XII. Mathematics, Grade 6

Grade 6 Mathematics Test

The spring 2008 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 grades 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/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 *Mathematics Curriculum Framework* content strands listed above.

Test Sessions

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. 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 Jill wrote the number pattern shown below.

1, 5, 25, 125, 625, . . .

Which of the following could be the rule for determining the next number in Jill's pattern?

A. add 4

B. add 20

C. multiply by 5

D. multiply by 25

2 Some adult hummingbirds weigh as little as 0.06 ounce. What is the value of the 6 in 0.06?

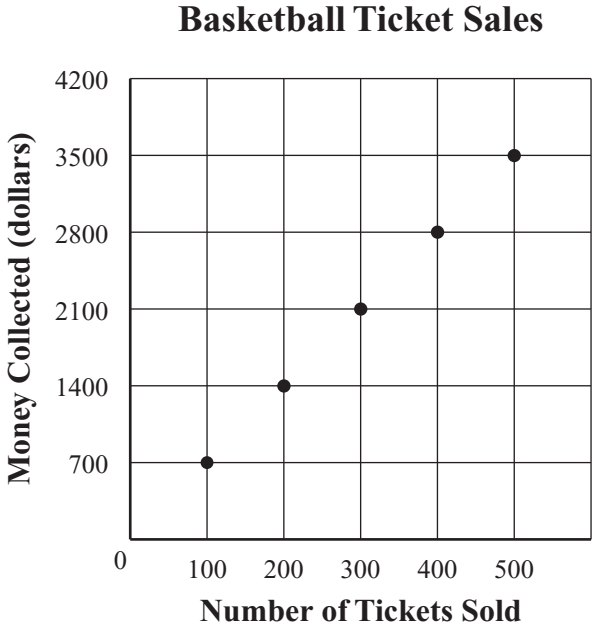
A. six

B. six tenths

C. six hundredths

D. six thousandths

3 The graph below shows the money collected by selling different numbers of tickets to a college basketball game.



Each ticket is the same price. Based on the data in the graph, what is the price of 1 ticket to the basketball game?

A. $7

B. $10

C. $17

D. $70

4 The lowest elevations for five states are recorded in the table below.

Lowest Elevations

State	Arkansas	California	Louisiana	Massachusetts	Texas
Lowest Elevation (feet above sea level)	55	−282	−8	0	−2

Which of the following lists the numbers in the table in order from least to greatest?

A. −282, −8, −2, 0, 55

B. −282, 55, −8, −2, 0

C. 0, −2, −8, 55, −282

D. 0, 55, −2, −8, −282

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5 Jim designed a rectangular garden with a width of 15 feet. The area of the garden is 300 square feet. What is the length of the garden?

A. 15 feet

B. 20 feet

C. 135 feet

D. 285 feet

6 Devin baked 20 cookies.

- She ate 4 of the cookies.
- She gave away the remaining cookies.

What fraction of the 20 cookies did Devin give away?

A. $\frac{1}{2}$

B. $\frac{2}{3}$

C. $\frac{3}{4}$

D. $\frac{4}{5}$

7 A farmer recorded the number of eggs produced in a month by each of his 6 hens. The results are shown in the table below.

Number of Eggs Produced in a Month

Name of Hen	Number of Eggs
Belle	20
Daisy	17
Princess	23
Lulu	22
Rosy	23
Tiny	15

What was the median number of eggs produced by the farmer's 6 hens for the month?

A. 20

B. 21

C. 22

D. 23

8 Julius copied the equation shown below from a study guide.

$$\frac{\triangle}{6} = 11$$

For this equation to be true, which of the following equations must also be true?

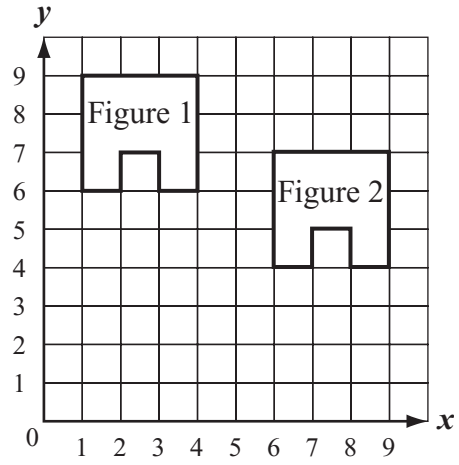
A. $\triangle = 11 - 6$

B. $\triangle = 11 + 6$

C. $\triangle = 11 \div 6$

D. $\triangle = 11 \times 6$

9 Which of the following describes the transformation from Figure 1 to Figure 2 shown on the graph below?



A. translation 2 units down and 5 units right

B. translation 2 units down and 2 units right

C. translation 1 unit up and 2 units right

D. translation 5 units up and 2 units left

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 At a recycling center in his state, Cody receives \$0.05 for every can he returns. In the equation below,

- m represents the total amount of money that Cody receives, and
- c represents the total number of cans he returns.

$$m = 0.05c$$

a. What is the total amount of money that Cody receives for returning 10 cans? Show or explain how you got your answer.

Cody received a total of \$10 for the cans he returned last week.

b. What was the total number of cans Cody returned last week? Show or explain how you got your answer.

Cody's cousin lives in another state. She receives \$0.05 more than Cody for every can she returns.

c. Write a new equation to determine the total amount of money, m, Cody's cousin receives for returning c cans in this other state. 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 The stem-and-leaf plot shown below displays the number of days it rained last year in 11 different cities.

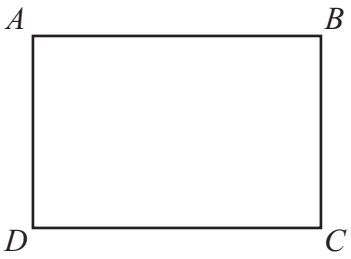
Number of Rainy Days

5	1 2 2 6
6	3 4 8
7	2 5 8 9

Key
5 | 8 represents 58

What is the mode of this set of data?

12 Rectangle *ABCD* is shown below.



Write the name of a line segment in rectangle *ABCD* that is parallel to $\overline{BC}$.

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 A store will celebrate the release of a new game system by giving free gifts to some of its customers. On the day the game system is released, every 5th customer will receive a free video game and every 12th customer will receive a free game system.

a. What is the total number of customers who will receive a free video game **before** a customer receives the first free game system? Show or explain how you got your answer.

b. Of the first 50 customers, what is the total number of customers who will receive a free gift? Show or explain how you got your answer.

c. If 200 customers visit the game store on this day, what is the total number of customers who will receive **both** a free video game and a free game system? 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 Harry made the input-output table shown below.

Input (x)	Output (y)
3	8
4	10
5	12
6	14

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

A. $x + 5 = y$

B. $x + 6 = y$

C. $2x + 2 = y$

D. $3x - 1 = y$

15 The school secretary can type an average of 12 names per minute on a class list. At this rate, what is the total number of minutes it will take the secretary to type a list of 696 names?

A. 59 minutes

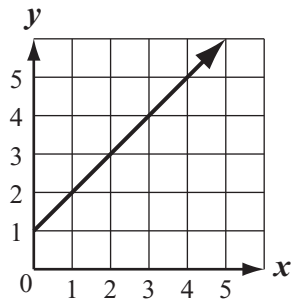
B. 58 minutes

C. 49 minutes

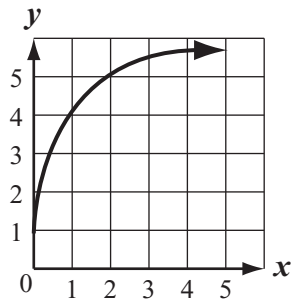
D. 48 minutes

16 Which of the following graphs shows a constant rate of change between the variables x and y?

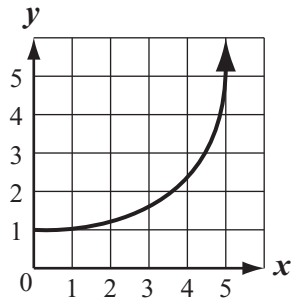
A.



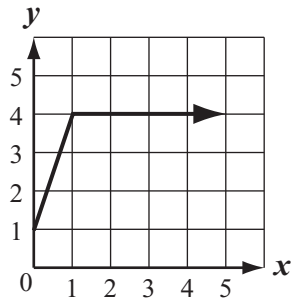
B.



C.



D.



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 Ellen is ordering a new mountain bike. She must choose 1 option from each column in the table shown below.

Mountain Bike Options

Color	Gears	Suspension
black (B)	15	front (T)
green (G)	18	full (L)
	21	

a. Show all the possible ways Ellen can order her new mountain bike. You may use a tree diagram or an organized list.

b. What is the total number of ways Ellen can order a bike with a **front** suspension? Show or explain how you got your answer.

c. Ellen learned that there are now 3 **more** color choices than before. What is the total number of **additional** ways Ellen can order her new mountain bike now that there are 3 more color choices? 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 Francine started the number pattern shown below using the rule "multiply the previous number by 2 and then add 3 to the result to get the next number."

1, 5, 13, 29, . . .

What is the fifth number in her pattern?

A. 53

B. 57

C. 61

D. 63

19 The temperature at midnight was 2°F. At sunrise the temperature was 5°F **lower**.

What was the temperature at sunrise?

A. −7°F

B. −3°F

C. 3°F

D. 7°F

20 The populations of three countries in the year 2005 are listed in the table below.

Populations in the Year 2005

Country	Population
Canada	32,805,041
Mexico	106,202,903
United States	295,734,134

Which of the following is closest to the total population of all three countries in the year 2005?

A. 325,000,000

B. 435,000,000

C. 622,000,000

D. 732,000,000

21 Which of the following is equivalent to the expression below?

$$(6 \times 1,000,000,000) + (5 \times 10,000,000) + (1 \times 100,000) + (2 \times 1,000)$$

A. 6,512

B. 6,512,000

C. 650,102,000

D. 6,050,102,000

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22 On Tuesday, 80% of the students bought lunch at school. The other 20% of the students brought lunch from home.

What fraction of the students bought lunch at school on Tuesday?

A. $\frac{1}{4}$

B. $\frac{2}{5}$

C. $\frac{3}{4}$

D. $\frac{4}{5}$

23 A tire has a diameter of 72 inches. Which of the following is closest to the circumference of the tire? (Use 3.14 for π.)

A. 72 inches

B. 113 inches

C. 226 inches

D. 4069 inches

24 At a bookstore the charge is $2.50 to use a computer for the first hour, plus $0.50 for each additional hour. Which of the following tables correctly displays the charges for the first four hours of using a computer at this bookstore?

A.

Bookstore Hourly Computer Charges

Time (hours)	Charge
1	$0.50
2	$1.00
3	$1.50
4	$2.00

B.

Bookstore Hourly Computer Charges

Time (hours)	Charge
1	$2.50
2	$3.00
3	$3.50
4	$4.00

C.

Bookstore Hourly Computer Charges

Time (hours)	Charge
1	$2.50
2	$3.50
3	$4.50
4	$5.50

D.

Bookstore Hourly Computer Charges

Time (hours)	Charge
1	$ 2.50
2	$ 5.00
3	$ 7.50
4	$10.00

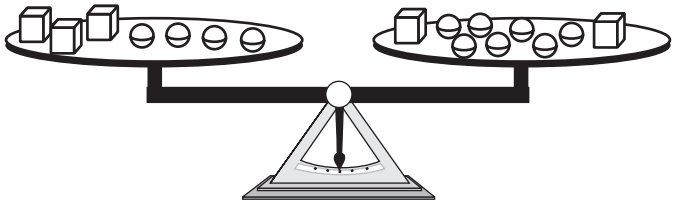
25 Bill, Leon, and Elaine each had the same total number of boxes.

- Bill made stacks of 3 boxes with none left over.
- Leon made stacks of 4 boxes with none left over.
- Elaine made stacks of 5 boxes with none left over.

Which of the following could be the total number of boxes that each person had?

A. 15
B. 24
C. 30
D. 60

26 The scale shown below is balanced.



Which of the following will balance one ⧈?

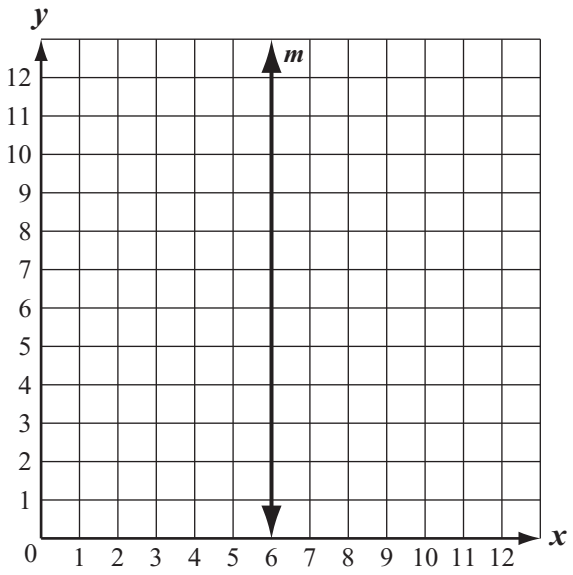
A. ⊖ ⊖ ⊖
B. ⊖ ⊖ ⊖ ⊖
C. ⊖ ⊖ ⊖ ⊖ ⊖
D. ⊖ ⊖ ⊖ ⊖ ⊖ ⊖ ⊖

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 On the grid in your Student Answer Booklet, copy the *x*-axis, the *y*-axis, and line *m*, as shown below.



Triangle *PQR* has vertices located at the following points:

- $P(1, 6)$
- $Q(4, 2)$
- $R(4, 6)$

a. Plot points *P*, *Q*, and *R*, and draw triangle *PQR* on your coordinate grid. Be sure to label the vertices of your triangle with the letters *P*, *Q*, and *R*.

b. Draw the reflection of triangle *PQR* across line *m* on your coordinate grid. Label this new triangle *STU*.

c. Write the coordinates of points *S*, *T*, and *U*.

Questions 28, 29, and 30 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 What is the value of the expression below when $\square = 12$?

$$\frac{\square}{4} + 6$$

29 Luke spent $2\frac{1}{2}$ hours reading on Saturday and $1\frac{3}{4}$ hours reading on Sunday. What was the total time, in hours, that Luke spent reading on Saturday and Sunday?

Write your answer to question 30 in the box provided in your Student Answer Booklet.

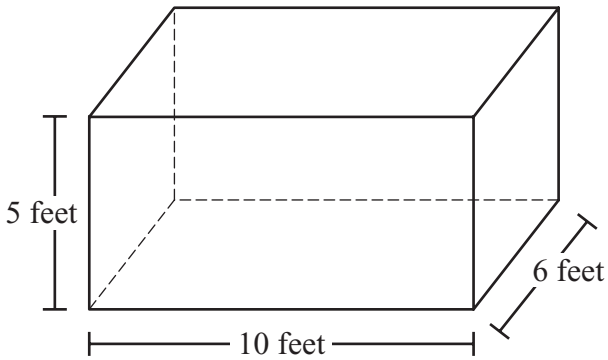
30 Ms. Edwards has visited 19 of the 50 states in the United States. What percent of the states has Ms. Edwards visited?

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 The diagram below shows the dimensions of a fish tank at a science museum.



a. What is the volume, in cubic feet, of the fish tank? Show your work.

b. The tank is made of glass and does **not** have a cover. What is the surface area, in square feet, of the outside of the fish tank? Show your work.

A new fish tank is being built for the museum. The new tank will have different dimensions than the first tank, but will have the same **volume** as the first tank.

c. What could be the dimensions of the new tank? 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 A millennium is 1,000 years. Which of the following is equivalent to 1,000?

A. 10^1

B. 10^2

C. 10^3

D. 10^4

33 Vincent uses $2\frac{1}{2}$ cups of flour for every 12 muffins that he makes. What is the total number of cups of flour Vincent will use to make 6 muffins?

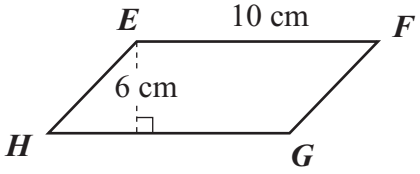
A. $1\frac{1}{4}$ cups

B. $1\frac{1}{2}$ cups

C. 2 cups

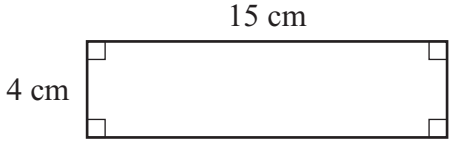
D. $2\frac{1}{4}$ cups

34 Parallelogram *EFGH* has the dimensions shown below.

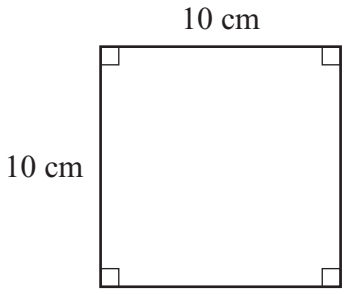


Which of the following quadrilaterals has the same area as parallelogram *EFGH*?

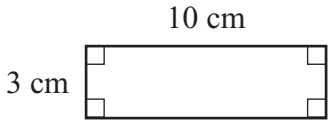
A.



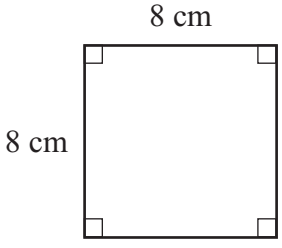
B.



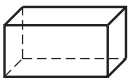
C.



D.

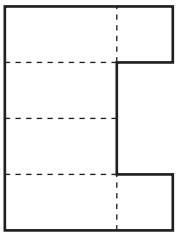


35 Bob folded a net to make the box shown below.

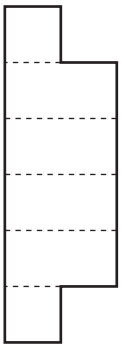


Which of the following nets could represent the net Bob folded?

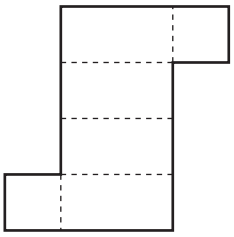
A.



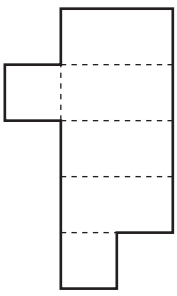
B.



C.



D.



36 A carton contains 12 eggs. Which of the following expressions represents the total number of eggs that are contained in c cartons?

A. $c - 12$

B. $c + 12$

C. $c \div 12$

D. $c \times 12$

37 To order a burrito from Teresa's Burrito Shop, Jim always chooses 1 item from each column in the table below.

Burrito Choices

Wrap	Filling	Topping
plain wheat	beans beef chicken	sour cream guacamole

What is the total number of ways that Jim can order a burrito at Teresa's Burrito Shop by choosing 1 wrap, 1 filling, and 1 topping?

A. 6

B. 7

C. 10

D. 12

38 A contest is being held at a school fair for fifth-grade and sixth-grade students.

- There are 40 fifth-grade students at the fair.
- There are 30 sixth-grade students at the fair.

Each student's name was written on one card and placed into a box. The principal will reach into the box and pick one card without looking. The student named on the card will be the winner of the contest.

What is the probability that the winner of the contest will be a sixth-grade student?

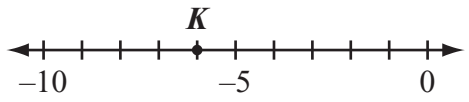
A. $\frac{1}{2}$

B. $\frac{3}{4}$

C. $\frac{3}{7}$

D. $\frac{1}{30}$

39 Which of the following best represents the location of point K on the number line below?



A. -1

B. -4

C. -6

D. -7

Massachusetts Comprehensive Assessment System
Grade 6 Mathematics Reference Sheet

PERIMETER FORMULAS

perimeter = distance around

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

rectangle . . . . . $P = 2b + 2h$
OR
$P = 2l + 2w$

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

AREA FORMULAS

square . . . . . $A = s \times s$

rectangle . . . . . $A = bh$
OR
$A = lw$

parallelogram . . . . . $A = bh$

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

circle . . . . . $A = \pi r^2$

VOLUME FORMULAS

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

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

CIRCLE FORMULAS

$C = 2\pi r$
OR
$C = \pi d$

$A = \pi r^2$

Grade 6 Mathematics
Spring 2008 Released Items:
Reporting Categories, Standards, and Correct Answers*

Item No.	Page No.	Reporting Category	Standard	Correct Answer (MC/SA)*
1	311	*Patterns, Relations, and Algebra*	6.P.1	C
2	311	*Number Sense and Operations*	6.N.2	C
3	311	*Patterns, Relations, and Algebra*	6.P.6	A
4	312	*Number Sense and Operations*	6.N.7	A
5	312	*Measurement*	6.M.1	B
6	312	*Number Sense and Operations*	6.N.4	D
7	313	*Data Analysis, Statistics, and Probability*	6.D.1	B
8	313	*Patterns, Relations, and Algebra*	6.P.3	D
9	313	*Geometry*	6.G.6	A
10	314	*Patterns, Relations, and Algebra*	6.P.5	
11	315	*Data Analysis, Statistics, and Probability*	6.D.2	52
12	315	*Geometry*	6.G.3	$\overline{AD}$
13	316	*Number Sense and Operations*	6.N.8	
14	317	*Patterns, Relations, and Algebra*	6.P.4	C
15	317	*Number Sense and Operations*	6.N.13	B
16	317	*Patterns, Relations, and Algebra*	6.P.7	A
17	318	*Data Analysis, Statistics, and Probability*	6.D.3	
18	319	*Patterns, Relations, and Algebra*	6.P.1	C
19	319	*Number Sense and Operations*	6.N.15	B
20	319	*Number Sense and Operations*	6.N.16	B
21	320	*Number Sense and Operations*	6.N.3	D
22	320	*Number Sense and Operations*	6.N.5	D
23	320	*Measurement*	6.M.5	C
24	321	*Patterns, Relations, and Algebra*	6.P.4	B
25	322	*Number Sense and Operations*	6.N.8	D
26	322	*Patterns, Relations, and Algebra*	6.P.5	A
27	323	*Geometry*	6.G.4	
28	324	*Patterns, Relations, and Algebra*	6.P.2	9
29	324	*Number Sense and Operations*	6.N.9	$4\frac{1}{4}$ hours
30	325	*Number Sense and Operations*	6.N.5	38%
31	326	*Measurement*	6.M.6	
32	327	*Number Sense and Operations*	6.N.1	C
33	327	*Number Sense and Operations*	6.N.9	A
34	327	*Measurement*	6.M.4	A
35	328	*Geometry*	6.G.9	C
36	328	*Patterns, Relations, and Algebra*	6.P.4	D
37	328	*Data Analysis, Statistics, and Probability*	6.D.3	D
38	329	*Data Analysis, Statistics, and Probability*	6.D.4	C
39	329	*Number Sense and Operations*	6.N.6	C

***** 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.