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## VII. Mathematics, Grade 6

# Grade 6 Mathematics Test

The spring 2004 Grade 6 MCAS Mathematics Test was based on learning standards in the Massachusetts *Mathematics Curriculum Framework* (2000). The *Framework* identifies the 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 website 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 grade 6 Mathematics Test contained two separate test sessions. Each session included multiple-choice, short-answer, and open-response questions. Common test items are shown on the following pages as they appeared in test booklets.

## Reference Materials and Tools

During testing, each student taking the Grade 6 Test was provided with a *Grade 6 Mathematics Reference Sheet*, a plastic ruler, and a protractor. A copy of the reference sheet follows the final question in this chapter.

No calculators, other reference tools, or materials were allowed, with the exception of bilingual word-to-word dictionaries used by limited English proficient students.

## 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.

## **HOW TO ANSWER OPEN-RESPONSE QUESTIONS**

Be sure to

- read all parts of each question carefully.
- make each response as clear, complete, and accurate as you can.
- check your answers.

# Mathematics

## SESSION 1

*You may use your reference sheet, MCAS ruler, and MCAS protractor 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** Steve scored 1,086,000 points in a video game. Which of the following expressions below is equal to 1,086,000?

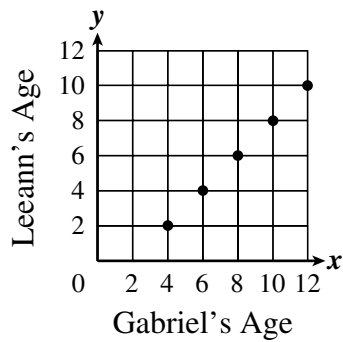
A.  $100 + 80 + 6$   
B.  $1,000 + 80 + 6$   
C.  $1,000,000 + 80,000 + 6,000$   
D.  $1,000,000 + 800,000 + 60,000$

- 2** Ms. Patterson divided the students in her class into groups of 6 for a classroom activity. There were 2 students left over. Which of the following could be the number of students in Ms. Patterson's class?

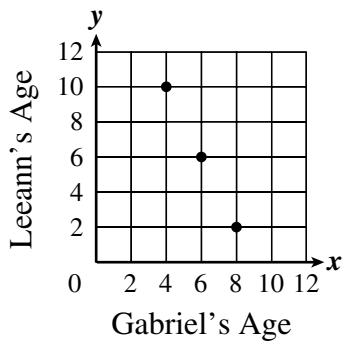
A. 11  
B. 20  
C. 36  
D. 45

- 3 Gabriel is 2 years older than his sister, Leeann. Which of the following graphs correctly represents the relationship between Gabriel's age and Leeann's age, in years?

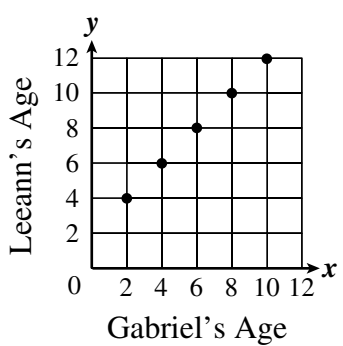
A.



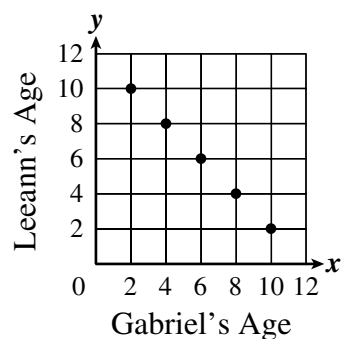
B.



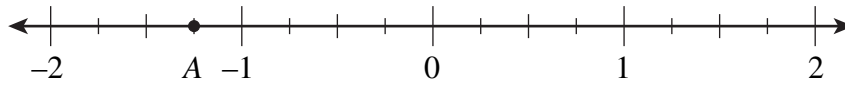
C.



D.



- 4 Which of the following **best** represents the location of point  $A$  on the number line shown below?



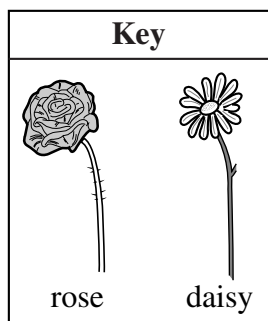
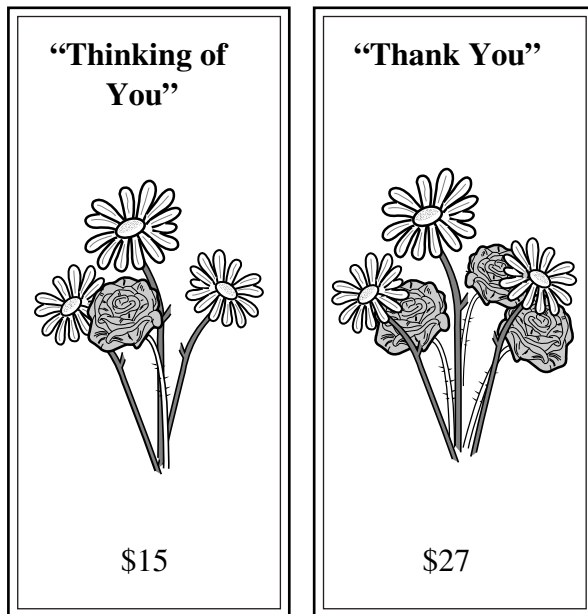
- A.  $-2\frac{3}{4}$
- B.  $-2\frac{1}{4}$
- C.  $-1\frac{1}{2}$
- D.  $-1\frac{1}{4}$

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

$$2 + 4 \times (3 + 7)$$

- A. 21
- B. 25
- C. 42
- D. 60

- 6 A flower shop sells the two flower arrangements shown below.



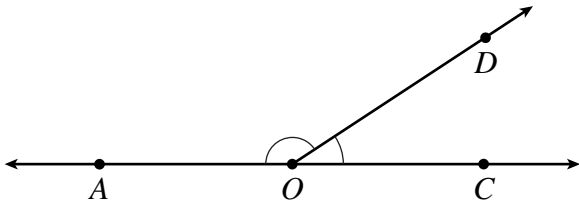
Each rose has the same price, and each daisy has the same price. What is the price of one rose?

- A. \$3
- B. \$6
- C. \$9
- D. \$12

- 7 Travis is rolling a fair number cube with faces numbered 1 through 6. What is the probability that the result on his next roll will be an odd number?

- A. 1 out of 6
- B. 2 out of 6
- C. 3 out of 6
- D. 6 out of 6

- 8 In the figure below, points  $A$ ,  $O$ , and  $C$  lie on the same line.



What is the sum of the measures of angle  $AOD$  and angle  $DOC$ ?

- A.  $90^\circ$
- B.  $180^\circ$
- C.  $270^\circ$
- D.  $360^\circ$

- 9 Allison lives 1 mile from the park. She walked at a rate of 2 miles per hour directly from her house to the park. If Allison left her house at 1:00 P.M., at what time did she arrive at the park?

- A. 1:02 P.M.
- B. 1:30 P.M.
- C. 1:50 P.M.
- D. 3:00 P.M.



Question 10 is an open-response question.

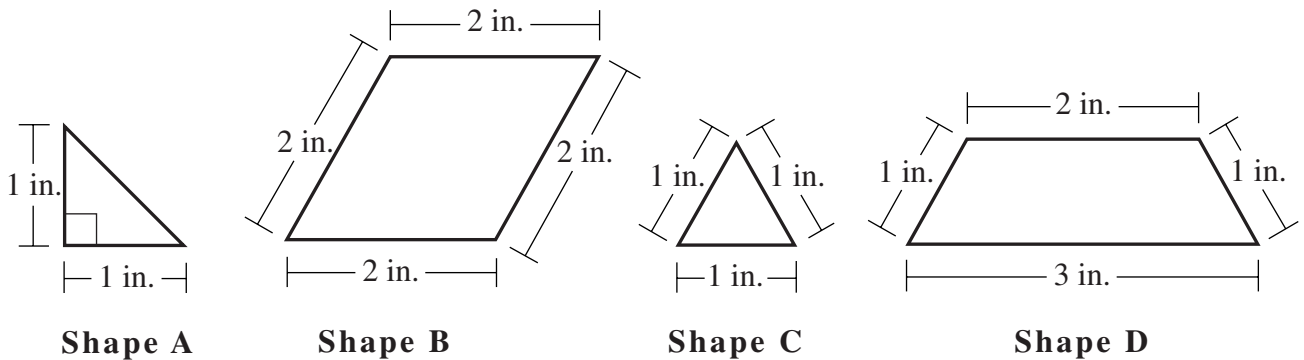
- **BE SURE TO ANSWER AND LABEL ALL PARTS OF THE QUESTION.**
- **Show all your work (drawings, tables, or computations) in your Student Answer Booklet.**
- **If you do the work in your head, explain in writing how you did the work.**

Write your answer to question 10 in the space provided in your Student Answer Booklet.

- 10** Four geometric terms are listed in alphabetical order below.

Equilateral Triangle      Rhombus      Right Isosceles Triangle      Trapezoid

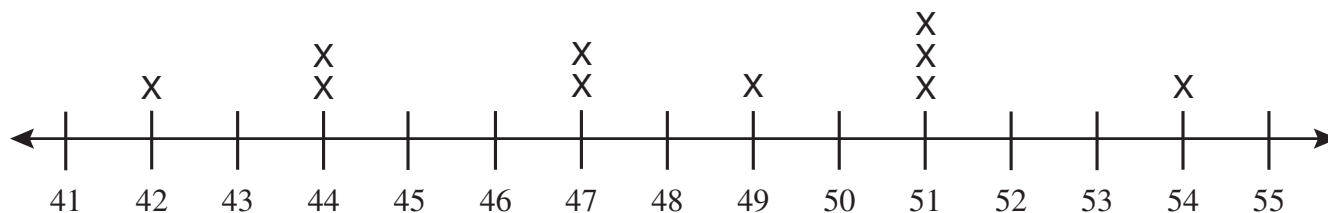
Four different shapes are represented below.



- Which one of the geometric terms listed above **most accurately** describes Shape A?  
Explain how you know your answer is correct.
- Which one of the geometric terms listed above **most accurately** describes Shape B?  
Explain how you know your answer is correct.
- Which one of the geometric terms listed above **most accurately** describes Shape C?  
Explain how you know your answer is correct.
- Which one of the geometric terms listed above **most accurately** describes Shape D?  
Explain how you know your answer is correct.

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 line plot below shows the MacArthur School's basketball team game scores.



What is the range of the scores for the MacArthur School's basketball team?

- 12 What is the value of the expression below when  $\Delta = 3$ ?

$$4(\Delta) - 5$$

Question 13 is an open-response question.

- **BE SURE TO ANSWER AND LABEL ALL PARTS OF THE QUESTION.**
- **Show all your work (drawings, 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.

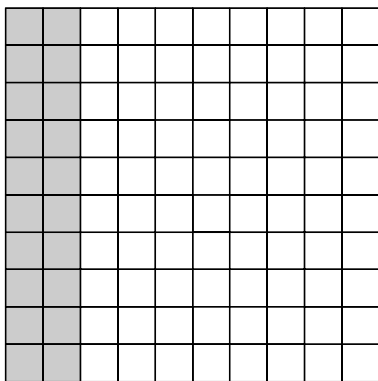
- 13** Diane has taken 9 math quizzes this year. Her quiz scores are shown below.

**98 94 86 88 89 100 82 91 100**

- In your Student Answer Booklet, create a stem-and-leaf plot that represents Diane's math quiz scores. Be sure to include a key.
- What is the mean of Diane's math quiz scores? Show your work or explain your answer.
- What is the mode of Diane's math quiz scores? Show your work or explain your answer.
- Diane will take one more math quiz this year. If the highest score possible on the quiz is 100, is it possible for Diane to have a quiz average (mean) of 95? Show your work or explain 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 grid below is shaded to represent a fraction.



What fraction of the grid is shaded?

- A.  $\frac{1}{20}$   
B.  $\frac{1}{5}$   
C.  $\frac{1}{4}$   
D.  $\frac{1}{3}$

- 15 Which of the following is a possible rule for the input-output table shown below?

Input-Output Table

Input	1	2	3	4	5
Output	3	5	7	9	11

- A. The output is 2 plus the input.  
B. The output is 3 times the input.  
C. The output is 0.5 less than half the input.  
D. The output is 1 more than twice the input.

- 16 If  $h - 6 = 10$ , which of the following is true?

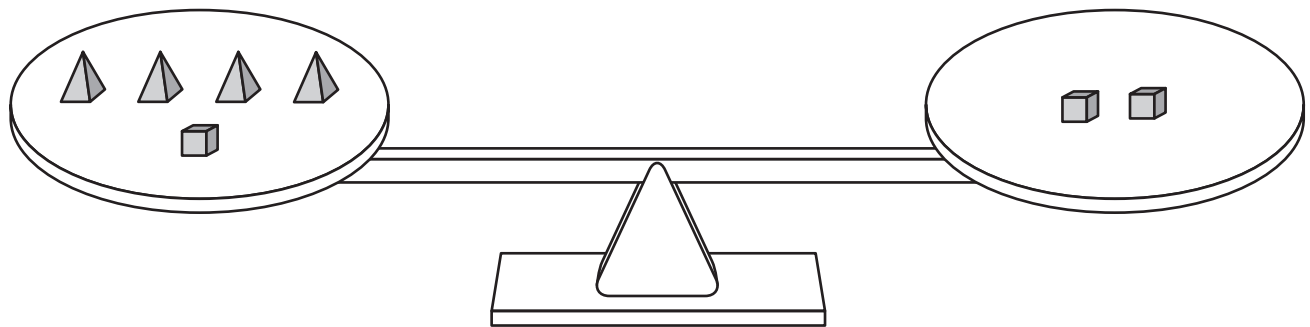
- A.  $h = 10 + 6$   
B.  $h = 10 - 6$   
C.  $h = 10 \times 6$   
D.  $h = 10 \div 6$

Question 17 is an open-response question.

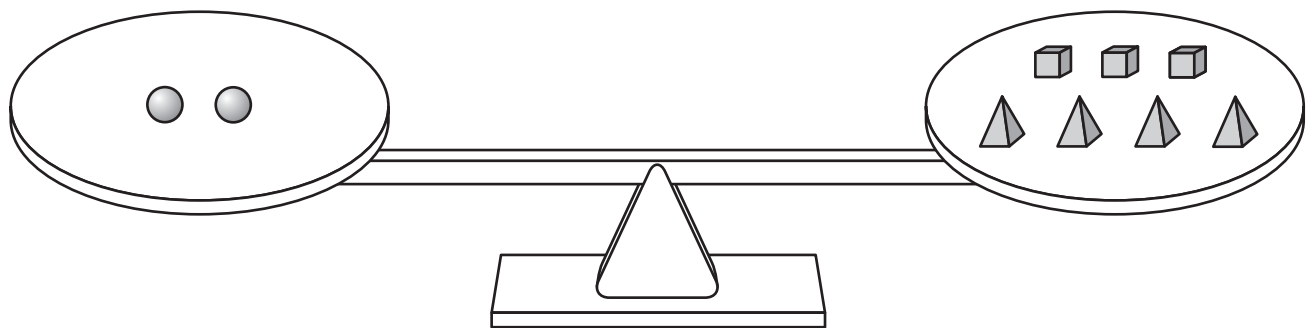
- **BE SURE TO ANSWER AND LABEL ALL PARTS OF THE QUESTION.**
- **Show all your work (drawings, tables, or computations) in your Student Answer Booklet.**
- **If you do the work in your head, explain in writing how you did the work.**

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

- 17** The pictures below show two scales that are balanced.



Scale A



Scale B

- Using Scale A, how many pyramids balance 1 cube? Show or explain your work.
- Using your answer in part a and using Scale B, how many pyramids balance 1 sphere? Show or explain your work.
- Using your answers in parts a and b, which weighs more, 3 spheres or 5 cubes? Show or explain your work.

# Mathematics

## SESSION 2

*You may use your reference sheet, MCAS ruler, and MCAS protractor during this session. You may **not** use a calculator during this session.*



### DIRECTIONS

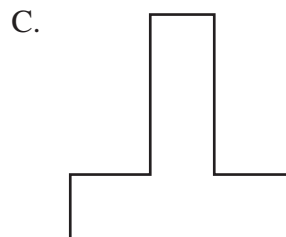
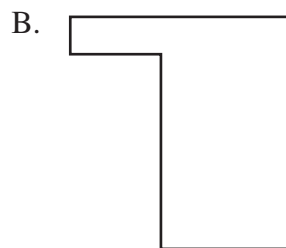
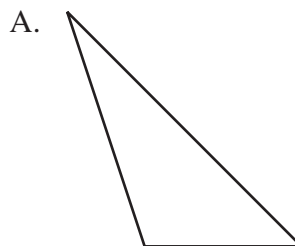
This session contains seventeen multiple-choice questions, three short-answer questions, and two open-response questions. Mark your answers to these questions in the spaces provided in your Student Answer Booklet.

- 18 If  $\Delta = 3$ , what is the value of the expression below?

$$(6 + \Delta) \div 2$$

- A. 3
- B. 4.5
- C. 7.5
- D. 9

- 19 Which picture below appears to have a single line of symmetry?



- 20 In which of the following tables does each pair of numbers  $(x, y)$  satisfy the equation shown below?

$$x + 6 = y$$

A.

$x$	$y$
1	7
2	9
3	9

B.

$x$	$y$
1	6
2	8
3	10

C.

$x$	$y$
1	7
2	8
3	9

D.

$x$	$y$
1	5
2	4
3	3

- 21 On Kelly's homework, the answer to the subtraction problem shown below was marked wrong.

$$\begin{array}{r} 178 \\ - 59 \\ \hline 129 \end{array}$$

Which of the following is one way for her to discover that her answer is wrong?

- A.  $129 - 59 = 70$
- B.  $129 + 59 = 188$
- C.  $178 + 129 = 307$
- D.  $178 + 59 = 237$

- 22 Bjorn is working on a class project on foreign newspapers. The chart below shows the information that Bjorn will present to his class.

**Foreign Newspapers**

Country	Number of Newspapers
Spain	85
Venezuela	89
Canada	107
Sweden	98
United Kingdom	103

Which of the following is a stem-and-leaf plot that correctly displays this information?

A.

Stem	Leaf
8	5 9
9	8
10	3 7

KEY
6 2 represents 62

B.

Stem	Leaf
1	3 7
8	9 5
9	8

KEY
6 2 represents 62

C.

Stem	Leaf
9	8
8	9 5
10	3 7

KEY
6 2 represents 62

D.

Stem	Leaf
8	85 89
9	98
10	103 107

KEY
6 2 represents 62



- 23 Nelida, Mandy, Owen, and Yin each took the same spelling test.

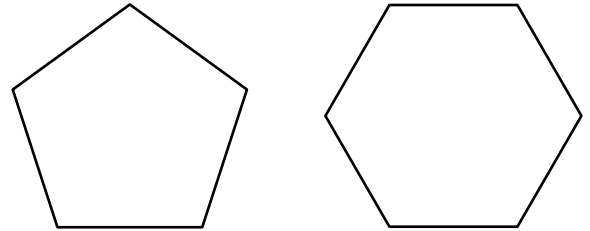
- Nelida spelled  $\frac{7}{10}$  of the words correctly.
- Mandy spelled  $\frac{3}{4}$  of the words correctly.
- Owen spelled  $\frac{4}{5}$  of the words correctly.
- Yin spelled  $\frac{2}{3}$  of the words correctly.

Who spelled the greatest number of words correctly?

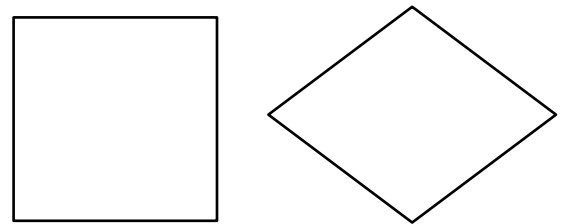
- A. Nelida
- B. Mandy
- C. Owen
- D. Yin

- 24 Which of the following appears to show a pair of congruent figures?

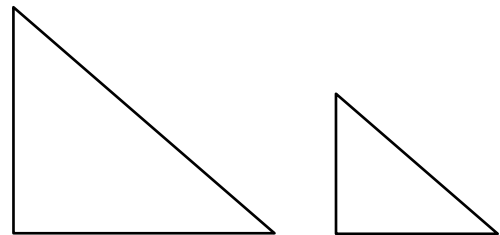
A.



B.



C.



D.



- 25 What is the sum of the measures of all of the interior angles of a triangle?

A.  $120^\circ$   
B.  $180^\circ$   
C.  $240^\circ$   
D.  $360^\circ$

- 26 What is the solution to the equation shown below?

$$2x - 4 = 12$$

A.  $x = 4$   
B.  $x = 8$   
C.  $x = 12$   
D.  $x = 16$

Question 27 is an open-response question.

- **BE SURE TO ANSWER AND LABEL ALL PARTS OF THE QUESTION.**
- **Show all your work (drawings, 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** Carolyn and Kim are selling lemonade this summer.

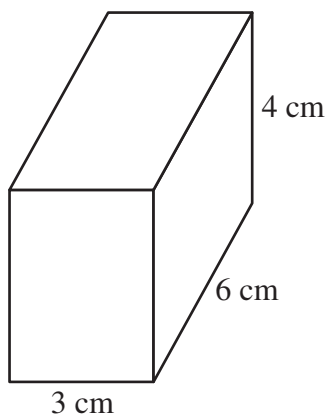
- It costs \$0.10 to make each cup of lemonade.
  - They are going to sell each cup of lemonade for \$0.25.
- a. What is the total cost to make 55 cups of lemonade? Show or explain your work.
  - b. If they sell 55 cups of lemonade, what is the amount of money they will collect? Show or explain your work.
  - c. If they sell 55 cups of lemonade, how much more money would they collect than they would spend? Show or explain your work.
  - d. What is the least number of cups of lemonade they need to sell in order to collect \$10.00 **more** than they spend? Show or explain your work.

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 What number should be between 35 and 61 in the following arithmetic progression?

35, \_\_\_\_, 61, 74, 87

- 29 What is the volume, in cubic centimeters, of the rectangular prism shown below?



**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** Kathryn walked  $1\frac{1}{2}$  miles per day for 30 days. What was the total number of miles she walked?

Question 31 is an open-response question.

- **BE SURE TO ANSWER AND LABEL ALL PARTS OF THE QUESTION.**
- **Show all your work (drawings, 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 circular ring of a circus has a radius of 10 feet.
- In your Student Answer Booklet, sketch the ring. Show and label the radius of the ring you sketched.
  - What is the diameter, in feet, of the ring? Show or explain your work.
  - What is the area, in square feet, of the ring? Show or explain your work. (Use 3.14 for  $\pi$ .)

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** Lana charges \$5 per hour for babysitting one child and \$1.25 for each additional child. Which of the following tables represents the amount per hour Lana charges for babysitting one through five children?

- A. 

Number of Children	1	2	3	4	5
Total Charge	\$5.00	\$6.25	\$7.50	\$8.75	\$10.00
- B. 

Number of Children	1	2	3	4	5
Total Charge	\$6.25	\$7.50	\$8.75	\$10.00	\$11.25
- C. 

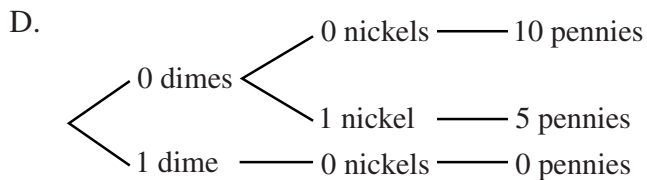
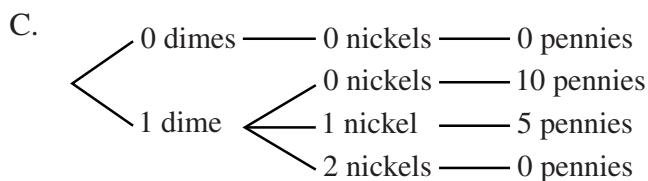
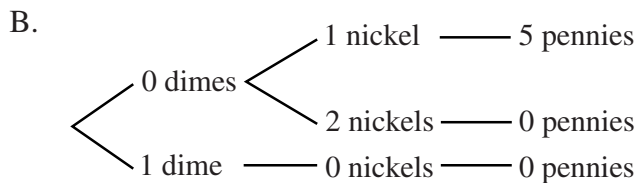
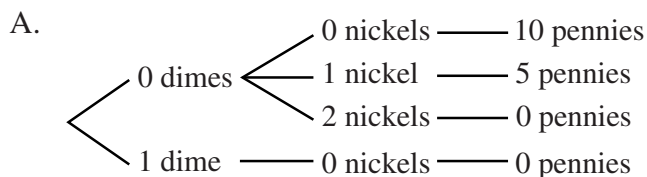
Number of Children	1	2	3	4	5
Total Charge	\$5.00	\$6.25	\$11.75	\$16.75	\$21.75
- D. 

Number of Children	1	2	3	4	5
Total Charge	\$6.25	\$12.50	\$18.50	\$24.75	\$31.00

- 33 A microscope magnifies an object 1000 times its actual size. Which of the following equals 1000?

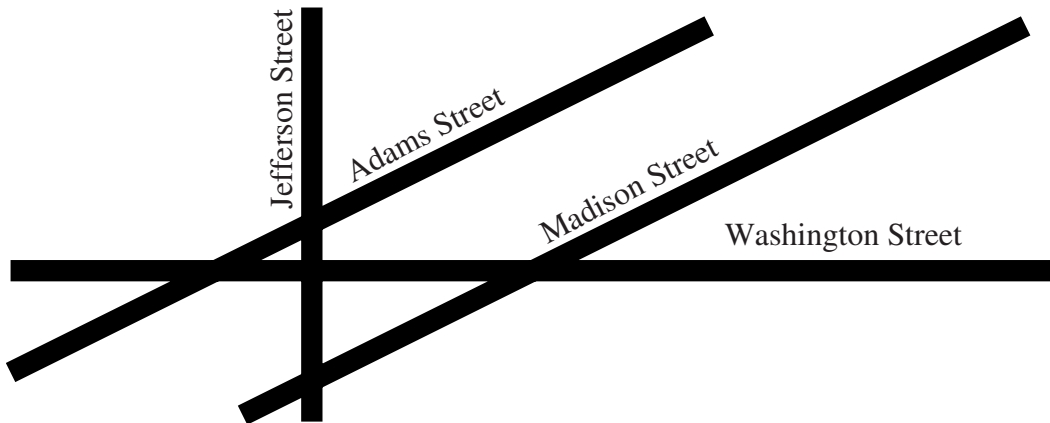
A.  $10^2$   
B.  $10^3$   
C.  $10^4$   
D.  $10^5$

- 34 Stuart bought a candy bar that cost 90 cents. He gave the cashier a \$1 bill. Which of the following tree diagrams shows all of the ways the cashier can give correct change using pennies, nickels, and dimes?





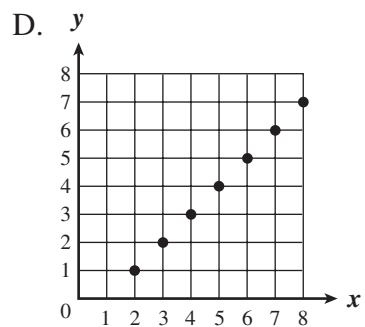
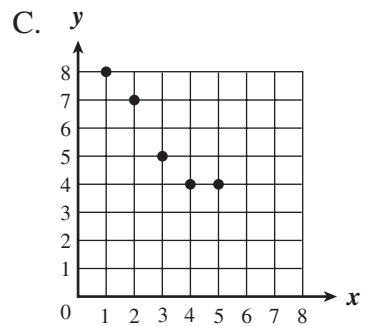
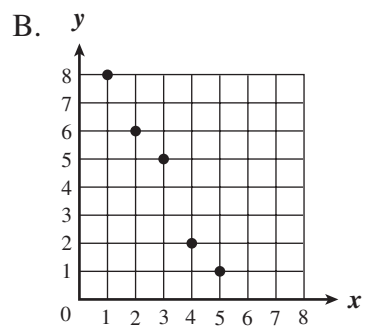
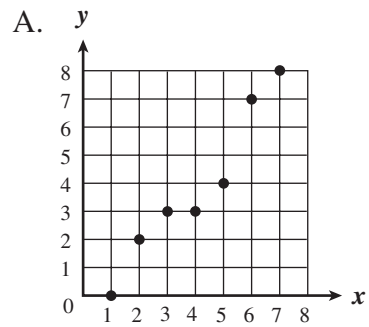
- 35 A map of four streets is shown below.



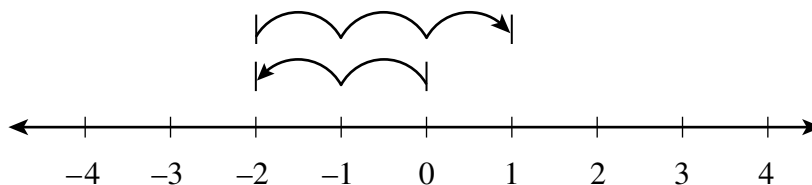
Which two streets appear to be perpendicular?

- A. Jefferson Street and Washington Street
- B. Adams Street and Washington Street
- C. Adams Street and Madison Street
- D. Jefferson Street and Madison Street

- 36 Which of the following graphs shows a constant rate of change?



- 37 Which of the following number sentences is represented on the number line shown below?



- A.  $-2 + (-3) = 1$   
B.  $1 + (-2) = -2$   
C.  $1 - (+2) = -1$   
D.  $-2 + 3 = 1$

- 38 Derek is making hot fudge sauce using the recipe shown below.

**Hot Fudge Sauce**

- 12 ounces of chocolate chips
- $\frac{3}{4}$  cup of heavy cream
- 1 tablespoon of butter

If Derek is going to double the recipe, how many cups of heavy cream will he need?

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

- 39 The chart below shows the number of minutes five students spent exercising yesterday.

Student	Minutes Spent Exercising
Bill	34
Hassan	32
Jenna	0
Monty	20
Beth	34

Based on the data given in the chart, what is the **median** number of minutes the five students spent exercising?

- A. 24 minutes
- B. 30 minutes
- C. 32 minutes
- D. 34 minutes



## 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 2004 Released Items:**  
**Reporting Categories, Standards, and Correct Answers**

Item No.	Page No.	Reporting Category	Standard	Correct Answer (MC/SA)*
1	151	<i>Number Sense and Operations</i>	6.N.3	C
2	151	<i>Number Sense and Operations</i>	6.N.8	B
3	152	<i>Patterns, Relations, and Algebra</i>	6.P.6	A
4	153	<i>Number Sense and Operations</i>	6.N.6	D
5	153	<i>Number Sense and Operations</i>	6.N.11	C
6	154	<i>Patterns, Relations, and Algebra</i>	6.P.5	B
7	154	<i>Data Analysis, Statistics, and Probability</i>	6.D.4	C
8	155	<i>Measurement</i>	6.M.2	B
9	155	<i>Measurement</i>	6.M.3	B
10	156	<i>Geometry</i>	6.G.1	
11	157	<i>Data Analysis, Statistics, and Probability</i>	6.D.2	12, or 42 to 54
12	157	<i>Patterns, Relations, and Algebra</i>	6.P.2	7
13	158	<i>Data Analysis, Statistics, and Probability</i>	6.D.1	
14	159	<i>Number Sense and Operations</i>	6.N.5	B
15	159	<i>Patterns, Relations, and Algebra</i>	6.P.4	D
16	159	<i>Patterns, Relations, and Algebra</i>	6.P.3	A
17	160	<i>Patterns, Relations, and Algebra</i>	6.P.5	
18	161	<i>Patterns, Relations, and Algebra</i>	6.P.2	B
19	161	<i>Geometry</i>	6.G.7	C
20	162	<i>Patterns, Relations, and Algebra</i>	6.P.4	C
21	162	<i>Number Sense and Operations</i>	6.N.12	B
22	163	<i>Data Analysis, Statistics, and Probability</i>	6.D.2	A
23	164	<i>Number Sense and Operations</i>	6.N.7	C
24	164	<i>Geometry</i>	6.G.8	D
25	165	<i>Measurement</i>	6.M.7	B
26	165	<i>Patterns, Relations, and Algebra</i>	6.P.5	B
27	166	<i>Number Sense and Operations</i>	6.N.9	
28	167	<i>Patterns, Relations, and Algebra</i>	6.P.1	48
29	167	<i>Measurement</i>	6.M.6	72cm <sup>3</sup>
30	168	<i>Number Sense and Operations</i>	6.N.9	45 miles
31	169	<i>Measurement</i>	6.M.5	
32	170	<i>Patterns, Relations, and Algebra</i>	6.P.4	A
33	171	<i>Number Sense and Operations</i>	6.N.1	B
34	171	<i>Data Analysis, Statistics, and Probability</i>	6.D.3	A
35	172	<i>Geometry</i>	6.G.3	A
36	173	<i>Patterns, Relations, and Algebra</i>	6.P.7	D
37	174	<i>Number Sense and Operations</i>	6.N.10	D
38	174	<i>Number Sense and Operations</i>	6.N.9	B
39	175	<i>Data Analysis, Statistics, and Probability</i>	6.D.1	C

\* 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 website later this year.