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## XI. Mathematics, Grade 5

## Grade 5 Mathematics Test

The spring 2007 grade 5 MCAS Mathematics test was based on learning standards in the Massachusetts *Mathematics Curriculum Framework* (2000). The *Framework* identifies five major content strands, listed below. Specific learning standards for grade 5 are found in the *Supplement to the Massachusetts Mathematics Curriculum Framework* (2004). Page numbers for the grades 5–6 *Framework* learning standards and for the grade 5 *Supplement* standards appear in parentheses.

- Number Sense and Operations (*Framework*, pages 25–26; *Supplement*, pages 7–8)
- Patterns, Relations, and Algebra (*Framework*, page 34; *Supplement*, page 8)
- Geometry (*Framework*, page 42; *Supplement*, page 9)
- Measurement (*Framework*, page 50; *Supplement*, pages 9–10)
- Data Analysis, Statistics, and Probability (*Framework*, page 58; *Supplement*, page 10)

The *Mathematics Curriculum Framework* and *Supplement* are available on the Department Web site at [www.doe.mass.edu/frameworks/current.html](http://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 5 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 5 Mathematics test was provided with a plastic ruler and a grade 5 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.

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 calculators, 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 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 Ramon wrote the pattern shown below.

6, 18, 30, 42, 54, . . .

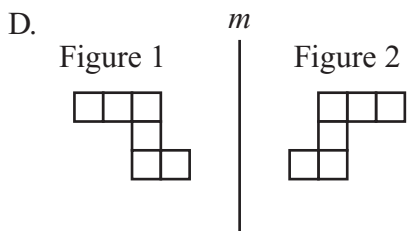
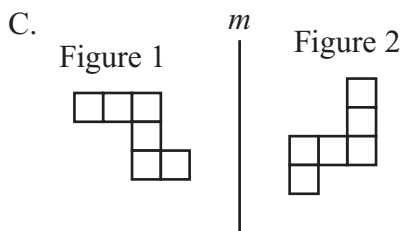
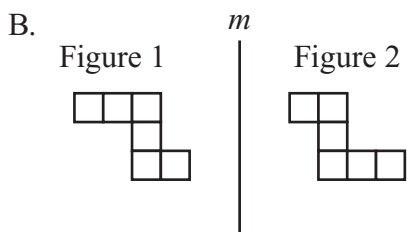
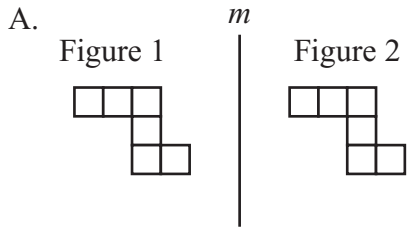
Which of the following is a rule for Ramon's pattern?

- A. add 6
- B. add 12
- C. multiply by 3
- D. multiply by 6

- 2 At one time the population of Massachusetts was about 6,349,100. What digit is in the hundred thousands place of this number?

- A. 1
- B. 3
- C. 4
- D. 6

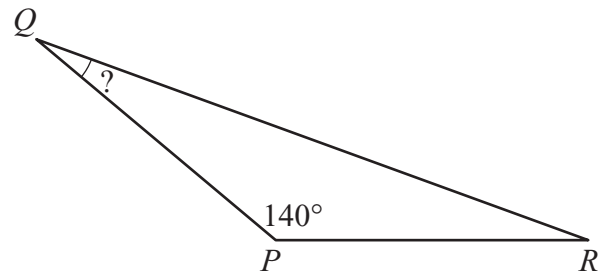
3 In which of the following diagrams does Figure 2 appear to be a reflection of Figure 1 across line  $m$ ?



4 A plumber spent 0.5 hours repairing a faucet. Which of the following fractions is **not** equivalent to 0.5?

- A.  $\frac{1}{2}$
- B.  $\frac{2}{4}$
- C.  $\frac{3}{5}$
- D.  $\frac{5}{10}$

5 In triangle  $PQR$ , shown below, angle  $P$  measures  $140^\circ$ .



Angle  $Q$  has the same measure as angle  $R$ . What is the measure of angle  $Q$ ?

- A.  $20^\circ$
- B.  $40^\circ$
- C.  $70^\circ$
- D.  $80^\circ$

- 6 Carla set up tables and chairs for a party. There were four chairs at each table.

Carla set up  $n$  tables. If  $n$  represents any number of tables, which of the following expressions represents the total number of chairs that Carla set up?

- A.  $n \div 4$
- B.  $4 \div n$
- C.  $n + 4$
- D.  $4 \times n$

- 7 Kevin has the following three kinds of juice boxes in a cooler.

- 12 apple juice
- 13 grape juice
- 15 orange juice

The juice boxes are all the same size and shape. Kevin will take out a juice box without looking.

What is the probability that Kevin will take out an apple juice box?

- A.  $\frac{1}{40}$
- B.  $\frac{1}{12}$
- C.  $\frac{12}{40}$
- D.  $\frac{12}{28}$

- 8 Greg recorded the heights of four plants. The heights are listed in the table below.

**Plant Heights**

Plant	Height (inches)
A	$5\frac{1}{2}$ inches
B	$5\frac{3}{8}$ inches
C	$5\frac{1}{4}$ inches
D	$5\frac{7}{16}$ inches

Which plant had the **greatest** height?

- A. Plant A
- B. Plant B
- C. Plant C
- D. Plant D

- 9 To make hot cereal, Macy uses the directions on the back of the cereal box, as shown in the table below.

**Directions for Making Hot Cereal**

Number of Servings of Hot Cereal	Dry Cereal Needed	Water Needed
1	$\frac{1}{4}$ cup	1 cup
2	$\frac{1}{2}$ cup	2 cups
3	$\frac{3}{4}$ cup	3 cups
4	1 cup	4 cups

Macy wants to make 10 servings of hot cereal. Using this table, what is the total number of cups of dry cereal that she should use?

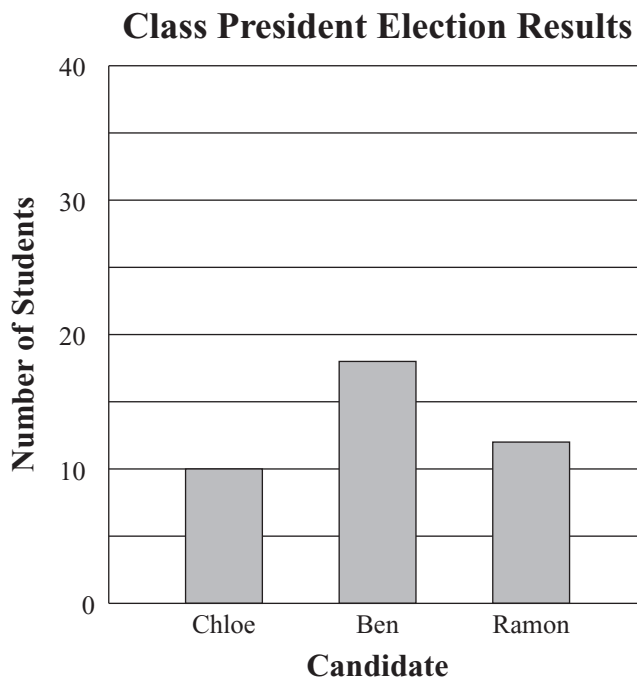
- A.  $1\frac{1}{4}$  cups
- B.  $2\frac{1}{2}$  cups
- C. 5 cups
- D. 10 cups

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** Three candidates ran in the election for fifth-grade class president. The bar graph below shows the number of students who voted for each candidate.



- a. Based on the graph, how many students voted for Ben? Explain your reasoning.
- b. Based on the graph, what is the total number of students who voted in the election? Show or explain how you got your answer.
- c. A reporter for the school newspaper wrote that each candidate got less than 50% of the total number of votes. Is the reporter correct? Explain your reasoning.

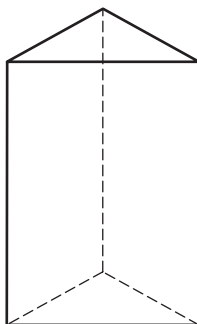
Questions 11 and 12 are short-answer questions. Write your answers to these questions in the boxes provided in your Student Answer Booklet. Do not write your answers in this test booklet. You may do your figuring in the test booklet.

- 11 Will earned the following grades on his last five mathematics tests.

88, 79, 99, 96, 91
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What was Will's median grade for these five tests?

- 12 A triangular prism is shown below.



What is the total number of vertices in a triangular prism?

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.

**13** The Fish Bowl store had a sale. During the sale, the store gave away two kinds of fish, goldfish and catfish.

- Every 5th customer received a free goldfish.
- Every 12th customer received a free catfish.

There were 134 customers on the day of the sale.

- a. How many customers received a free goldfish? Show or explain how you got your answer.
- b. How many customers received a free catfish? Show or explain how you got your answer.
- c. How many customers received **both** a free goldfish and a free catfish? 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 Which of the following is equivalent to the expression below?

$$10^4$$

- A. 104
- B.  $10 + 4$
- C.  $10 \times 4$
- D.  $10 \times 10 \times 10 \times 10$

- 15 Madison started a bicycle trip at 2:00 p.m. At 5:00 p.m. the same day she had completed 75% of the total distance.

If Madison continues at the same speed, at what time will she finish the total distance?

- A. 6:00 p.m.
- B. 6:30 p.m.
- C. 7:00 p.m.
- D. 7:30 p.m.

- 16 Jack has 18 toy cars. Each car weighs 4.2 ounces.

Which of the following expressions has a value that is closest to the total weight, in ounces, of Jack's 18 toy cars?

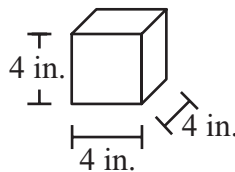
- A.  $10 \times 4$
- B.  $10 \times 5$
- C.  $20 \times 4$
- D.  $20 \times 5$

Question 17 is an open-response question.

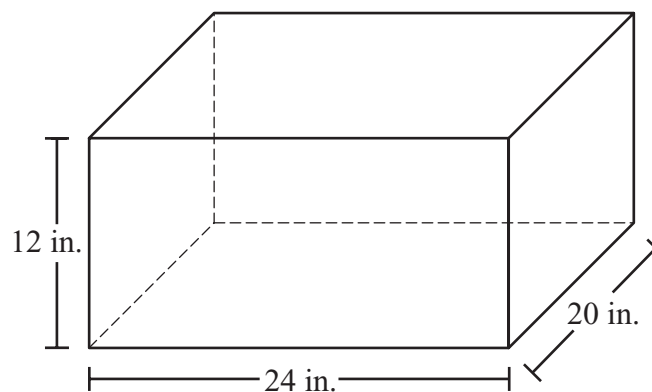
- **BE SURE TO ANSWER AND LABEL ALL PARTS OF THE QUESTION.**
- **Show all your work (diagrams, tables, or computations) in your Student Answer Booklet.**
- **If you do the work in your head, explain in writing how you did the work.**

Write your answer to question 17 in the space provided in your Student Answer Booklet.

- 17 Georgia has some 4-inch cubes like the one shown below.



Georgia will put the cubes in the box shown below.



- What is the total number of cubes that Georgia needs to exactly cover the bottom of the box with a layer one cube deep? Show or explain how you got your answer.
- Georgia is going to fill the entire box with her cubes. What is the total number of cubes that Georgia needs? 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.

- 18 Which of the following sentences best describes two parallel lines?

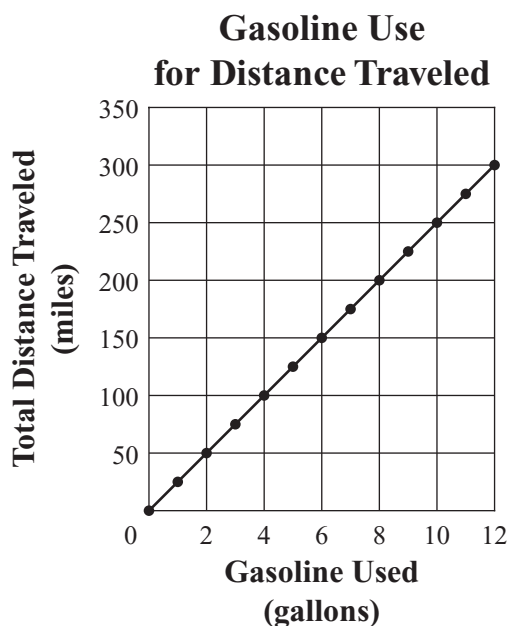
- A. They meet at exactly one point.
- B. They meet at exactly two points.
- C. They form a right angle.
- D. They are always the same distance apart.

- 19 What is the value of the expression below?

$$4 \times (9 - 6)$$

- A. 12
- B. 15
- C. 30
- D. 60

- 20 The graph below shows the relationship between gasoline used and total distance traveled for Katya's car.



Based on this graph, what is the number of miles traveled per gallon of gasoline used?

- A. 25 miles per gallon
- B. 50 miles per gallon
- C. 75 miles per gallon
- D. 100 miles per gallon

- 21 Tenisha is planning a backpacking trip. The table below shows the weights of the items she has packed so far.

**Backpacking Trip  
Items and Weights**

Item	Weight
tent	4 pounds 4 ounces
sleeping bag	2 pounds 10 ounces
food	5 pounds 6 ounces

What is the total weight of the items listed in the table? (1 pound = 16 ounces)

- A. 12 pounds
  - B. 12 pounds 4 ounces
  - C. 12 pounds 8 ounces
  - D. 13 pounds
- 22 Which of the following is equivalent to the expression below?

$$(6 \times 1) + (5 \times 0.01) + (8 \times 0.001)$$

- A. 65.08
- B. 60.58
- C. 6.508
- D. 6.058

- 23 A baker had 1128 cookies. She put them all in bags, with 24 cookies in each bag. What is the total number of bags that she used?

- A. 37
- B. 38
- C. 47
- D. 48

- 24 Paula uses the rule below to estimate the distance of a thunderstorm from her location.

**Paula’s Rule**

Count the number of seconds between seeing the lightning and hearing the thunder.  
For every 5 seconds counted, the storm is 1 mile away.

Based on Paula’s rule, which of the following tables shows the relationship between the number of seconds counted and the distance of the thunderstorm?

A. **Thunderstorm Distance**

Time (in seconds)	Distance (in miles)
0	0
5	1
10	2
15	3
20	4

C. **Thunderstorm Distance**

Time (in seconds)	Distance (in miles)
1	0
2	5
3	10
4	15
5	20

B. **Thunderstorm Distance**

Time (in seconds)	Distance (in miles)
0	1
5	2
10	3
15	4
20	5

D. **Thunderstorm Distance**

Time (in seconds)	Distance (in miles)
0	0
1	5
2	10
3	15
4	20

- 25 Barbara wrote the equation shown below.

$$\square \div 6 = 3$$

If Barbara's equation is true, which of the following equations must also be true?

- A.  $6 \div \square = 3$
- B.  $3 \times \square = 6$
- C.  $\square = 3 + 6$
- D.  $3 \times 6 = \square$

- 26 Carol is training for a bicycle race. The number of miles that she rode her bicycle on each of the past 5 days is shown below.

12, 18, 13, 17, 20
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What is the mean (average) number of miles that Carol rode her bicycle per day?

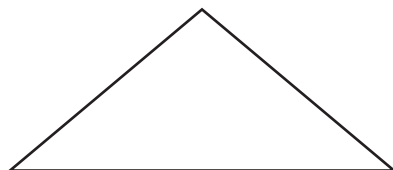
- A. 13 miles
- B. 16 miles
- C. 17 miles
- D. 20 miles

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.

**27** Zulma drew the triangle shown below.



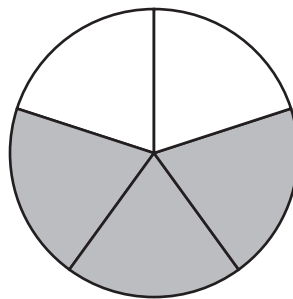
- a. What is the total number of lines of symmetry that the triangle appears to have? Show or explain how you got your answer.
- b. On the grid in your Student Answer Booklet, draw a quadrilateral that has **exactly two** lines of symmetry. Draw the lines of symmetry.
- c. On the grid in your Student Answer Booklet, draw a quadrilateral that has **more than two** lines of symmetry. Draw the lines of symmetry.

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.

- 28 Compute:

$$12.63 - 3.72$$

- 29 The circle below is divided into congruent parts. What **percent** of the whole circle is shaded?



**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.**

- 30** The perimeter of an equilateral triangle is 24 centimeters. How many centimeters long is each side of the triangle?

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.

- 31** Ms. Taylor is playing a number game with one of her students. When the student tells Ms. Taylor a number, Ms. Taylor uses a rule to determine a new number. Ms. Taylor always uses the same rule.

The table below shows some of the student's numbers and Ms. Taylor's numbers.

**Number Game**

<b>Student's Number</b>	<b>Ms. Taylor's Number</b>
5	16
8	25
1	4
4	13
2	7

- What should be Ms. Taylor's number when the student's number is 6?
- When the student tells Ms. Taylor a number, what is the rule that Ms. Taylor uses to determine her number?
- If the student's numbers are always whole numbers, could 43 be one of Ms. Taylor's numbers? Show or explain how you got your answer.

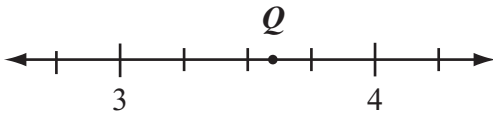
Mark your answers to multiple-choice questions 32 through 39 in the spaces provided in your Student Answer Booklet. Do not write your answers in this test booklet. You may do your figuring in the test booklet.

- 32 What is the value of the expression below when  $n = 3$ ?

$$58 - (4 \times n)$$

- A. 15
- B. 46
- C. 51
- D. 162

- 33 The location of point  $Q$  is shown on the number line below.



Which of the following numbers is best represented by point  $Q$ ?

- A. 3.4
- B. 3.6
- C. 3.8
- D. 4.4

- 34 Which of the following is a prime number?

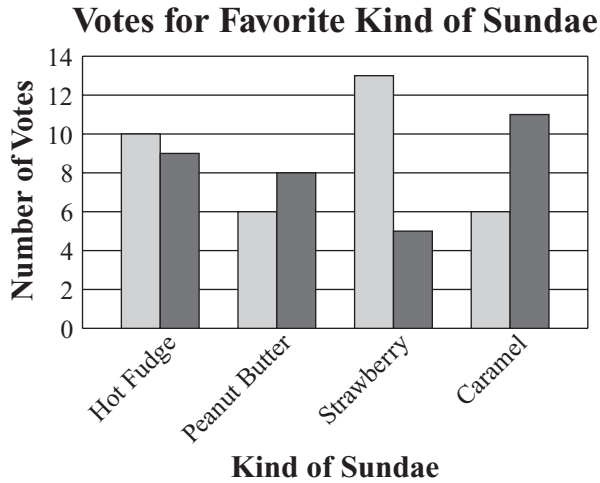
- A. 65
- B. 58
- C. 39
- D. 23

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

$$3\frac{3}{4} + 1\frac{1}{2}$$

- A.  $4\frac{1}{4}$
- B.  $4\frac{3}{4}$
- C.  $5\frac{1}{4}$
- D.  $5\frac{3}{4}$

- 36 The manager of an ice cream shop asked some boys and girls to vote for their favorite kind of sundae. The results are shown in the graph below.



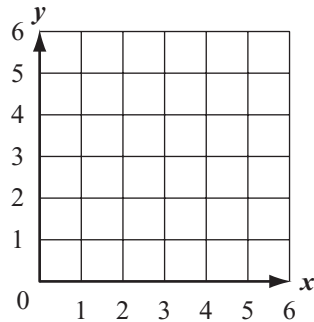
Key	
□	represents boys
■	represents girls

Which kind of sundae received the greatest **total** number of votes?

- A. hot fudge
- B. peanut butter
- C. strawberry
- D. caramel

- 37 There were 123 players at a soccer camp. The players were divided into teams having 11 players each.
- What was the total number of teams and the total number of players left over?
- A. 10 teams, with 3 players left over
  - B. 11 teams, with 1 player left over
  - C. 11 teams, with 2 players left over
  - D. 12 teams, with 3 players left over

- 38 Molly will draw a figure on the grid shown below.



She will follow the steps below to draw the figure.

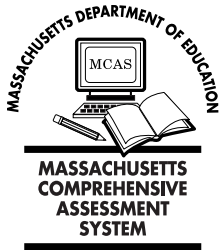
- Step 1: Draw a line segment from (1, 2) to (1, 4).
- Step 2: Draw a line segment from (1, 4) to (3, 2).
- Step 3: Draw a line segment from (3, 2) to (3, 4).

Which of the following figures will Molly draw?

- A. a square
- B. the letter N
- C. a triangle
- D. the letter H

- 39 For a sale, the price of a computer was reduced by \$100 to \$950. Which of the following expressions represents the price of the computer before the sale?

- A.  $100 + 950$
- B.  $100 - 950$
- C.  $950 - 100$
- D.  $950 \div 100$



## Massachusetts Comprehensive Assessment System Grade 5 Mathematics Reference Sheet

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### PERIMETER ( $P$ ) FORMULAS

perimeter = distance around

square . . . . .  $P = 4 \times s$   
( $s$  = length of a side)

rectangle . . . . .  $P = (2 \times l) + (2 \times w)$   
( $l$  = length;  $w$  = width)

triangle . . . . .  $P = a + b + c$   
( $a$ ,  $b$ , and  $c$  are the lengths of the sides)

### VOLUME ( $V$ ) FORMULAS

rectangular prism . . . . .  $V = l \times w \times h$   
( $l$  = length;  $w$  = width;  $h$  = height)

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

### AREA ( $A$ ) FORMULAS

square . . . . .  $A = s \times s$   
( $s$  = length of a side)

rectangle . . . . .  $A = l \times w$   
( $l$  = length;  $w$  = width)

triangle . . . . .  $A = \frac{1}{2} \times b \times h$   
( $b$  = length of the base;  
 $h$  = height)

**Grade 5 Mathematics**  
**Spring 2007 Released Items:**  
**Reporting Categories, Standards, and Correct Answers**

Item No.	Page No.	Reporting Category	Standard	Correct Answer (MC/SA)*
1	279	<i>Patterns, Relations, and Algebra</i>	5.P.1	B
2	279	<i>Number Sense and Operations</i>	5.N.2	B
3	280	<i>Geometry</i>	5.G.5	D
4	280	<i>Number Sense and Operations</i>	5.N.5	C
5	280	<i>Measurement</i>	5.M.5	A
6	281	<i>Patterns, Relations, and Algebra</i>	5.P.4	D
7	281	<i>Data Analysis, Statistics, and Probability</i>	5.D.3	C
8	282	<i>Number Sense and Operations</i>	5.N.7	A
9	282	<i>Patterns, Relations, and Algebra</i>	5.P.5	B
10	283	<i>Data Analysis, Statistics, and Probability</i>	5.D.2	
11	284	<i>Data Analysis, Statistics, and Probability</i>	5.D.1	91
12	284	<i>Geometry</i>	5.G.2	6
13	285	<i>Number Sense and Operations</i>	5.N.8	
14	286	<i>Number Sense and Operations</i>	5.N.1	D
15	286	<i>Patterns, Relations, and Algebra</i>	5.P.5	A
16	286	<i>Number Sense and Operations</i>	5.N.14	C
17	287	<i>Measurement</i>	5.M.4	
18	288	<i>Geometry</i>	5.G.3	D
19	288	<i>Number Sense and Operations</i>	5.N.10	A
20	288	<i>Patterns, Relations, and Algebra</i>	5.P.6	A
21	289	<i>Measurement</i>	5.M.3	B
22	289	<i>Number Sense and Operations</i>	5.N.3	D
23	289	<i>Number Sense and Operations</i>	5.N.12	C
24	290	<i>Patterns, Relations, and Algebra</i>	5.P.4	A
25	291	<i>Patterns, Relations, and Algebra</i>	5.P.3	D
26	291	<i>Data Analysis, Statistics, and Probability</i>	5.D.1	B
27	292	<i>Geometry</i>	5.G.6	
28	293	<i>Number Sense and Operations</i>	5.N.12	8.91
29	293	<i>Number Sense and Operations</i>	5.N.5	60%
30	294	<i>Measurement</i>	5.M.1	8 cm
31	295	<i>Patterns, Relations, and Algebra</i>	5.P.4	
32	296	<i>Patterns, Relations, and Algebra</i>	5.P.2	B
33	296	<i>Number Sense and Operations</i>	5.N.6	B
34	296	<i>Number Sense and Operations</i>	5.N.8	D
35	296	<i>Number Sense and Operations</i>	5.N.13	C
36	297	<i>Data Analysis, Statistics, and Probability</i>	5.D.2	A
37	297	<i>Number Sense and Operations</i>	5.N.9	C
38	298	<i>Geometry</i>	5.G.4	B
39	298	<i>Number Sense and Operations</i>	5.N.11	A

\* 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.