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## VII. Mathematics, Grade 6

# Grade 6 Mathematics Test

The spring 2005 Grade 6 MCAS Mathematics Test was based on learning standards in the Massachusetts *Mathematics Curriculum Framework* (2000). The *Framework* identifies five major content strands, listed below. Page numbers for the grade 5–6 learning standards appear in parentheses.

- Number Sense and Operations (*Framework*, pages 25–26)
- Patterns, Relations, and Algebra (*Framework*, page 34)
- Geometry (*Framework*, page 42)
- Measurement (*Framework*, page 50)
- Data Analysis, Statistics, and Probability (*Framework*, page 58)

The *Mathematics Curriculum Framework* is available on the Department Web site at [www.doe.mass.edu/frameworks/math/2000/final.pdf](http://www.doe.mass.edu/frameworks/math/2000/final.pdf).

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 *Mathematics Curriculum Framework* content strands listed above.

## Test Sessions and Content Overview

The MCAS Grade 6 Mathematics Test included two separate test sessions. Each session included multiple-choice, short-answer, and open-response questions.

## Reference Materials and Tools

Each student taking the Grade 6 Mathematics Test was provided with a plastic ruler and a *Grade 6 Mathematics Reference Sheet*. A copy of the reference sheet follows the final question in this chapter. No calculators, other reference tools, or materials were allowed.

The use of bilingual word-to-word dictionaries was allowed for limited English proficient students only, during both Mathematics test sessions.

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

- 1 Bonnie bought a 13-pound turkey for \$0.85 per pound. How much money did she pay for the turkey?
- A. \$11.05
  - B. \$13.85
  - C. \$33.00
  - D. \$110.05

- 2 The table below shows the number of pounds of fertilizer needed to cover a given area.

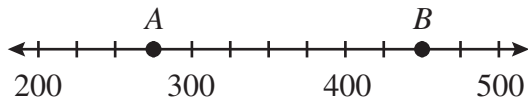
**Fertilizer Coverage**

Pounds	Square Yards of Coverage
4	100
8	200
12	300
16	400

Based on the pattern in the table, how many pounds of fertilizer are needed to cover 600 square yards?

- A. 18 pounds
- B. 20 pounds
- C. 24 pounds
- D. 25 pounds

- Which of the following is closest to the distance between point *A* and point *B* on the number line shown below?



- A. 175 units
  - B. 275 units
  - C. 450 units
  - D. 725 units
- 4 A sea otter has over 1,000,000 hairs per square inch on its back. Which of the following equals 1,000,000?
- A.  $10^5$
  - B.  $10^6$
  - C.  $10^7$
  - D.  $10^8$

- Which of the following is closest to the product  $298.7 \times 10.1$ ?

- A. 300
- B. 2,000
- C. 3,000
- D. 20,000

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

$$2x + 2 = 10$$

- A.  $x = 4$
- B.  $x = 6$
- C.  $x = 8$
- D.  $x = 12$

- Rae is making a salad. The choices for the ingredients are shown in the chart below.

**Salad Ingredients**

Lettuce	Vegetable	Dressing
Iceberg	Carrot	Ranch
Romaine	Celery	Italian
	Broccoli	Caesar
	Cauliflower	Vinaigrette
		French

What is the total number of different salads she can make using one lettuce, one vegetable, and one dressing?

- A. 11
- B. 15
- C. 20
- D. 40

- Judith has a total of 8 fish in her aquarium. Exactly 6 of the fish are guppies. What percent of the fish in the aquarium are guppies?

- A. 48%
- B. 60%
- C. 68%
- D. 75%

- Sam is 37 years older than Dennis. If Sam is 55 years old now, how old is Dennis?

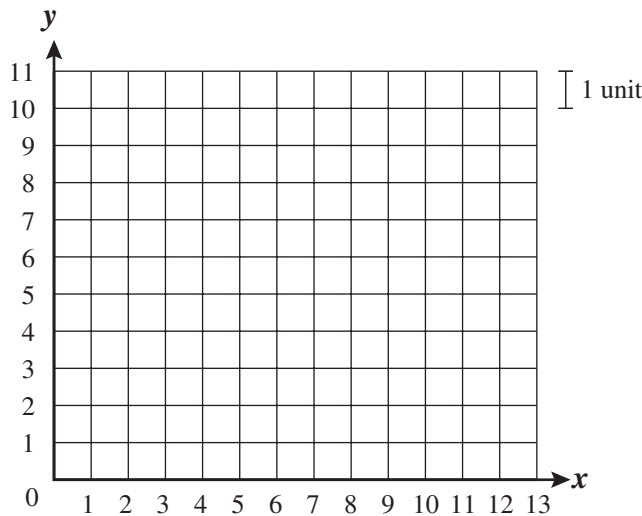
- A. 12 years old
- B. 18 years old
- C. 28 years old
- D. 92 years old

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** On the grid in your Student Answer Booklet, create a coordinate grid like the one shown below.



- a. On your coordinate grid, plot the point  $(4, 3)$ . Label the point  $A$ .
- b. On your coordinate grid, plot the point  $(4, 9)$ . Label the point  $B$ .
- c. The points  $A$  and  $B$  will be used to form a triangle.
  - On your coordinate grid, plot and label a third point,  $C$ , so that a right isosceles triangle will be formed when points  $A$ ,  $B$ , and  $C$  are connected.
  - What are the coordinates of point  $C$ ?
  - Explain how you know that the triangle formed is **both** right and isosceles.
- d. What is the area, in square units, of triangle  $ABC$ ? Show or explain how you got your answer.

Questions 11 and 12 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.

● What is the value of the following expression?

$$3 + 6 \times 4$$

● The radius of a circle is 14 inches. What is the diameter of the circle?

Question 13 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 13 in the space provided in your Student Answer Booklet.

The local library charges the same fine per day for each day a library book is overdue. The table below shows the amount of the fine for a book that is overdue for different numbers of days.

**Fines for Overdue Library Books**

Number of Days Overdue	Amount of Fine
2	\$0.30
4	\$0.60
6	\$0.90
⋮	⋮
18	

- What is the amount of the fine for a book that is 1 day overdue? Show or explain how you got your answer.
- What will be the amount of the fine for a book that is 18 days overdue? Show or explain how you got your answer.
- Using numbers, words, or symbols, write an expression that represents the amount of the fine for a book that is  $x$  days overdue.
- What is the fewest number of days a book can be overdue if the amount of the fine is greater than \$14.00? Show or explain how you got your answer.



Mark your answers to multiple-choice questions 14 through 16 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.

- 14 What is the value of the expression below when  $\triangle = 8$ ?

$$\frac{\triangle}{2} - 2$$

- A. 2
- B. 3
- C. 4
- D. 6

- 15 Mr. Young wrote five numbers on the board in his classroom. After class, one of the numbers was erased. Four of the five numbers are shown below.

18   25   30   17   ?

If the median of the five numbers that Mr. Young wrote on the board was 18, which of the following could be true?

- A. The number that was erased was greater than 30.
- B. The mode of the five numbers Mr. Young wrote on the board was 24.
- C. The mean of the five numbers Mr. Young wrote on the board was 22.6.
- D. The number that was erased was less than or equal to 18.

- 16 There are 11 teachers and 132 students at a middle school. What is the ratio of teachers to students?

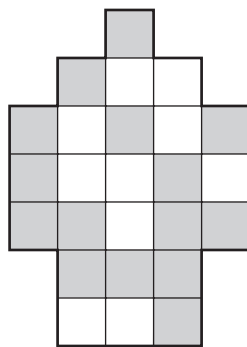
- A. 1 to 11
- B. 1 to 12
- C. 11 to 12
- D. 11 to 13



Question 17 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 17 in the space provided in your Student Answer Booklet.

● Shing made the design shown below using gray square tiles and white square tiles.



Key	
	represents 1 gray tile
	represents 1 white tile

- a. What fractional part of the whole design is made up of gray tiles? Write your answer as a fraction. Show or explain how you got your answer.
- b. Write the fraction from part a. as a decimal. Show or explain how you got your answer.
- c. Write the fraction from part a. as a percent. 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 **not** use a calculator during this session.



### DIRECTIONS

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

- Mr. Donato drew an equilateral triangle. Which of the following statements is true about the triangle?
- A. At least one angle is obtuse.
  - B. All of the angles are acute.
  - C. At least one angle measures 90 degrees.
  - D. All of the angles have different measurements.

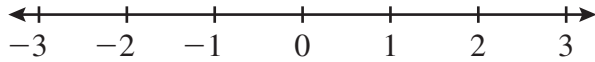
- 19 Bridget created the input-output table shown below.

Input	1	2	3	4	5	6	7
Output	4	6	8	10	12	14	16

Which of the following rules is true for all values in Bridget's input-output table?

- A.  $\text{Input} + 3 = \text{Output}$
- B.  $\text{Input} \times 3 = \text{Output}$
- C.  $(\text{Input} \times 2) + 1 = \text{Output}$
- D.  $(\text{Input} \times 2) + 2 = \text{Output}$

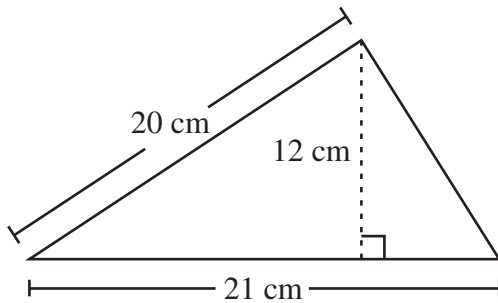
- Marta is plotting points on the number line below.



Between which two numbers should Marta plot  $-2\frac{1}{2}$ ?

- A. 1 and 2
- B. 2 and 3
- C. -2 and -1
- D. -3 and -2

- What is the area of the triangle shown below?



- A.  $126 \text{ cm}^2$
- B.  $210 \text{ cm}^2$
- C.  $252 \text{ cm}^2$
- D.  $420 \text{ cm}^2$

- 22 Based on the equation below, which of the following statements must be true?

$$3(\Delta) = 12$$

- A.  $\Delta = 3 + 12$
- B.  $\Delta = 12 - 3$
- C.  $\Delta = 12 \div 3$
- D.  $\Delta = 3 \div 12$

- 23 Which of the following shows the numbers in order from **least to greatest**?

- A. 0.765, 0.82, 0.791
- B. 0.765, 0.791, 0.82
- C. 0.791, 0.82, 0.765
- D. 0.791, 0.765, 0.82

- 24 What is the value of the expression shown below?

$$-6 + (-9)$$

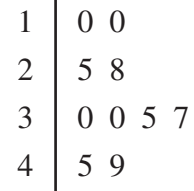
- A. -15
- B. -3
- C. 3
- D. 15

- 25 Which of the following represents the statement “3 times the sum of 2 and 4”?

- A.  $3 \times 2 + 4$
- B.  $3 + (2 \times 4)$
- C.  $3 \times 4 + 2$
- D.  $3 \times (2 + 4)$

- 26 The stem-and-leaf plot below shows the number of minutes each of Ms. Dena’s students spent practicing the piano on Monday night.

**Minutes Spent Practicing**



<b>Key</b>	
6   5	represents 65

Each student’s assignment was to practice **at least** 30 minutes on Monday night. What is the total number of students who completed their assignment?

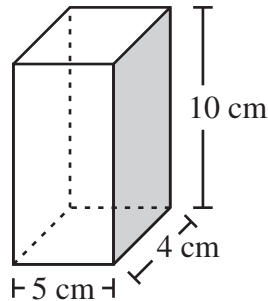
- A. 4
- B. 6
- C. 8
- D. 10

Question 27 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 27 in the space provided in your Student Answer Booklet.

- Mattias has a rectangular prism with the dimensions shown below.



- What is the area, in square centimeters, of the shaded face of the rectangular prism? Show or explain how you got your answer.
- What is the volume, in cubic centimeters, of the rectangular prism? Show or explain how you got your answer.
- What is the total surface area, in square centimeters, of the rectangular prism? Show or explain how you got your answer.

Questions 28 and 29 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.

- Based on the pattern in the input-output table below, what is the value of  $y$  when  $x = 4$ ?

Input ( $x$ )	Output ( $y$ )
1	7
2	14
3	21
4	?

- Ticket sales for the sixth-grade banquet are shown in the table below.

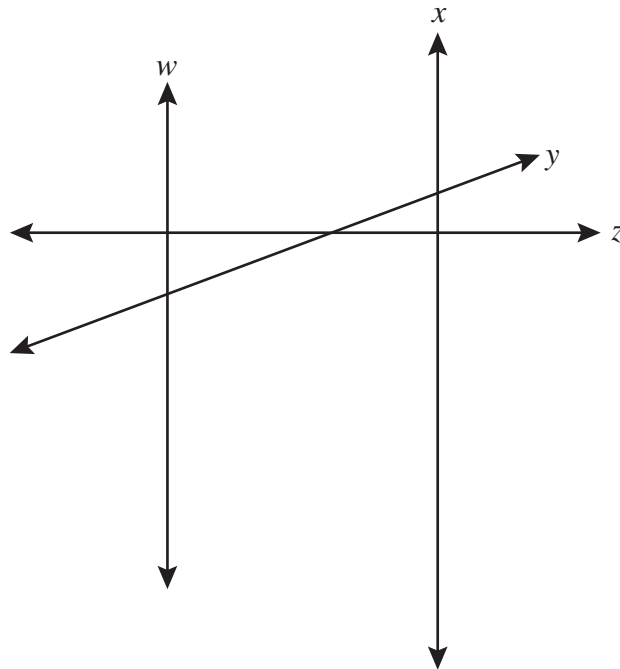
**Banquet Tickets Sold**

Homeroom	Number of Tickets Sold
Ms. Sanchez	22
Ms. Blake	28
Mr. Chang	21
Mr. Williams	25

What is the **mean** number of tickets sold per homeroom?

Question 30 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.

● Lines  $w$ ,  $x$ ,  $y$ , and  $z$  are shown below.



What are 2 lines that appear to be perpendicular to each other?

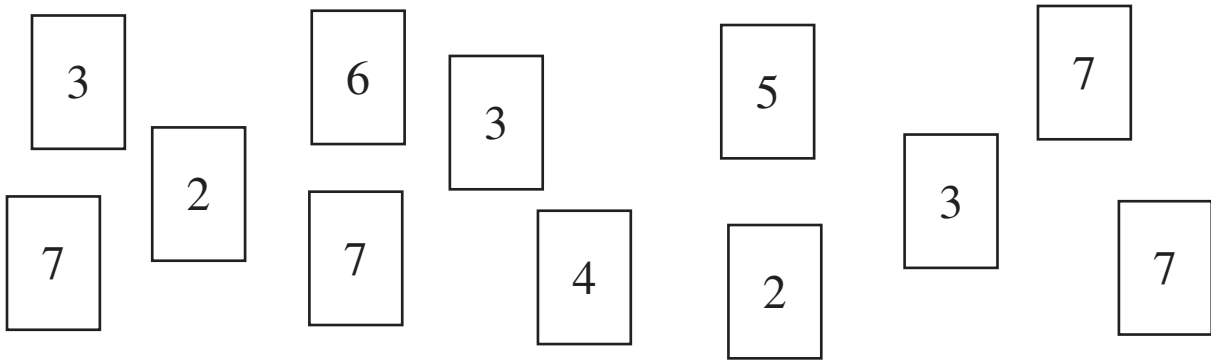


Question 31 is an open-response question.

- **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 31 in the space provided in your Student Answer Booklet.

● Silas has the cards shown below. All cards are the same size and shape. He put the cards into a bag.

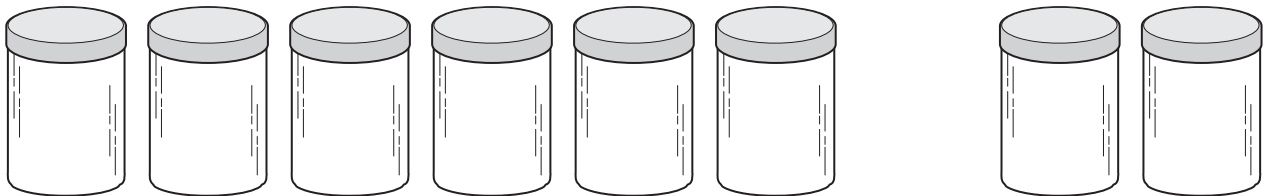


Silas will pull one card out of the bag without looking.

- a. Will the number on the card Silas pulls out more likely be an even number or more likely be an odd number? Show or explain how you got your answer.
- b. What is the probability that the card Silas pulls out will have a 3 on it? Show or explain how you got your answer.
- c. Silas will perform this experiment a total of 72 times, replacing the card after each pull. What is the total number of times he should expect to pull out a card with a 7 on it? Show or explain how you got your answer.

Mark your answers to multiple-choice questions 32 through 39 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.

● Each jar below contains an equal number of coins.



The total number of coins in 6 of the 8 jars is 54. How many coins are in all 8 jars?

- A. 24
- B. 61
- C. 72
- D. 324

● Arnie wrote the number pattern below.

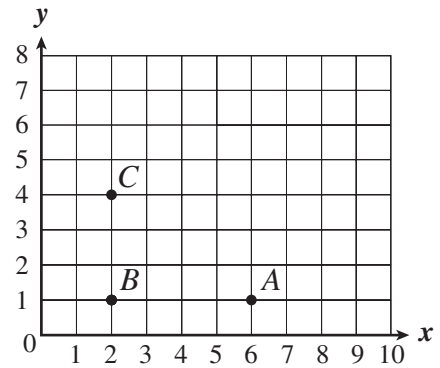
1, 2, 5, 14, 41

If the pattern continues in the same way, which of the following rules can Arnie use to find the next number in the number pattern?

- A. Add 1.
- B. Multiply by 2.
- C. Multiply by 2; then add 1.
- D. Multiply by 3; then subtract 1.

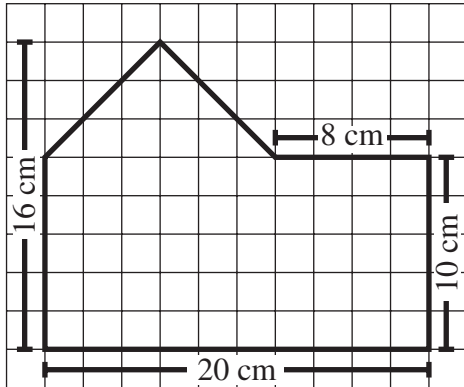
- Which of the following shows one hundred four thousand, six hundred twenty-nine and four hundredths written in standard form?
  - A. 104,629.004
  - B. 104,629,400
  - C. 104,629.04
  - D. 104,629.4

- 35 Julian is drawing a rectangle on the coordinate grid below. Each vertex of his rectangle will have whole number coordinates. Vertices *A*, *B*, and *C* of the rectangle are shown on the grid.



- Julian will graph the point *D* to complete the rectangle. What are the coordinates of point *D*?
- A. (4, 6)
  - B. (5, 5)
  - C. (6, 4)
  - D. (6, 5)

- Mariatu drew the figure shown on the grid below.



What is the area of the entire figure?

- A.  $320 \text{ cm}^2$
- B.  $236 \text{ cm}^2$
- C.  $200 \text{ cm}^2$
- D.  $72 \text{ cm}^2$

- The Gupta family uses 20 to 25 plums to make a jar of preserves. Which of the following is closest to the number of jars of preserves they can make using a total of 3700 plums?

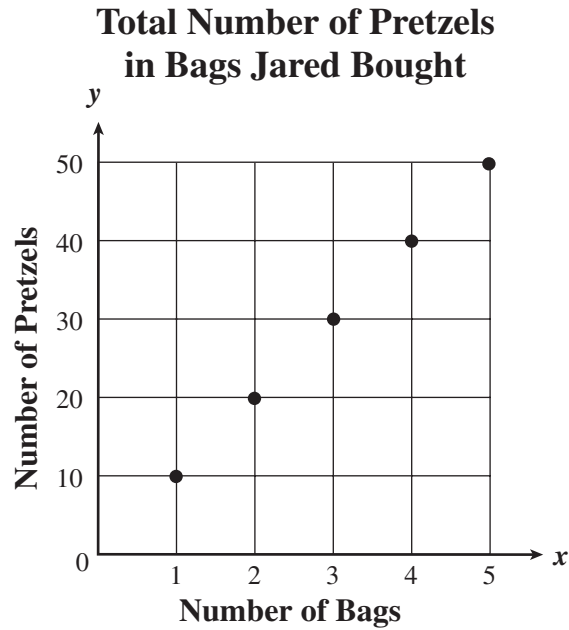
- A. 17 jars
- B. 85 jars
- C. 170 jars
- D. 340 jars

- What is the value of the expression below when  $x = 16$ ?

$$2x + 15$$

- A. 31
- B. 33
- C. 47
- D. 62

- Jared bought bags of large pretzels at the food store. The graph below represents the relationship between the number of bags he bought and the total number of pretzels in the bags.



Based on the graph, what is the relationship between the number of bags and the total number of pretzels in the bags?

- A. Total Number of Pretzels =  $10 \times$  Number of Bags
- B. Total Number of Pretzels =  $10 +$  Number of Bags
- C. Total Number of Pretzels =  $10 -$  Number of Bags
- D. Total Number of Pretzels =  $10 \div$  Number of Bags



## Massachusetts Comprehensive Assessment System Grade 6 Mathematics Reference Sheet

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### AREA FORMULAS

square .....  $A = s \cdot s$

OR

$$A = lw$$

rectangle .....  $A = bh$

OR

$$A = lw$$

parallelogram .....  $A = bh$

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

### PERIMETER FORMULAS

perimeter = distance around

square .....  $P = 4s$

rectangle .....  $P = 2b + 2h$

OR

$$P = 2l + 2w$$

triangle .....  $P = a + b + c$

### VOLUME FORMULAS

rectangular prism .....  $V = lwh$

cube .....  $V = s \cdot s \cdot s$   
( $s$  = length of an edge)

### CIRCLE FORMULAS

$$C = 2\pi r$$

OR

$$C = \pi d$$

$$A = \pi r^2$$

### CONVERSIONS

3 feet = 1 yard

5280 feet = 1 mile

60 seconds = 1 minute

60 minutes = 1 hour

**Grade 6 Mathematics**  
**Spring 2005 Released Items:**  
**Reporting Categories, Standards, and Correct Answers**

Item No.	Page No.	Reporting Category	Standard	Correct Answer (MC/SA)*
1	157	<i>Number Sense and Operations</i>	6.N.13	A
2	157	<i>Patterns, Relations, and Algebra</i>	6.P.1	C
3	158	<i>Geometry</i>	6.G.5	A
4	158	<i>Number Sense and Operations</i>	6.N.1	B
5	158	<i>Number Sense and Operations</i>	6.N.16	C
6	158	<i>Patterns, Relations, and Algebra</i>	6.P.5	A
7	159	<i>Data Analysis, Statistics, and Probability</i>	6.D.3	D
8	159	<i>Number Sense and Operations</i>	6.N.5	D
9	159	<i>Number Sense and Operations</i>	6.N.12	B
10	160	<i>Geometry</i>	6.G.4	
11	161	<i>Number Sense and Operations</i>	6.N.11	27
12	161	<i>Measurement</i>	6.M.5	28 inches
13	162	<i>Patterns, Relations, and Algebra</i>	6.P.4	
14	163	<i>Patterns, Relations, and Algebra</i>	6.P.2	A
15	163	<i>Data Analysis, Statistics, and Probability</i>	6.D.1	D
16	163	<i>Number Sense and Operations</i>	6.N.4	B
17	164	<i>Number Sense and Operations</i>	6.N.5	
18	165	<i>Geometry</i>	6.G.1	B
19	165	<i>Patterns, Relations, and Algebra</i>	6.P.4	D
20	166	<i>Number Sense and Operations</i>	6.N.6	D
21	166	<i>Measurement</i>	6.M.4	A
22	166	<i>Patterns, Relations, and Algebra</i>	6.P.3	C
23	166	<i>Number Sense and Operations</i>	6.N.7	B
24	167	<i>Number Sense and Operations</i>	6.N.15	A
25	167	<i>Patterns, Relations, and Algebra</i>	6.P.4	D
26	167	<i>Data Analysis, Statistics, and Probability</i>	6.D.2	B
27	168	<i>Measurement</i>	6.M.6	
28	169	<i>Patterns, Relations, and Algebra</i>	6.P.4	28
29	169	<i>Data Analysis, Statistics, and Probability</i>	6.D.1	24
30	170	<i>Geometry</i>	6.G.3	line $z$ and line $w$ , or line $z$ and line $x$
31	171	<i>Data Analysis, Statistics, and Probability</i>	6.D.4	
32	172	<i>Number Sense and Operations</i>	6.N.9	C
33	172	<i>Patterns, Relations, and Algebra</i>	6.P.1	D
34	173	<i>Number Sense and Operations</i>	6.N.2	C
35	173	<i>Geometry</i>	6.G.4	C
36	174	<i>Measurement</i>	6.M.4	B
37	174	<i>Number Sense and Operations</i>	6.N.16	C
38	174	<i>Patterns, Relations, and Algebra</i>	6.P.2	C
39	175	<i>Patterns, Relations, and Algebra</i>	6.P.6	A

\* 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 shaded cells, will be posted to the Department's Web site later this year.