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## XI. Mathematics, Grade 5

## Grade 5 Mathematics Test

The spring 2006 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* 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). The *Supplement to the Massachusetts Mathematics Curriculum Framework* is available at [www.doe.mass.edu/frameworks/math/052504\\_sup.pdf](http://www.doe.mass.edu/frameworks/math/052504_sup.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 *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 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 In the equations below, each shape stands for the same number every time that it appears.

$$\square + 6 = 18$$

$$\triangle \times 3 = \square$$

If both of these equations are true, what is the value of  $\triangle$ ?

- A. 4
- B. 8
- C. 12
- D. 36

- 2 Marcus does sit-ups every night for his exercise program. Each week, he increases the number of sit-ups he does every night, as shown in the table below.

**Sit-Ups Done Each Week**

Week	Sit-Ups Every Night
1	15
2	30
3	45
4	?

Based on the pattern shown in the table, what is the total number of sit-ups that Marcus will do every night during week 4?

- A. 50
- B. 55
- C. 60
- D. 65

- 3 The running log below shows how many miles Jason ran Monday through Friday of last week.

**Jason’s Running Log**

Day	Miles
Monday	5
Tuesday	6
Wednesday	2
Thursday	6
Friday	1

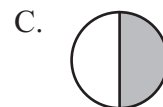
What is the mean (average) number of miles he ran each day for the days shown in the running log?

- A. 2
  - B. 4
  - C. 5
  - D. 6
- 4 Ms. Reed travels a total of 78 miles each day that she goes to work. During July, she went to work 21 days.
- Which of the following expressions has a value that is closest to the total number of miles Ms. Reed traveled to work in July?
- A.  $80 \times 30$
  - B.  $70 \times 20$
  - C.  $80 \times 20$
  - D.  $75 \times 20$

- 5 Ms. Brown needs 8 eggs in order to make 2 cakes. What is the total number of cakes she could make with 24 eggs?

- A. 3
- B. 4
- C. 6
- D. 8

- 6 Which of the following circles appears to have  $\frac{1}{5}$  shaded?



- 7 The table below shows the fees that a video store charges for returning a video late.

**Fees for Returning a Video Late**

Days Late	Late Fee
1	\$1.00
2	\$1.50
3	\$2.00
4	\$2.50
5	\$3.00

For the data in the table, which of the following could be a rule for calculating the late fee?

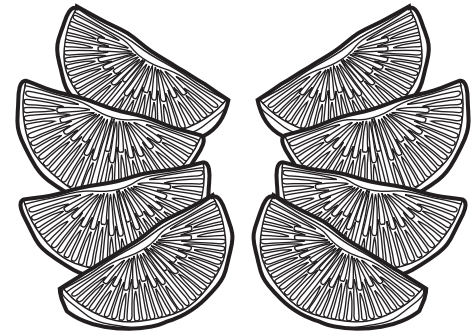
- A. \$1.00 for each day late
- B. \$0.50 for each day late
- C. \$0.50 for the first day late, and \$1.00 for each additional day late
- D. \$1.00 for the first day late, and \$0.50 for each additional day late

- 8 What number is equivalent to the expression below?

$$(3 \times 1,000,000) + (6 \times 10,000) + (5 \times 100) + 1$$

- A. 3,651
- B. 306,501
- C. 3,060,501
- D. 3,065,001

- 9 Miguel ate two of the orange pieces pictured below.



What fraction of the total number of orange pieces did Miguel eat?

- A.  $\frac{1}{8}$
- B.  $\frac{1}{4}$
- C.  $\frac{1}{3}$
- D.  $\frac{1}{2}$

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** The table below shows a city's average temperature by month for the first six months of one year.

**Average Temperature by Month**

<b>Month</b>	<b>Average Temperature (in Degrees Fahrenheit)</b>
January	13°
February	20°
March	31°
April	46°
May	59°
June	68°

- What is the range of the data for these six months? Show or explain how you got your answer.
- On the grid in your Student Answer Booklet, make a bar graph to show the data in the table. Be sure to title your graph, label each axis, and use an appropriate scale.

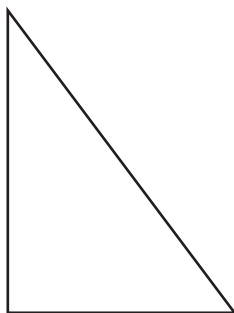
Questions 11 and 12 are short-answer questions. Write your answers to these questions in the boxes provided in your Student Answer Booklet. Do not write your answers in this test booklet. You may do your figuring in the test booklet.

- 11 Compute:

$$3.52 \times 14$$

Use your MCAS ruler to answer question 12.

- 12 What is the perimeter, in **centimeters**, of the triangle below?



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** Molly sings in the chorus at her school. In the chorus,  $\frac{3}{5}$  of the students are in the sixth grade, and the rest are in the fifth grade.
- What fraction of the students in the chorus are in the fifth grade? Show or explain how you got your answer.
  - Write your answer from part (a) as a **percent**. Show or explain how you got your answer.
  - There are 35 students in the chorus. What is the total number of students in the chorus who are in the fifth grade? 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.

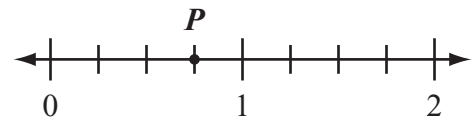
- 14 The Wilsons have a rectangular patio that is 10 feet wide and 15 feet long. What is the area, in square feet, of the patio?
- A. 50 square feet
  - B. 75 square feet
  - C. 115 square feet
  - D. 150 square feet

- 15 Amir asked some of his friends how many minutes they spent on homework last night. Their answers are shown below.

5, 10, 20, 30, 30, 35

- What is the median number of minutes Amir’s friends spent on homework?
- A. 20
  - B. 25
  - C. 30
  - D. 35

- 16 Point  $P$  is located on the number line shown below.



Which of the following fractions best represents the location of point  $P$ ?

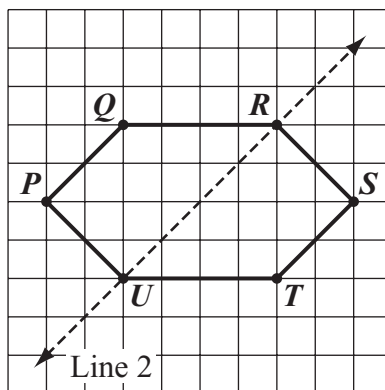
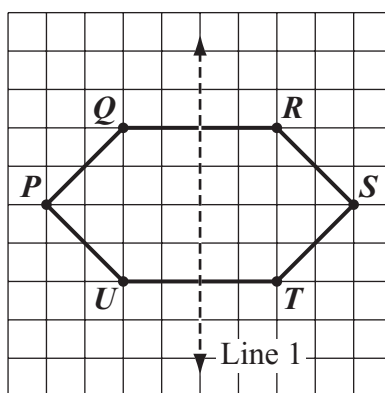
- A.  $\frac{1}{4}$
- B.  $\frac{3}{8}$
- C.  $\frac{3}{4}$
- D.  $\frac{4}{5}$

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 Hexagon  $PQRSTU$  is shown in the diagrams below. In the first diagram, Line 1 passes through the midpoints of sides  $\overline{QR}$  and  $\overline{UT}$ . In the second diagram, Line 2 passes through vertices  $R$  and  $U$ .



- Is Line 1 a line of symmetry? Explain your reasoning.
- Is Line 2 a line of symmetry? Explain your reasoning.
- Is there a line other than Line 1 or Line 2 that is a line of symmetry for hexagon  $PQRSTU$ ?
  - If there is another line of symmetry, describe where the line would be on the hexagon.
  - If there is not another line of symmetry, explain why not.

# 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

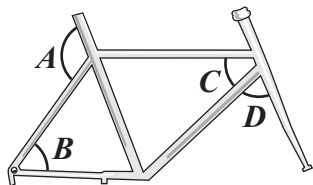
This session contains seventeen multiple-choice questions, three short-answer questions, and two open-response questions. Mark your answers to these questions in the spaces provided in your Student Answer Booklet.

- 18 What is the value of  $\diamond$  that makes the equation below true?

$$\diamond \div 4 = 8$$

- A. 2
- B. 12
- C. 32
- D. 36

- 19 Some angles are marked on the bicycle frame shown below.



Which angle appears to be obtuse?

- A. angle A
- B. angle B
- C. angle C
- D. angle D

- 20 The table below shows the amount of time each of four students spent on a mathematics test yesterday.

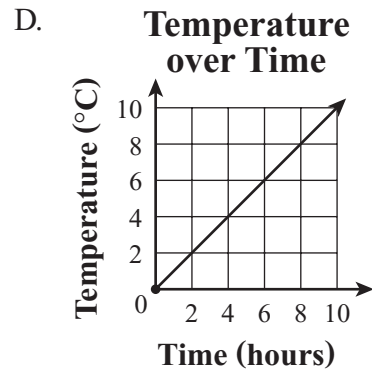
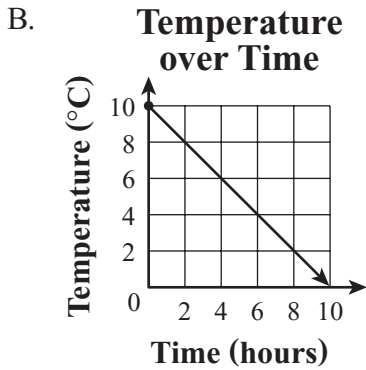
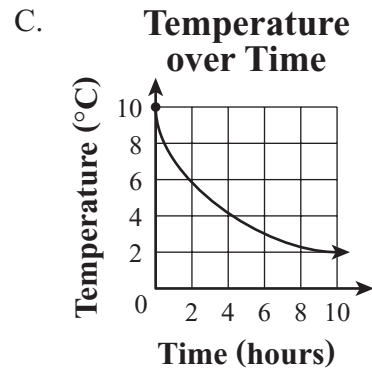
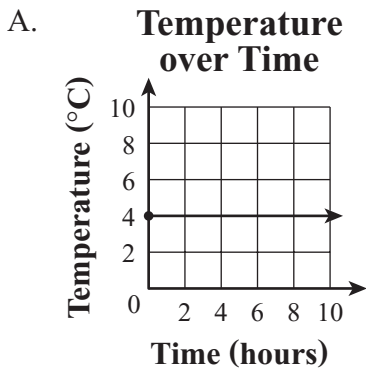
**Time Spent  
on Mathematics Test**

Name	Time (in hours)
Joe	$\frac{1}{2}$
Keith	$\frac{2}{3}$
Lena	$\frac{1}{4}$
Mia	$\frac{2}{5}$

Which student spent the **greatest** amount of time on the test?

- A. Joe
- B. Keith
- C. Lena
- D. Mia

21 Which of the following graphs shows temperature increasing over time?



22 Kyra will toss a number cube that has faces numbered 1 through 6. What is the probability that the cube will land with an even number showing on the top face?

- A.  $\frac{1}{6}$
- B.  $\frac{1}{5}$
- C.  $\frac{1}{3}$
- D.  $\frac{1}{2}$

23 Which of the following fractions is equivalent to  $1\frac{1}{2}$ ?

- A.  $\frac{8}{4}$
- B.  $\frac{6}{4}$
- C.  $\frac{5}{4}$
- D.  $\frac{3}{4}$

- 24 Carrie is decorating her room using a pattern of shapes. The picture below shows her pattern repeated three times.



If the pattern continues, what will be the 75th shape in the pattern?

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

- 25 The estimated populations of two New England states for the year 2003 are given below.

- New Hampshire: 1,287,687
- Maine: 1,305,728

Which of the following numbers is greater than the estimated population of New Hampshire but less than the estimated population of Maine?

- A. 1,291,012
- B. 1,310,104
- C. 1,267,805
- D. 1,308,549

- 26 What is the value of the digit 2 in the number below?

827,140,659

- A. twenty
- B. two hundred thousand
- C. two million
- D. twenty million

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** Jillian has a rowing machine. The table below lists the number of calories she burns when she exercises on her rowing machine.

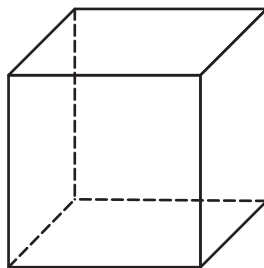
**Calories Burned  
Exercising on  
Rowing Machine**

Minutes Exercised	Calories Burned
10	70
20	140
30	210

- Based on the data in the table, what is the total number of calories that Jillian burns in 1 minute? Show or explain how you got your answer.
- Based on your answer to part (a), what is the total number of calories that Jillian will burn if she exercises on her rowing machine for 25 minutes? Show or explain how you got your answer.
- Based on your answer to part (a), what is the total number of minutes that Jillian exercised if she burned 385 calories? 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.

- 28 A cube is pictured below.



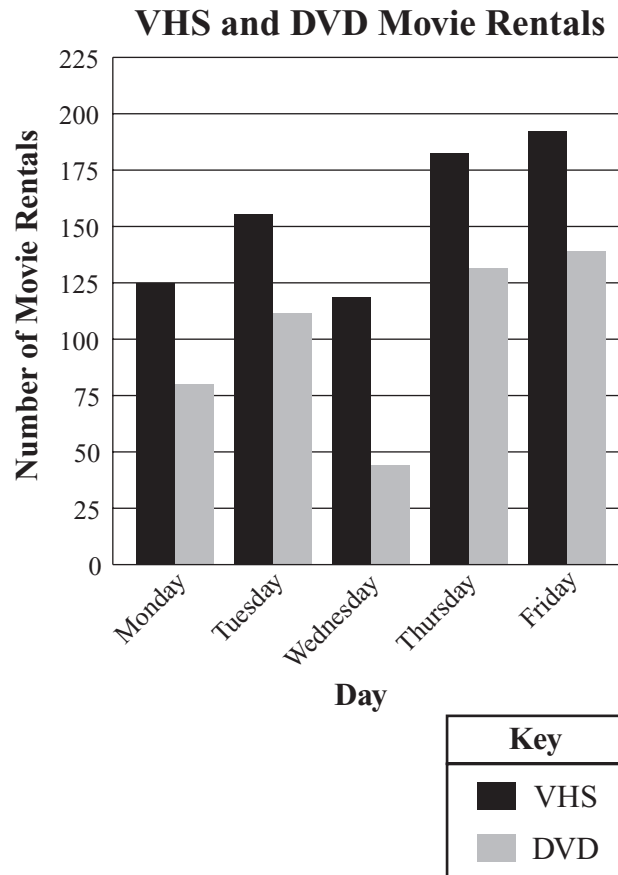
What is the total number of edges that a cube has?

- 29 What number belongs in the  to make the equation below true?

$$2 \times 3 \times \text{?} = 30$$

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 manager of a video store recorded the numbers of VHS and DVD movie rentals each day for five days. The graph below shows the results.



On which day was the difference between VHS and DVD movie rentals greatest?

**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.**

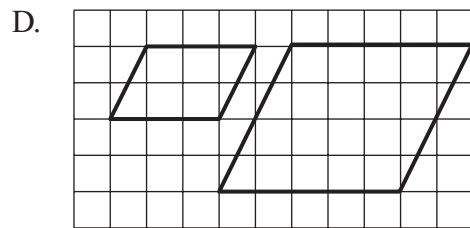
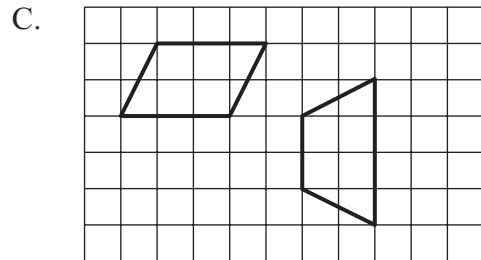
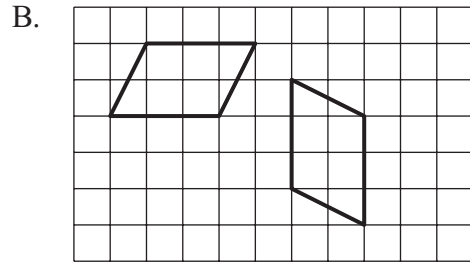
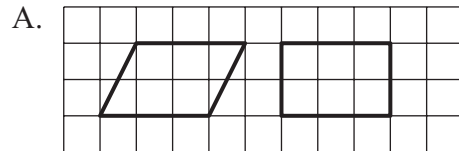
- 31** Harry planned a rectangular garden that was 40 feet long and 10 feet wide.
- What was the perimeter, in feet, of the garden that Harry planned? Show or explain how you got your answer.
  - What was the area, in square feet, of the garden that Harry planned? Show or explain how you got your answer.
  - Suppose Harry decided to change the shape of his garden to a square with the same area as the rectangle. What would be the perimeter, in feet, of the square garden? 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 number is 30 thousand greater than 265,408?
- A. 265,438
  - B. 268,408
  - C. 295,408
  - D. 565,408

- 33 What is the total number of factors of 12?
- A. 4
  - B. 6
  - C. 8
  - D. 12

- 34 Which of the following pairs of quadrilaterals appears to be congruent?

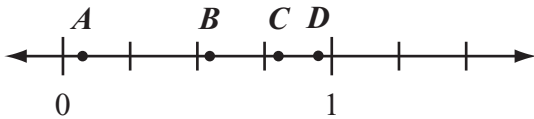


- 35 A bookstore had 3,200 copies of a new book. Every copy was sold for \$16 per copy.

What was the total amount of the bookstore’s sales from this book?

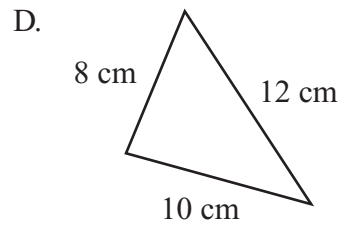
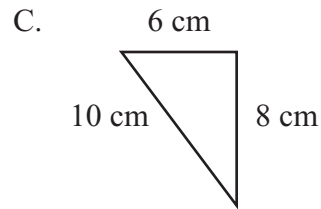
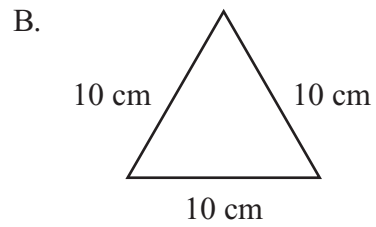
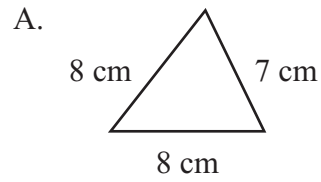
- A. \$22,400
- B. \$32,000
- C. \$50,200
- D. \$51,200

- 36 Which point on the number line below best represents 0.8?



- A. point *A*
- B. point *B*
- C. point *C*
- D. point *D*

- 37 Which of the following triangles is isosceles but **not** equilateral?



- 38 What is the value of  $\square$  that makes the equation below true?

$$\frac{75}{\square} = 5$$

- A. 15
- B. 25
- C. 70
- D. 375

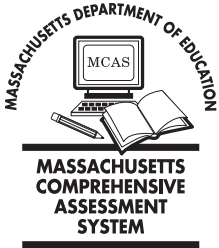
- 39 The table below shows the number of milligrams of sodium in each of three different sizes of a soft drink.

**Sodium Amounts in  
Soft Drink Sizes**

Drink Size (fluid ounces)	Sodium Amount (milligrams)
8	36
12	54
16	72

Based on the pattern in the table, what is the total number of milligrams of sodium in a 24-fluid-ounce cup of the soft drink?

- A. 90 mg
- B. 108 mg
- C. 126 mg
- D. 144 mg



## 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 2006 Released Items:**  
**Reporting Categories, Standards, and Correct Answers**

Item No.	Page No.	Reporting Category	Standard	Correct Answer (MC/SA)*
1	258	<i>Patterns, Relations, and Algebra</i>	5.P.3	A
2	258	<i>Patterns, Relations, and Algebra</i>	5.P.5	C
3	259	<i>Data Analysis, Statistics, and Probability</i>	5.D.1	B
4	259	<i>Number Sense and Operations</i>	5.N.14	C
5	259	<i>Patterns, Relations, and Algebra</i>	5.P.5	C
6	259	<i>Number Sense and Operations</i>	5.N.4	B
7	260	<i>Patterns, Relations, and Algebra</i>	5.P.4	D
8	260	<i>Number Sense and Operations</i>	5.N.3	C
9	260	<i>Number Sense and Operations</i>	5.N.4	B
10	261	<i>Data Analysis, Statistics, and Probability</i>	5.D.2	
11	262	<i>Number Sense and Operations</i>	5.N.12	49.28
12	262	<i>Measurement</i>	5.M.1	12 centimeters
13	263	<i>Number Sense and Operations</i>	5.N.13	
14	264	<i>Measurement</i>	5.M.1	D
15	264	<i>Data Analysis, Statistics, and Probability</i>	5.D.1	B
16	264	<i>Number Sense and Operations</i>	5.N.4	C
17	265	<i>Geometry</i>	5.G.6	
18	266	<i>Patterns, Relations, and Algebra</i>	5.P.3	C
19	266	<i>Measurement</i>	5.M.2	A
20	266	<i>Number Sense and Operations</i>	5.N.7	B
21	267	<i>Patterns, Relations, and Algebra</i>	5.P.6	D
22	267	<i>Data Analysis, Statistics, and Probability</i>	5.D.3	D
23	267	<i>Number Sense and Operations</i>	5.N.5	B
24	268	<i>Patterns, Relations, and Algebra</i>	5.P.1	C
25	268	<i>Number Sense and Operations</i>	5.N.7	A
26	268	<i>Number Sense and Operations</i>	5.N.2	D
27	269	<i>Patterns, Relations, and Algebra</i>	5.P.5	
28	270	<i>Geometry</i>	5.G.2	12
29	270	<i>Patterns, Relations, and Algebra</i>	5.P.3	5
30	271	<i>Data Analysis, Statistics, and Probability</i>	5.D.2	Wednesday
31	272	<i>Measurement</i>	5.M.1	
32	273	<i>Number Sense and Operations</i>	5.N.2	C
33	273	<i>Number Sense and Operations</i>	5.N.8	B
34	273	<i>Geometry</i>	5.G.7	B
35	274	<i>Number Sense and Operations</i>	5.N.9	D
36	274	<i>Number Sense and Operations</i>	5.N.6	C
37	274	<i>Geometry</i>	5.G.1	A
38	275	<i>Patterns, Relations, and Algebra</i>	5.P.3	A
39	275	<i>Patterns, Relations, and Algebra</i>	5.P.5	B

\* 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.