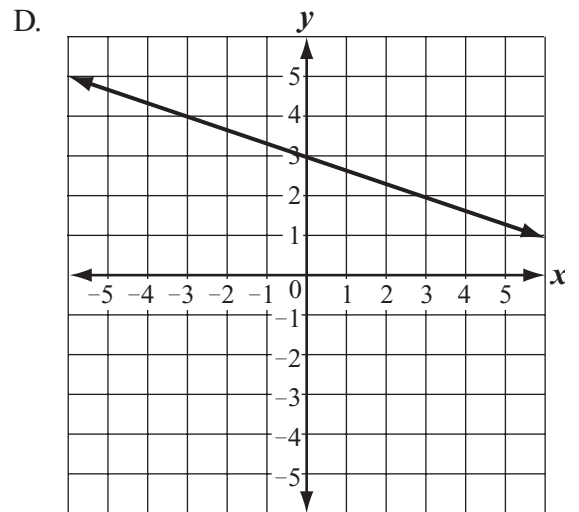
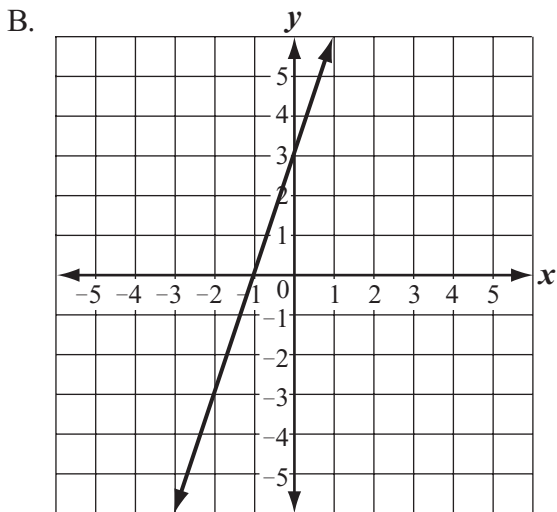
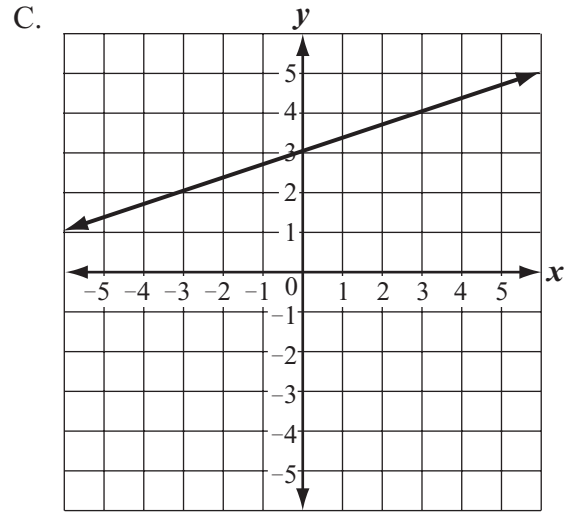
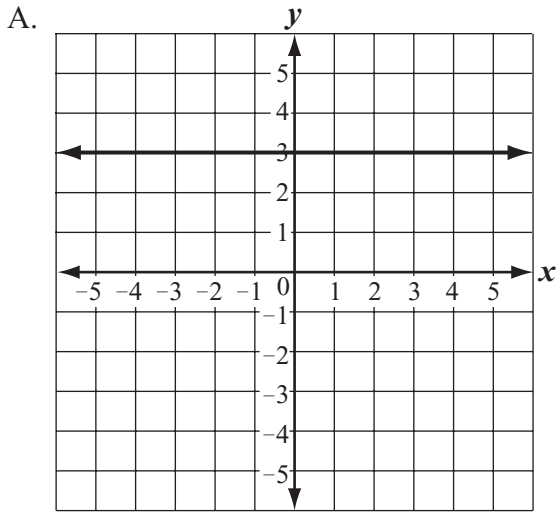
Conveyor Belt



Based on the data in the graph, which of the following best represents the number of feet per second that a package travels on the conveyor belt?

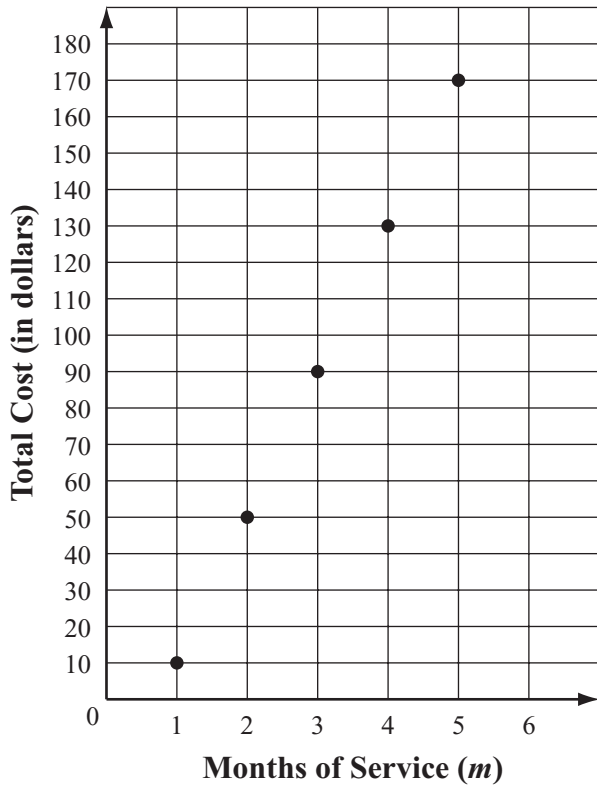
- A. 5 feet per second
- B. $2\frac{1}{2}$ feet per second
- C. $1\frac{1}{4}$ feet per second
- D. $\frac{4}{5}$ foot per second

13 Which of the following lines appears to have the greatest slope?



- 14 The graph below shows the total cost of cable service to new customers for the first five months.

Total Cost of Cable Service



Based on the data in the graph, which of the following expressions can be used to represent the total cost of cable service for m months?

- A. $10m + 30$
- B. $10m + 40$
- C. $40m - 10$
- D. $40m - 30$

- 15 Which of the following is equivalent to the expression below?

$$17(83 - 16)$$

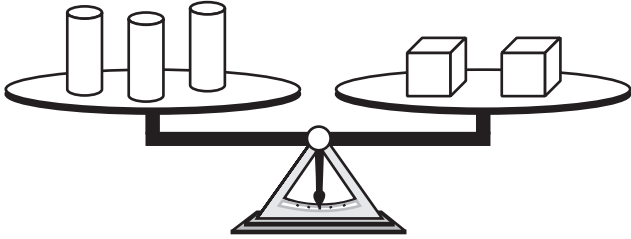
- A. $17(83) - 16$
- B. $(17 - 16)(83)$
- C. $17(83) - 17(16)$
- D. $(17 - 83)(17 - 16)$

- 16 What is the value of the expression below?

$$50 - \sqrt{16} \cdot 4$$

- A. 34
- B. 42
- C. 136
- D. 184

- 17 Yoshi has some identical wooden cylinders and some identical wooden cubes. He balanced 3 of the cylinders with 2 of the cubes, as shown below.



What is the number of cylinders needed to balance 16 cubes?

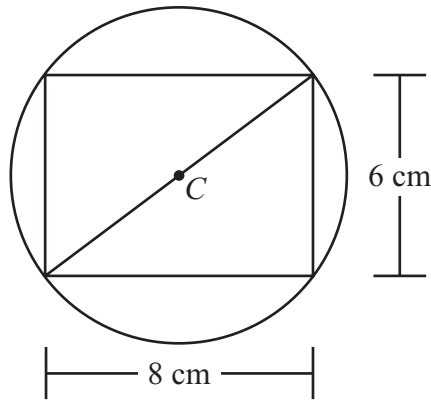
- A. 11
- B. 16
- C. 17
- D. 24

- 18 Which of the following is a true statement?

- A. $|3| = -|-3|$
- B. $|3| < -|-3|$
- C. $-|-3| = |-3|$
- D. $-|-3| < |-3|$

Questions 19, 20, and 21 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.

- 19 For an art project, Calvin drew a rectangle inscribed in circle C , as shown below. The rectangle is 8 centimeters long and 6 centimeters wide.



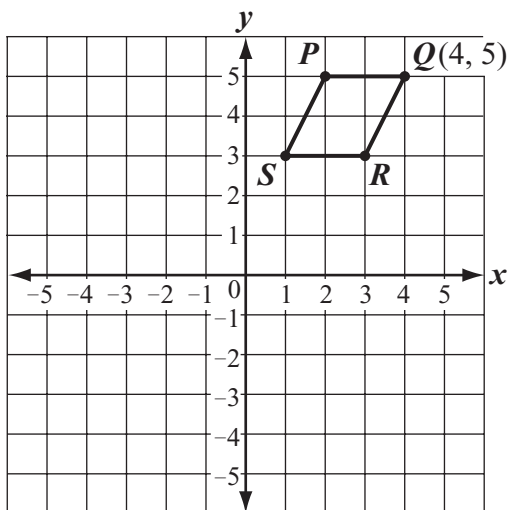
What is the diameter, in centimeters, of circle C ?

- 20 What is the solution to the inequality below?

$$5 + 2x \geq 13$$

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

- 21 Parallelogram $PQRS$ and the coordinates of point Q are shown on the coordinate plane below.



What are the coordinates of the image of point Q after parallelogram $PQRS$ is translated 6 units to the left?

Question 22 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 22 in the space provided in your Student Answer Booklet.

22 Carrie recorded the temperature outside her school at the same time each day for four days.

- On Monday, the temperature was 11°F .
- On Tuesday, the temperature was 15°F **less than** the temperature on Monday.
- On Wednesday, the temperature was 3°F **greater than** the temperature on Tuesday.
- On Thursday, the temperature was 4°F **greater than** the temperature on Wednesday.

a. In your Student Answer Booklet, copy and complete the table below using the information Carrie recorded. Show or explain how you got each of your answers.

**Temperatures Outside
Carrie’s School**

Day	Temperature
Monday	11°F
Tuesday	
Wednesday	
Thursday	

b. What was the difference, in degrees Fahrenheit, between the temperature on Monday and the temperature on Wednesday? Show or explain how you got your answer.

Carrie also recorded the temperature outside her school on Friday. She calculated that the mean temperature for the 5 days, Monday through Friday, was 2°F .

c. What was the temperature, in degrees Fahrenheit, on Friday? Show or explain how you got your answer.

Mathematics

SESSION 2

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

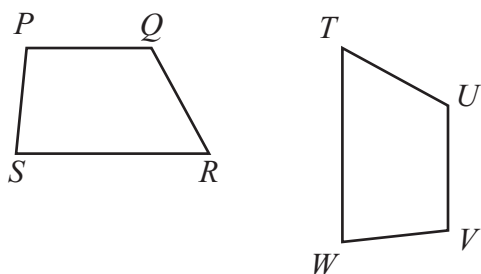
You may use a calculator during this session.



DIRECTIONS

This session contains fourteen multiple-choice questions and three open-response questions. Mark your answers to these questions in the spaces provided in your Student Answer Booklet.

- 23 In the figure below, quadrilateral $PQRS$ is congruent to quadrilateral $VUTW$.



Which of the following pairs of angles **must** be congruent?

- A. $\angle P$ and $\angle T$
- B. $\angle Q$ and $\angle U$
- C. $\angle R$ and $\angle V$
- D. $\angle S$ and $\angle T$

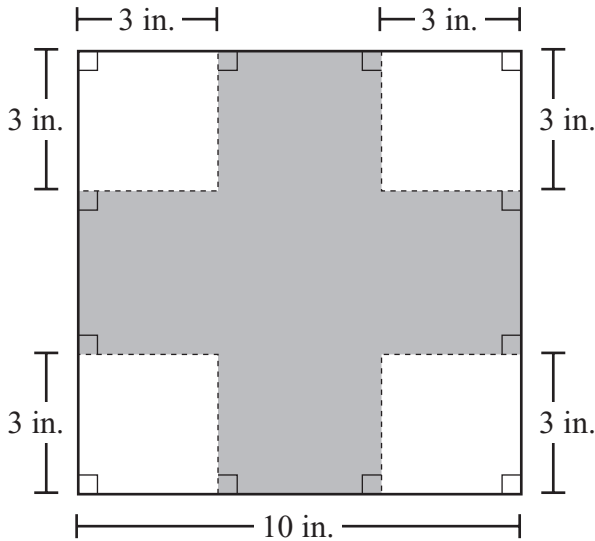
- 24 The scores Melanie earned on her first four mathematics tests are shown in the box below.

78, 82, 92, 94

Melanie earned a 92 on her fifth mathematics test. Which of the following measures does **not** change when her fifth test score is included?

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

- 25 Madelyn had a square piece of cardboard that was 10 inches in length. She cut one 3-inch square from each corner, as shown below.



The shaded part represents the remaining cardboard. What is the area of the remaining cardboard?

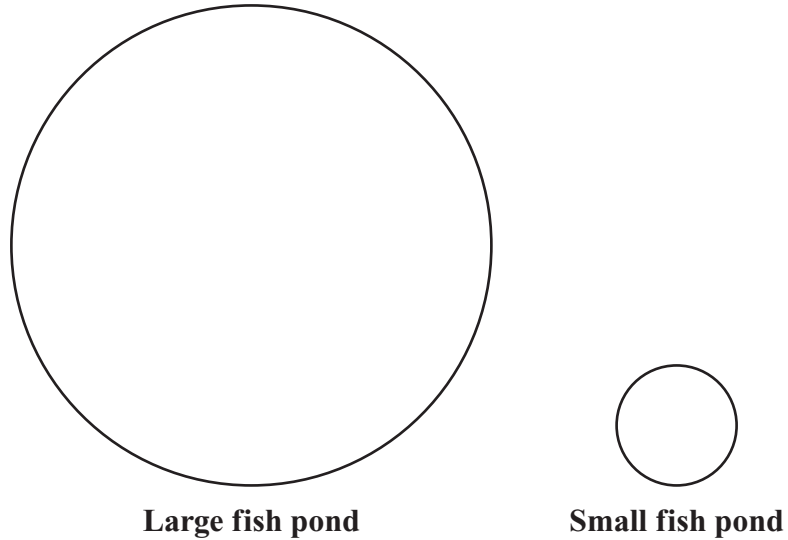
- A. 36 sq. in.
- B. 48 sq. in.
- C. 64 sq. in.
- D. 80 sq. in.

- 26 At the school carnival, Luke bought a hot dog for \$2. He also bought g game tickets for \$0.25 each. Luke spent a total of \$10.

Which of the following equations can be used to find the number of game tickets that Luke bought?

- A. $2g + 0.25 = 10$
- B. $2g - 0.25 = 10$
- C. $0.25g + 2 = 10$
- D. $0.25g - 2 = 10$

- 27 A park has a large fish pond and a small fish pond, as shown below.



- Each pond is in the shape of a circle.
- The radius of the large fish pond is 4 times the radius of the small fish pond.

Based on this information, which of the following statements is true?

- A. The area of the large pond is 2 times the area of the small pond.
- B. The area of the large pond is 4 times the area of the small pond.
- C. The area of the large pond is 8 times the area of the small pond.
- D. The area of the large pond is 16 times the area of the small pond.

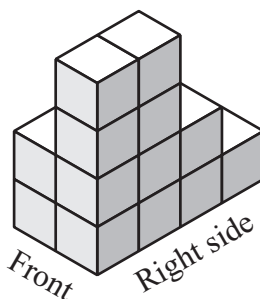
Questions 28 and 29 are open-response questions.

- **BE SURE TO ANSWER AND LABEL ALL PARTS OF EACH 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 28 in the space provided in your Student Answer Booklet.

- 28 Michael stacked cubes to make the structure shown below.

Michael’s Structure



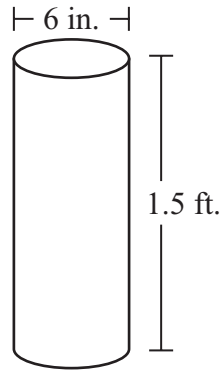
- a. Draw the right side view of Michael’s structure. Be sure to label your drawing “right side view.”

Michael used a total of 14 cubes to make his structure.

- b. Draw the front view of Michael’s structure. Be sure to label your drawing “front view.”
- c. Draw one possible top view for Michael’s structure. Be sure to label your drawing “top view.” Show or explain how you got your answer.

Write your answer to question 29 in the space provided in your Student Answer Booklet.

- 29 Erika has a cylindrical container with a diameter of 6 inches and a height of 1.5 feet, as shown below.



- What is the height, in **inches**, of the container? Show or explain how you got your answer.
- What is the volume, in cubic inches, of the container? Show or explain how you got your answer. (Use 3.14 for π .)
- Erika filled the container with 250 cubic inches of sand. What is the approximate height, in inches, of the sand that Erika put in the container? Show or explain how you got your answer.

Mark your answers to multiple-choice questions 30 through 38 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.

- 30 Yasmin works in a pet store. The list in the box below shows the number of pets that Yasmin sold each week for seven weeks.

7, 5, 6, 10, 4, 12, 5

What is the mode of the number of pets that Yasmin sold each week for these seven weeks?

- A. 5
- B. 6
- C. 7
- D. 8

- 31 For an assembly, 105 chairs will be set up using the fewest possible rows.
- There will be the same number of chairs in each row.
 - There will be more than one row of chairs.

What will be the number of **chairs** in each row?

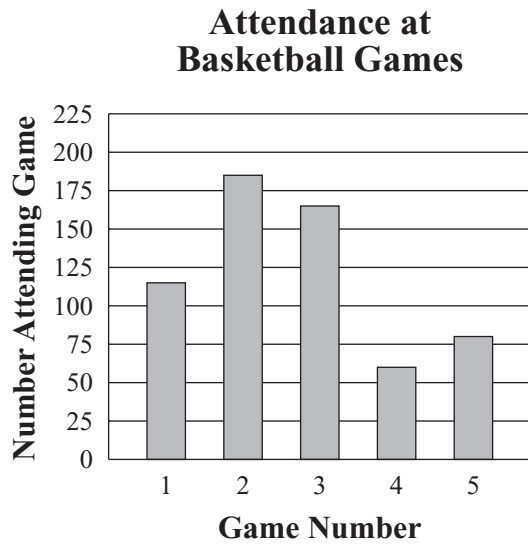
- A. 3
- B. 5
- C. 21
- D. 35

- 32 Which of the following is equivalent to the expression below?

$$-3(x + 1)$$

- A. $-3x - 3$
- B. $-3x - 1$
- C. $-3x + 1$
- D. $-3x + 3$

- 33 The bar graph below shows the attendance at each of five basketball games.



Which of the following is closest to the difference between the least and the greatest attendance for the five basketball games?

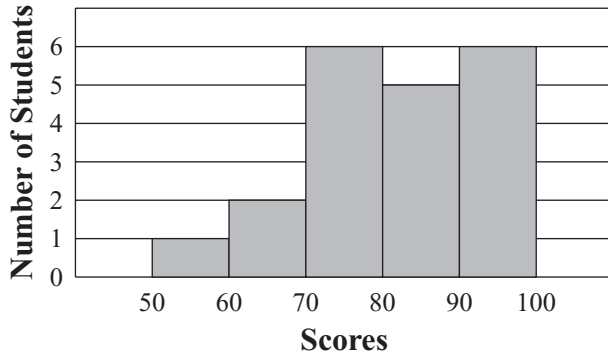
- A. 35
- B. 55
- C. 70
- D. 125

- 34 Massachusetts has 4230 miles of rivers. Which of the following measures is closest to the length, in kilometers, of the rivers in Massachusetts? (1 mile \approx 1.609 kilometers)

- A. 2629 kilometers
- B. 3804 kilometers
- C. 5839 kilometers
- D. 6806 kilometers

- 35 The histogram below shows the scores for all the students who took a mathematics quiz.

Student Scores on Mathematics Quiz



What percent of the students received a score of 80 or above?

- A. 55%
- B. 40%
- C. 25%
- D. 11%

- 36 Which of the following is more likely to be an estimate than an exact number?

- A. the balance due on a telephone bill
- B. the population of deer in the state of Massachusetts
- C. the change a customer receives when making a purchase
- D. the number of cans of tomato soup that a store manager orders

- 37 Jake has a coin bank in the shape of a cylinder that has a radius of 1.5 inches and a height of 5 inches. He made a paper label to completely cover the curved surface of the cylinder.

The expression below can be used to find the area of the label, where r stands for the radius and h stands for the height.

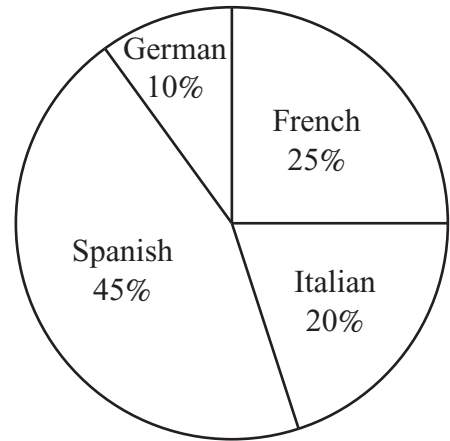
$$2\pi rh$$

Which of the following is closest to the area of Jake's label? (Use 3.14 for π .)

- A. 15 square inches
- B. 24 square inches
- C. 35 square inches
- D. 47 square inches

- 38 The circle graph below shows the percent of students enrolled in each of four foreign language classes being offered at a school.

Students Enrolled in Foreign Language Classes



- No student is enrolled in more than one foreign language class.
- The number of students enrolled in Italian is 36.

Based on the graph and the given data, what is the total number of students enrolled in foreign language classes?

- A. 72
- B. 100
- C. 116
- D. 180

Question 39 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 39 in the space provided in your Student Answer Booklet.

- 39 The manager of a car dealership is ordering a new car. The options for the new car are shown in the table below.

Options for New Car

Categories	Options
Color	white red silver
Roof style	hard top convertible
Number of doors	2 doors 4 doors

The manager decides to let his computer randomly select one option for each of the three categories in the table.

- a. Based on the table, what is the total number of combinations of 1 color, 1 roof style, and 1 number of doors that can be selected for the new car? Show or explain how you got your answer.
- b. What is the probability that the computer will select a hard top for the new car? Show or explain how you got your answer.
- c. What is the probability that the computer will **not** select white for the new car’s color? Show or explain how you got your answer.
- d. What is the probability that the computer will select for the new car to **both** be silver and have 2 doors? Show or explain how you got your answer.



Massachusetts Comprehensive Assessment System Grade 8 Mathematics Reference Sheet

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

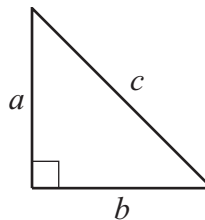
$$C = 2\pi r$$

OR

$$C = \pi d$$

$$A = \pi r^2$$

PYTHAGOREAN THEOREM



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

Grade 8 Mathematics
Spring 2008 Released Items:
Reporting Categories, Standards, and Correct Answers*

Item No.	Page No.	Reporting Category	Standard	Correct Answer (MC/SA)*
1	359	<i>Patterns, Relations, and Algebra</i>	8.P.6	C
2	359	<i>Patterns, Relations, and Algebra</i>	8.P.5	C
3	360	<i>Data Analysis, Statistics, and Probability</i>	8.D.4	B
4	361	<i>Patterns, Relations, and Algebra</i>	8.P.1	D
5	361	<i>Number Sense and Operations</i>	8.N.1	A
6	361	<i>Number Sense and Operations</i>	8.N.9	B
7	362	<i>Data Analysis, Statistics, and Probability</i>	8.D.2	12
8	362	<i>Number Sense and Operations</i>	8.N.12	1296°F
9	363	<i>Patterns, Relations, and Algebra</i>	8.P.6	
10	364	<i>Number Sense and Operations</i>	8.N.2	B
11	364	<i>Number Sense and Operations</i>	8.N.12	B
12	364	<i>Measurement</i>	8.M.5	C
13	365	<i>Patterns, Relations, and Algebra</i>	8.P.10	B
14	366	<i>Patterns, Relations, and Algebra</i>	8.P.4	D
15	366	<i>Number Sense and Operations</i>	8.N.8	C
16	366	<i>Number Sense and Operations</i>	8.N.7	A
17	367	<i>Patterns, Relations, and Algebra</i>	8.P.7	D
18	367	<i>Number Sense and Operations</i>	8.N.6	D
19	368	<i>Geometry</i>	8.G.4	10 centimeters
20	368	<i>Patterns, Relations, and Algebra</i>	8.P.7	$x \geq 4$
21	369	<i>Geometry</i>	8.G.6	$(-2, 5)$
22	370	<i>Number Sense and Operations</i>	8.N.12	
23	371	<i>Geometry</i>	8.G.2	B
24	371	<i>Data Analysis, Statistics, and Probability</i>	8.D.3	A
25	372	<i>Measurement</i>	8.M.3	C
26	372	<i>Patterns, Relations, and Algebra</i>	8.P.7	C
27	373	<i>Patterns, Relations, and Algebra</i>	8.P.8	D
28	374	<i>Geometry</i>	8.G.8	
29	375	<i>Measurement</i>	8.M.3	
30	376	<i>Data Analysis, Statistics, and Probability</i>	8.D.3	A
31	376	<i>Number Sense and Operations</i>	8.N.5	D
32	376	<i>Patterns, Relations, and Algebra</i>	8.P.3	A
33	377	<i>Data Analysis, Statistics, and Probability</i>	8.D.2	D
34	377	<i>Measurement</i>	8.M.2	D
35	378	<i>Data Analysis, Statistics, and Probability</i>	8.D.2	A
36	378	<i>Number Sense and Operations</i>	8.N.11	B
37	379	<i>Patterns, Relations, and Algebra</i>	8.P.2	D
38	379	<i>Data Analysis, Statistics, and Probability</i>	8.D.2	D
39	380	<i>Data Analysis, Statistics, and Probability</i>	8.D.4	

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