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## XIII. Mathematics, Grade 7

## Grade 7 Mathematics Test

The spring 2015 grade 7 Mathematics test was based on standards in the five domains for grade 7 in the *Massachusetts Curriculum Framework for Mathematics* (March 2011). The grade 7 standards can be found on pages 59–64 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.

### Test Sessions

The grade 7 Mathematics test included two separate test sessions. Each session included multiple-choice, short-answer, and open-response questions. Approximately half of the common test items are shown on the following pages as they appeared in test booklets.

### Reference Materials and Tools

Each student taking the grade 7 Mathematics test was provided with a plastic ruler and a grade 7 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 Session 2, each student had sole access to a calculator with at least four functions and a square root key. Calculator use was not allowed during Session 1.

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 other reference tools or materials were allowed.

# Grade 7 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 one open-response question. Mark your answers to these questions in the spaces provided in your Student Answer Booklet.

1 At a carnival, Andrew went on rides and played games.

- Each ride cost \$2.
- Each game cost \$2.
- Andrew went on 3 rides and played  $g$  games.

Andrew wrote the expression below to represent the total amount of money, in dollars, he spent at the carnival.

$$6 + 2g$$

Which of the following is another way Andrew could represent the total amount of money, in dollars, that he spent at the carnival?

- A.  $2 \times 3g$
- B.  $2(3 + g)$
- C.  $4 \times 3g$
- D.  $4(3 + g)$

2 What is the value of the expression below?

$$-\frac{2}{3} \cdot \frac{5}{-6}$$

- A.  $-\frac{4}{5}$
- B.  $-\frac{5}{9}$
- C.  $\frac{5}{9}$
- D.  $\frac{4}{5}$

3 There are 24 students in Ms. Woodall’s class.

- $\frac{1}{2}$  of the students are boys.
- $\frac{1}{3}$  of the boys have brown hair.

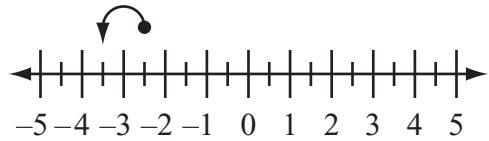
What is the number of boys in Ms. Woodall’s class who have brown hair?

- A. 4
- B. 8
- C. 12
- D. 20

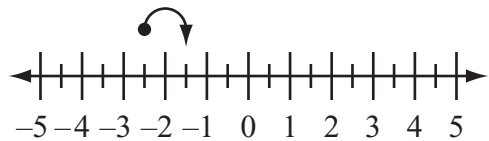
4 Which of the following number lines models the expression below?

$$-2.5 + (-1)$$

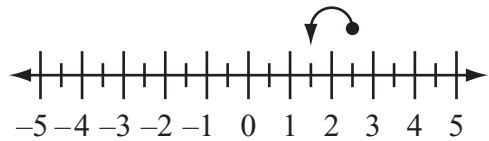
A.



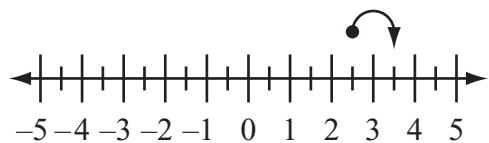
B.



C.



D.



**Question 5 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.**

- 5** An art teacher spent 7% of the art supply budget on colored paper. The art supply budget was \$1000. What was the total amount of money, in dollars, the art teacher spent on colored paper?

Mark your answers to multiple-choice questions 6 through 8 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.

- 6 Which of the following numbers has a value that is between 10% and  $\frac{1}{9}$ ?
- A. 0.151
  - B. 0.112
  - C. 0.108
  - D. 0.019
- 7 Serena is conducting a survey to find out which sport the students at her high school like the most. Which of the following groups would be **best** for her to survey to obtain valid data?
- A. physical education teachers
  - B. students at a football game
  - C. parents at a town meeting
  - D. students in the cafeteria
- 8 A building code allows a maximum of 140 people in a meeting room. There is one large table in the room, along with some small tables. When filled, the large table seats 15 people, and the small tables each seat 5 people.
- Which of the following can be used to find  $t$ , the **greatest** number of small tables that can be filled when the large table is also filled?
- A.  $5t + 15 \geq 140$
  - B.  $5t + 15 \leq 140$
  - C.  $15t + 5 \geq 140$
  - D.  $15t + 5 \leq 140$

**Question 9 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.**

- 9 The temperature in a city increased from  $-12^{\circ}\text{F}$  at dawn to  $7^{\circ}\text{F}$  in the afternoon. What was the change in temperature in degrees Fahrenheit?

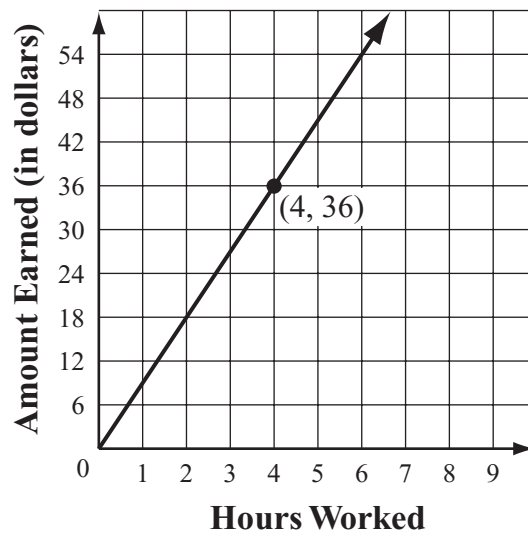
Question 10 is an open-response question.

- **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** Narita works part time on Saturdays. The graph below shows the relationship between the number of hours Narita works on Saturdays and the total amount of money she earns.

**Narita’s Earnings**



- a. What does the point (4, 36) on the graph represent in this situation?
- b. What does the point (0, 0) on the graph represent in this situation?
- c. What is the amount of money, in dollars, that Narita earns for each hour she works?  
Show or explain how you got your answer.
- d. Write an equation that could be used to find  $t$ , the total amount of money Narita earns for working  $h$  hours.



Mark your answer to multiple-choice question 11 in the space provided in your Student Answer Booklet. Do not write your answer in this test booklet. You may do your figuring in the test booklet.

- 11 What is the value of the expression below?

$$|-7| + |40|$$

- A. -47
- B. -33
- C. 33
- D. 47

# Grade 7 Mathematics

## SESSION 2

You may use your reference sheet and MCAS ruler during this session.



You may use a calculator during this session.

### DIRECTIONS

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

- 12 A plumber charged \$12 for 15 minutes of work. At this rate, what would the plumber charge for 1 hour of work?
- A. \$18
  - B. \$30
  - C. \$48
  - D. \$60

- 13 Sidney has 4 hats and 2 scarves in a drawer. All the hats are the same size, shape, and material. Both scarves are the same size, shape, and material. The table below shows the colors of Sidney's hats and scarves.

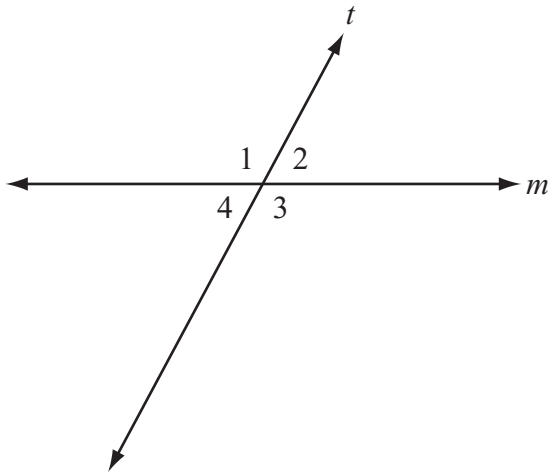
**Colors of Sidney's Hats and Scarves**

Hats	Scarves
1 blue	1 green
1 red	1 white
1 tan	
1 purple	

Sidney will pick one hat and one scarf from the drawer without looking. What is the probability that Sidney will pick a blue hat and a white scarf?

- A.  $\frac{1}{8}$
- B.  $\frac{1}{6}$
- C.  $\frac{1}{4}$
- D.  $\frac{1}{2}$

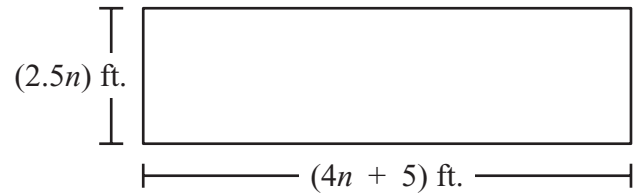
- 14 Line  $m$  is intersected by line  $t$ , as shown in the diagram below.



Based on the diagram, which of the following equations **must** be true?

- A.  $m\angle 1 + m\angle 2 = 180^\circ$
  - B.  $m\angle 1 + m\angle 3 = 180^\circ$
  - C.  $m\angle 2 + m\angle 3 = 90^\circ$
  - D.  $m\angle 2 + m\angle 4 = 90^\circ$
- 15 A pharmacist measured 10 milliliters of medicine. Which of the following is closest to the number of teaspoons of medicine that the pharmacist measured? (1 teaspoon  $\approx$  5 milliliters)
- A. 0.5 teaspoon
  - B. 2 teaspoons
  - C. 15 teaspoons
  - D. 50 teaspoons

- 16 The dimensions, in feet, of a rectangle are represented by expressions, as shown in the diagram below.



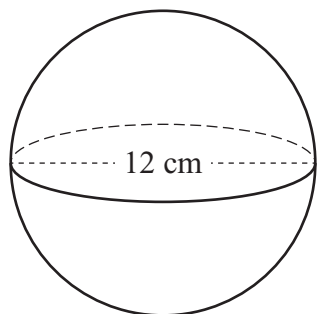
Which of the following expressions represents the perimeter, in feet, of the rectangle?

- A.  $6.5n + 5$
- B.  $10.5n + 10$
- C.  $13n + 10$
- D.  $20n + 5$

- 17 The formula for the surface area of a sphere that has a radius  $r$  is shown in the box below.

$$SA = 4\pi r^2$$

A sphere and one of its dimensions are shown in the diagram below.



What is the surface area, in square centimeters, of the sphere?

- A.  $48\pi$
- B.  $96\pi$
- C.  $144\pi$
- D.  $576\pi$

- 18 The table below shows the scores Analisa and Luke earned on four science projects.

**Science Project Scores**

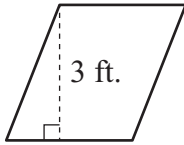
Project	Analisa	Luke
1	95	90
2	81	84
3	76	95
4	88	91
5	?	?

Analisa and Luke worked on a fifth science project together. They each earned the same score on the project. When the fifth score is included in the table, Analisa’s mean score does not change.

Which of the following statements describes how Luke’s mean score changes when the fifth score is included in the table?

- A. It decreases by 2.5.
- B. It decreases by 1.
- C. It increases by 2.5.
- D. It increases by 1.

- 19 A parallelogram and one of its measurements are shown below.



The area of the parallelogram, in square feet, can be represented by the expression  $12n$ .

Which of the following expressions represents the base, in feet, of the parallelogram?

- A.  $4n$
- B. 4
- C.  $36n$
- D. 36

**Question 20 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.**

- 20** A list of numbers is shown in the box below.

3, 4, 5, 8, 9, 10, 14, 19, 20
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What is the probability that a number selected at random from the list will be an even number?

Question 21 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 21 in the space provided in your Student Answer Booklet.

- 21** A box of chocolate chip cookies is in the shape of a rectangular prism. The rectangular bottom of the box is 10 inches long and 3 inches wide.
- a. What is the area, in square inches, of the bottom of the cookie box? Show or explain how you got your answer.
  - b. The height of the cookie box is 8 inches. What is the volume, in cubic inches, of the box? Show or explain how you got your answer.
  - c. A box of oatmeal cookies is also in the shape of a rectangular prism. It has the same length and width as the box of chocolate chip cookies, but it has a volume of 210 cubic inches. What is the height of the box of oatmeal cookies? Show or explain how you got your answer.

**PERIMETER FORMULAS**

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

rectangle . . . . .  $P = 2b + 2h$

OR

$P = 2l + 2w$

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

**AREA FORMULAS**

square . . . . .  $A = s^2$

rectangle . . . . .  $A = bh$

OR

$A = lw$

parallelogram . . . . .  $A = bh$

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

trapezoid . . . . .  $A = \frac{1}{2}h(b_1 + b_2)$

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

**TOTAL SURFACE AREA FORMULAS**

rectangular prism . . .  $SA = 2(lw) + 2(hw) + 2(lh)$

cylinder . . . . .  $SA = 2\pi r^2 + 2\pi rh$

**VOLUME FORMULAS**

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

OR

$V = Bh$

( $B$  = area of a base)

cube . . . . .  $V = s^3$

( $s$  = length of an edge)

cylinder . . . . .  $V = \pi r^2 h$

**CIRCLE FORMULAS**

$C = 2\pi r$

OR

$C = \pi d$

$A = \pi r^2$



**Grade 7 Mathematics**  
**Spring 2015 Released Items:**  
**Reporting Categories, Standards, and Correct Answers\***

Item No.	Page No.	Reporting Category	Standard	Correct Answer (MC/SA)*
1	204	<i>Expressions and Equations</i>	EE.2	B
2	204	<i>The Number System</i>	NS.2	C
3	205	<i>The Number System</i>	NS.3	A
4	205	<i>The Number System</i>	NS.1	A
5	206	<i>Expressions and Equations</i>	EE.3	\$70
6	207	<i>The Number System</i>	NS.2	C
7	207	<i>Statistics and Probability</i>	SP.1	D
8	207	<i>Expressions and Equations</i>	EE.4	B
9	208	<i>The Number System</i>	NS.1	19°F
10	209	<i>Ratios and Proportional Relationships</i>	RP.2	
11	210	<i>The Number System</i>	NS.1	D
12	211	<i>Ratios and Proportional Relationships</i>	RP.1	C
13	211	<i>Statistics and Probability</i>	SP.8	A
14	212	<i>Geometry</i>	G.5	A
15	212	<i>Ratios and Proportional Relationships</i>	RP.3	B
16	212	<i>Expressions and Equations</i>	EE.1	C
17	213	<i>Geometry</i>	G.7	C
18	213	<i>Statistics and Probability</i>	SP.3	B
19	214	<i>Expressions and Equations</i>	EE.4	A
20	215	<i>Statistics and Probability</i>	SP.7	$\frac{5}{9}$
21	216	<i>Geometry</i>	G.6	

\* 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 7 Mathematics**  
**Spring 2015 Unreleased Common Items:**  
**Reporting Categories and Standards**

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