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## XII. Mathematics, Grade 6

# Grade 6 Mathematics Test

## Test Sessions and Content Overview

The spring 2016 grade 6 Mathematics test was made up of two separate test sessions. Each session included:

- Twenty-one common items, including multiple-choice, short-answer, and open-response questions. These common items are the items on which each student's 2016 MCAS Mathematics score will be based.
- Three items developed by the Partnership for Assessment of Readiness for College and Careers (PARCC), including multiple-choice, multiple-select, and open-response questions. Students' performance on these PARCC items will **not** be factored into their MCAS scores.

Approximately half of the common test items are shown on the following pages as they appeared in test booklets.

The PARCC items are not being released in this document. The Department will post information about these items to the Student Assessment webpage in a separate document. See page 4 of the Introduction to this document for more information about the inclusion of PARCC items in the 2016 MCAS tests.

## Standards and Reporting Categories

The common items in the spring 2016 grade 6 Mathematics test assessed standards in the five domains for grade 6 in the *Massachusetts Curriculum Framework for Mathematics* (March 2011). The grade 6 standards can be found on pages 53–58 in the *Framework*, and the five domains are listed below.

- Ratios and Proportional Relationships
- The Number System
- Expressions and Equations
- Geometry
- Statistics and Probability

The *Massachusetts Curriculum Framework for Mathematics* is available on the Department website at [www.doe.mass.edu/frameworks/current.html](http://www.doe.mass.edu/frameworks/current.html).

Mathematics test results are reported under five MCAS reporting categories, which are identical to the five framework domains listed above.

The tables at the conclusion of this chapter indicate each released and unreleased common item's reporting category and the framework standard it assesses. The correct answers for released multiple-choice and short-answer questions are also displayed in the released item table.

Standards and reporting categories for the PARCC items in the grade 6 Mathematics test will be listed in a separate document, which will be posted to the Student Assessment webpage.

## 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.

During both Mathematics test sessions, the use of bilingual word-to-word dictionaries was allowed for current and former English language learner students only. No calculators, other reference tools, or materials were allowed.

# Grade 6 Mathematics

## SESSION 1

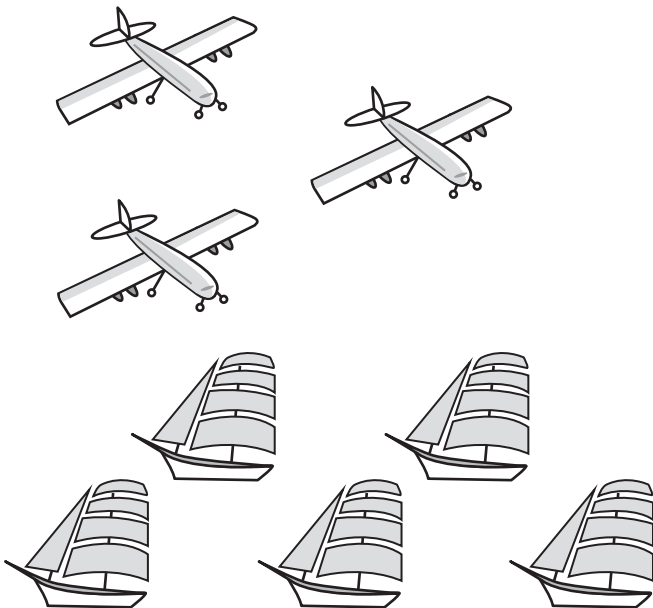
You may use your reference sheet and MCAS ruler during this session.  
You may **not** use a calculator during this session.



### DIRECTIONS

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

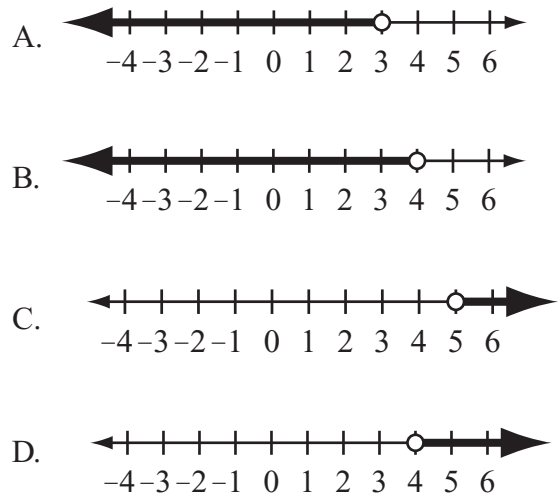
- 1 The diagram below shows some model airplanes and some model ships.



What is the ratio of the number of model airplanes to the number of model ships?

- A. 8:3
- B. 5:3
- C. 3:8
- D. 3:5

- 2 Which of the following number lines best represents all the solutions of the inequality  $x < 4$ ?



- 3 Bianca read 5 books last month. The number of pages in each book that Bianca read is listed in the box below.

120, 106, 94, 100, 180
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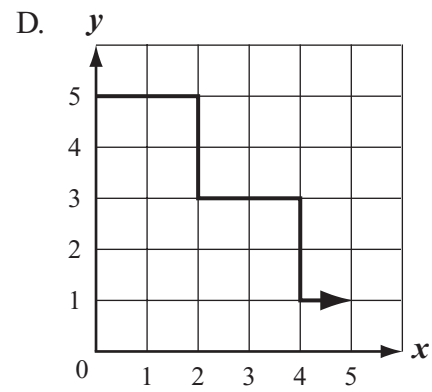
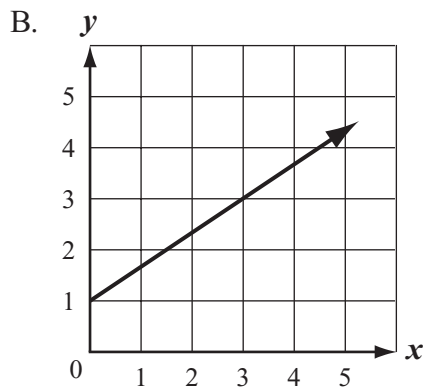
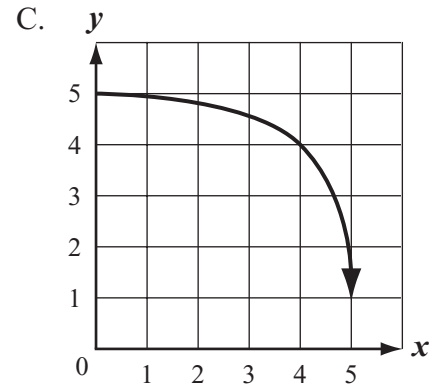
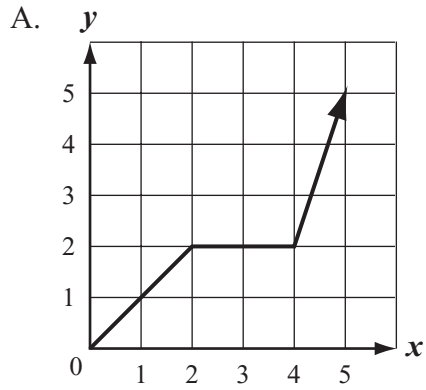
What is the mean absolute deviation of the number of pages in the 5 books Bianca read?

- A. 24
- B. 30
- C. 106
- D. 120

- 4 Roya paid \$48 for 12 cartons of orange juice. What is the unit rate per carton of orange juice that Roya paid?

- A. \$3
- B. \$4
- C. \$6
- D. \$12

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



Questions 6 and 7 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.

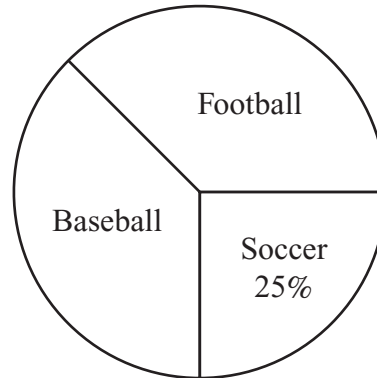
- 6 An expression is shown below.

$$g + 3f + f + g + g$$

Write an equivalent expression that uses each variable only **once**.

- 7 Marvin surveyed his classmates to find out their favorite sports. Each classmate chose only one sport. The results of his survey are represented in the circle graph below.

**Classmates' Favorite Sports**



In all, Marvin surveyed 48 of his classmates. An equal number of Marvin's classmates chose baseball and football. Based on the circle graph, what is the total number of classmates who chose baseball as their favorite sport?

Question 8 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 8 in the space provided in your Student Answer Booklet.

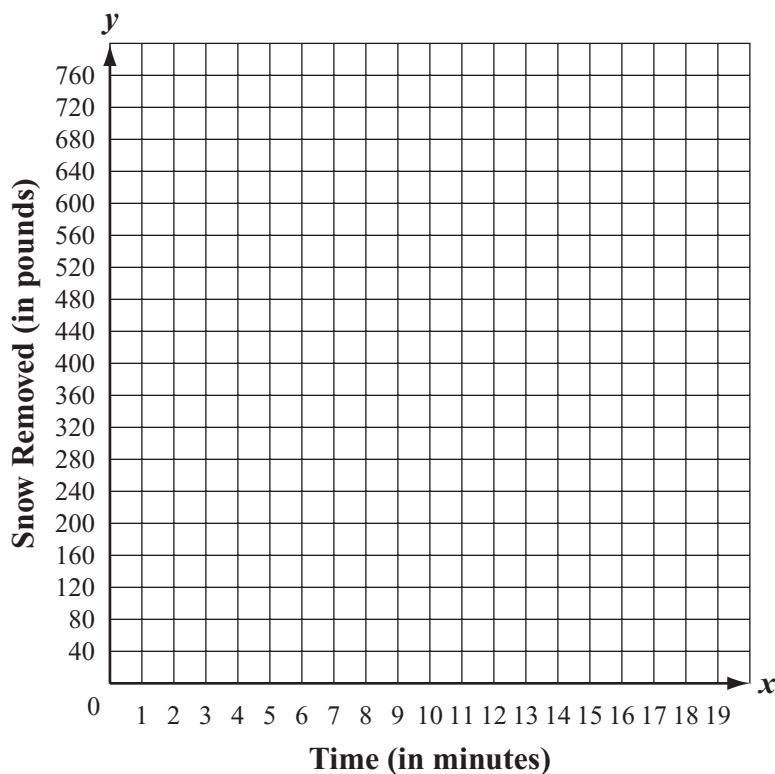
- 8 The table below shows the amount, in pounds, of snow that Andy can remove over time using a shovel.

**Snow Removal Using a Shovel**

<b>Time (in minutes)</b>	1	2	3	4	5	6
<b>Snow Removed (in pounds)</b>	80	160	240	320		480

- a. Based on the table, what is the amount, in pounds, of snow that Andy can remove in 5 minutes using a shovel? Show or explain how you got your answer.

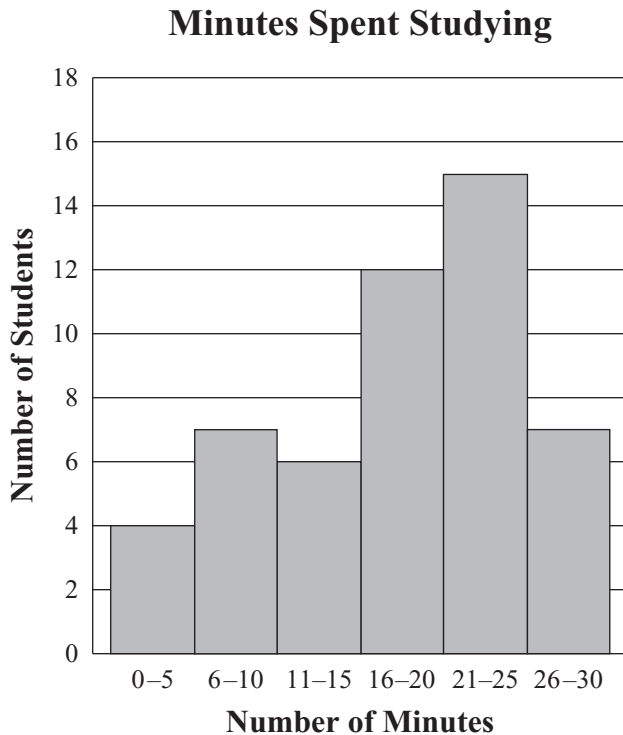
On the grid in your Student Answer Booklet, copy the  $x$ -axis, the  $y$ -axis, and the labels exactly as shown below.



- b. On your grid, plot the data from the table to show the amount of snow that Andy can remove over time.
- c. Based on your graph, what is the amount, in pounds, of snow that Andy can remove in 10 minutes? Show or explain how you got your answer.

Mark your answers to multiple-choice questions 9 through 11 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.

- 9 The histogram below represents the number of minutes some students studied for a geography quiz.



Based on the histogram, what is the total number of students who studied between 11 and 25 minutes for the geography quiz?

- A. 6
- B. 14
- C. 21
- D. 33

- 10 Which of the following expressions represents “subtract 17 from  $x$ ”?

- A.  $17 - x$
- B.  $x - 17$
- C.  $-17x$
- D.  $-x - 17$

- 11 A radio station manager has \$1000 in prize money to give away. She will give away \$50 in prize money each hour.

Which of the following expressions represents the amount of prize money the radio station manager will have left to give away after  $h$  hours, where  $h$  is any number of hours?

- A.  $1000 + 50h$
- B.  $1000h + 50$
- C.  $1000 - 50h$
- D.  $1000h - 50$

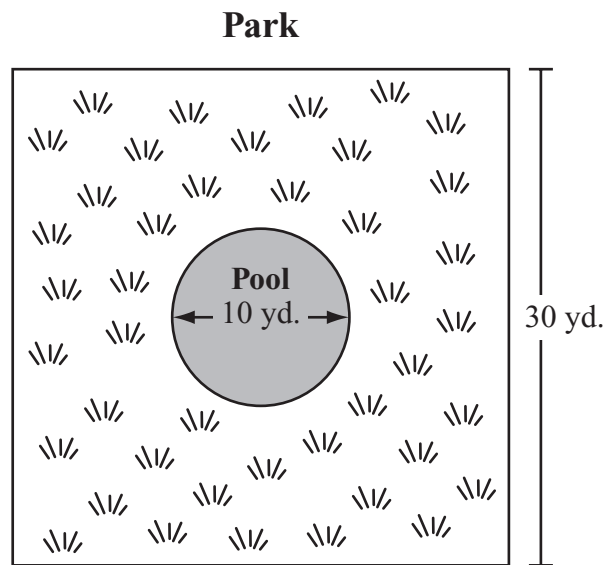


Question 12 is an open-response question.

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

- 12** A circular pool is located in the center of a square park. The park, the pool, and some of their dimensions are shown in the diagram below.



- What is the radius, in yards, of the pool? Show or explain how you got your answer.
- What is the circumference, in yards, of the pool? Show or explain how you got your answer. (Use 3.14 for  $\pi$ .)
- What is the area, in square yards, of the pool? Show or explain how you got your answer. (Use 3.14 for  $\pi$ .)

The ground in the park surrounding the pool is covered with grass.

- What is the total area, in square yards, of the ground in the park that is covered with grass? Show or explain how you got your answer.

# Grade 6 Mathematics

## SESSION 2

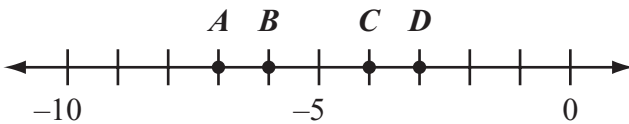
You may use your reference sheet and MCAS ruler during this session.  
You may **not** use a calculator during this session.



### DIRECTIONS

This session contains eight multiple-choice questions and one short-answer question. Mark your answers to these questions in the spaces provided in your Student Answer Booklet.

- 13 Points  $A$ ,  $B$ ,  $C$ , and  $D$  are shown on the number line below.



Which point is located at  $-7$ ?

- A. point  $A$
- B. point  $B$
- C. point  $C$
- D. point  $D$

- 14 What is the value of the expression below when  $n = 6$ ?

$$2n + 3n$$

- A. 12
- B. 18
- C. 30
- D. 62

- 15 Guthrie made the input-output table shown below.

Input ( $x$ )	Output ( $y$ )
1	4
2	7
3	10
4	13

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

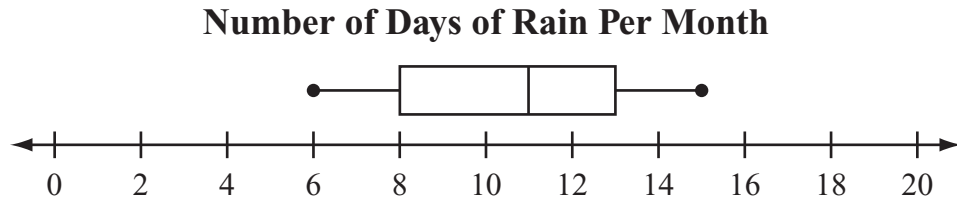
- A.  $x + 3 = y$
- B.  $x + 7 = y$
- C.  $3x + 1 = y$
- D.  $4x - 1 = y$

- 16 At the beginning of the day, a water tank contained 526.8 gallons of water. During the day, some of the water was used to water a garden. At the end of the day, the water tank contained 318.05 gallons of water.

What was the total amount of water used that day?

- A. 202.75 gallons
- B. 208.75 gallons
- C. 208.85 gallons
- D. 210.80 gallons

- 17 Luke recorded the number of days it rained each month for 12 months. He made a box plot to represent the data, as shown below.



What is the interquartile range of the data in Luke's box plot?

- A. 11
- B. 9
- C. 8
- D. 5

**Question 18 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.**

**18** Elijah wrote two numbers that follow the rules in the box below.

- Both numbers are less than 10.
- Both numbers are whole numbers.
- The least common multiple of the numbers is 18.
- The greatest common factor of the numbers is 3.

What two numbers did Elijah write?

Mark your answers to multiple-choice questions 19 through 21 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.

- 19 A theater has a total of 750 seats.
- There are 30 rows of seats in the theater.
  - Each row has the same number of seats.

What is the total number of seats in each row of the theater?

- A. 21
- B. 23
- C. 25
- D. 27

- 20 Which of the following expressions has the greatest value?
- A.  $2^3 + 2^3$
  - B.  $2^3 + 7^1$
  - C.  $3^2 + 3^2$
  - D.  $3^2 + 7^1$

- 21 Ethan is hiking in a canyon.
- He is at an elevation that is below sea level.
  - His elevation is within 200 feet of sea level.

Which of the following could be Ethan's elevation in feet?

- A.  $-300$
- B.  $-150$
- C.  $150$
- D.  $300$

**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 2016 Released Items:**  
**Reporting Categories, Standards, and Correct Answers\***

Item No.	Page No.	Reporting Category	Standard	Correct Answer (MC/SA)*
1	191	<i>Ratios and Proportional Relationships</i>	RP.1	D
2	191	<i>Expressions and Equations</i>	EE.8	B
3	192	<i>Statistics and Probability</i>	SP.5	A
4	192	<i>Ratios and Proportional Relationships</i>	RP.2	B
5	193	<i>Expressions and Equations</i>	EE.9	B
6	194	<i>Expressions and Equations</i>	EE.4	$4f + 3g$ or $3g + 4f$
7	194	<i>Statistics and Probability</i>	SP.4	18
8	195	<i>Ratios and Proportional Relationships</i>	RP.3	
9	196	<i>Statistics and Probability</i>	SP.4	D
10	196	<i>Expressions and Equations</i>	EE.2	B
11	196	<i>Expressions and Equations</i>	EE.6	C
12	197	<i>Geometry</i>	G.1	
13	198	<i>The Number System</i>	NS.6	A
14	198	<i>Expressions and Equations</i>	EE.2	C
15	199	<i>Expressions and Equations</i>	EE.9	C
16	199	<i>The Number System</i>	NS.3	B
17	200	<i>Statistics and Probability</i>	SP.5	D
18	201	<i>The Number System</i>	NS.4	6 and 9
19	202	<i>The Number System</i>	NS.2	C
20	202	<i>Expressions and Equations</i>	EE.1	C
21	202	<i>The Number System</i>	NS.5	B

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



**Grade 6 Mathematics**  
**Spring 2016 Unreleased Common Items:**  
**Reporting Categories and Standards**

<b>Item No.</b>	<b>Reporting Category</b>	<b>Standard</b>
22	<i>Ratios and Proportional Relationships</i>	RP.3
23	<i>The Number System</i>	NS.1
24	<i>Expressions and Equations</i>	EE.5
25	<i>Geometry</i>	G.4
26	<i>Expressions and Equations</i>	EE.3
27	<i>Geometry</i>	G.3
28	<i>Geometry</i>	G.2
29	<i>Expressions and Equations</i>	EE.2
30	<i>The Number System</i>	NS.8
31	<i>Geometry</i>	G.1
32	<i>Statistics and Probability</i>	SP.4
33	<i>Expressions and Equations</i>	EE.6
34	<i>The Number System</i>	NS.7
35	<i>Ratios and Proportional Relationships</i>	RP.1
36	<i>The Number System</i>	NS.6
37	<i>Ratios and Proportional Relationships</i>	RP.1
38	<i>Expressions and Equations</i>	EE.7
39	<i>Ratios and Proportional Relationships</i>	RP.3
40	<i>The Number System</i>	NS.3
41	<i>Ratios and Proportional Relationships</i>	RP.3
42	<i>Statistics and Probability</i>	SP.5