XIII. Mathematics, Grade 7

Grade 7 Mathematics Test

The spring 2014 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.

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.

The grade 7 Mathematics test normally contains 42 items. During the 2014 test administration, however, it was discovered that one multiple-choice item had an incorrect graphic. This item was *not* scored and has *not* been included in the tables at the end of the chapter. As a result of removing this item, each student who took the grade 7 Mathematics test received a raw score and a scaled score based on his or her performance on the 41 remaining items only.

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.

The use of bilingual word-to-word dictionaries was allowed for current and former English language learner students only, during both Mathematics test sessions. 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 seven 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 In the faculty parking lot of a school, 21 out of 25 cars have four doors. What percent of the cars have four doors?

A. 21%

B. 46%

C. 84%

D. 96%

2 Blake organized a checkers tournament. Every player will play each of the other players once. Blake made the table shown below to calculate the number of games to be played based on the number of players.

Checkers Tournament

Number of Players	Number of Games to Be Played
2	1
3	3
4	6
5	10
6	15
7	21

What is the number of games to be played with 10 players?

A. 20

B. 21

C. 30

D. 45

3 Lee used her computer for 60 minutes on Friday. On Saturday, she used her computer for 150% of the number of minutes she used it on Friday.

What was the number of minutes that Lee used her computer on Saturday?

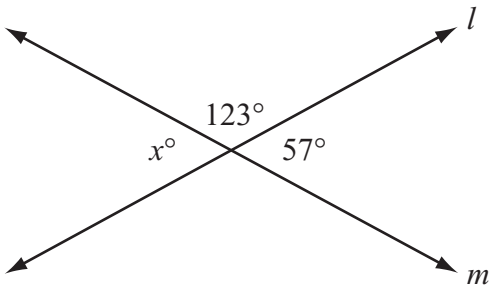
A. 40 minutes
B. 90 minutes
C. 110 minutes
D. 210 minutes

4 Linda bought a circular tablecloth that has a radius of 3 feet. What is the circumference, to the nearest foot, of Linda's tablecloth? (Use 3.14 for π.)

A. 6 feet
B. 9 feet
C. 19 feet
D. 28 feet

Questions 5 and 6 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.

5 Lines l and m intersect, as shown in the diagram below.



Based on the diagram, what is the value of x?

6 Simplify the expression below.

$$13y + x - 7y$$

Mark your answers to multiple-choice questions 7 through 9 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.

7 A package of 12 pencils costs $2.04. Based on the cost of this package, what is the cost of 1 pencil?

A. $0.06
B. $0.17
C. $0.24
D. $0.59

8 The average surface temperature on Jupiter is −162°F. The average surface temperature on Saturn is 46°F less than on Jupiter. What is the average surface temperature on Saturn?

A. −116°F
B. −126°F
C. −208°F
D. −218°F

9 What is the value of the expression below?

$$\frac{3}{4} \div 12$$

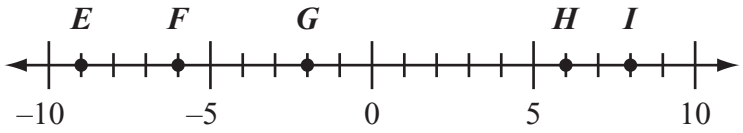
A. $\frac{1}{16}$
B. $\frac{1}{9}$
C. 9
D. 16

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 Ethan plotted points E, F, G, H, and I on a number line, as shown below.



a. Which two points that Ethan plotted represent numbers that have a sum of 0? Show or explain how you got your answer.

b. Write an equation using **subtraction** that could be used to find d, the distance, in units, between point E and point I.

c. Solve the equation that you wrote in part (b). Show or explain how you got your answer.

Ethan wrote the expression below to represent the distance between point G and point H.

$$|-2| + |6|$$

d. What is the value of Ethan's expression?

e. Explain how you know Ethan's expression is equivalent to the distance between point G and point H.

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 nine 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.

11 Danielle will use the instructions in the box below to make a cleaning solution.

> Add 13 cups of water to every 2 cups of concentrated cleaner.

Which of the following proportions can be used to find w, the number of cups of water Danielle will add to 5 cups of concentrated cleaner?

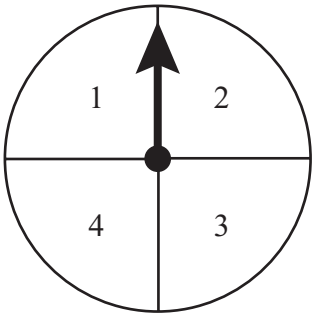
A. $\frac{13}{2} = \frac{w}{5}$

B. $\frac{13}{2} = \frac{5}{w}$

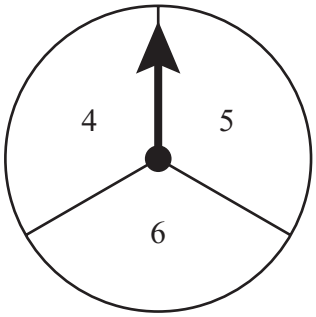
C. $\frac{13}{5} = \frac{w}{2}$

D. $\frac{5}{2} = \frac{13}{w}$

12 Jared has two spinners. Each spinner is divided into congruent sections, as shown below.



First spinner



Second spinner

Jared will spin the arrow on each spinner one time. The organized list below shows all the possible combinations that can occur.

1,4	2,4	3,4	4,4
1,5	2,5	3,5	4,5
1,6	2,6	3,6	4,6

After he spins the arrows on the two spinners, Jared will add the numbers in the sections where the arrows stop. What is the probability that the sum of the two numbers will be **less than** 8?

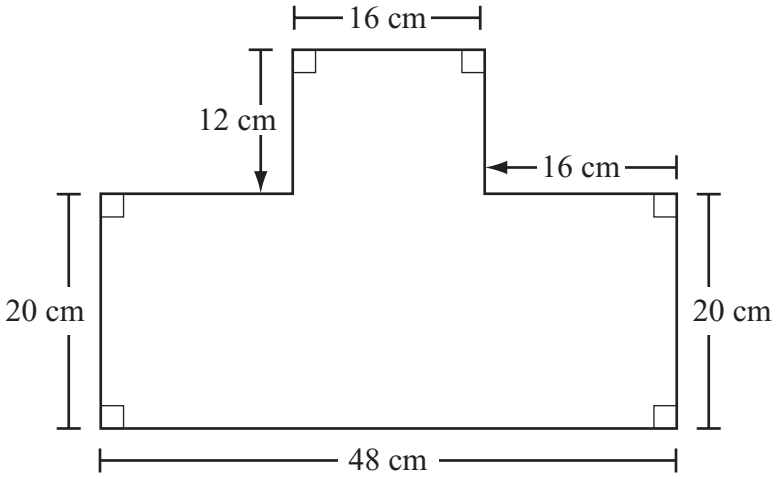
A. $\frac{3}{4}$

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

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

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

13 Jaden is installing fencing around his garden. A scale drawing of his garden is shown below.



Scale
4 centimeters : 3 meters

What is the minimum number of meters of fencing Jaden needs to go around his garden with no overlap?

A. 120

B. 160

C. 213

D. 480

14 The nutrition label on Erin's box of animal crackers states that 16 crackers contain 24 grams of carbohydrates.

Erin ate 12 animal crackers from the box. What is the number of grams of carbohydrates in 12 animal crackers?

A. 8 grams
B. 12 grams
C. 18 grams
D. 20 grams

15 Which of the following sets of steps could be used to completely solve the equation below?

$$3x + 9 = 15$$

A. add 9 to each side, and then multiply each side by 3
B. subtract 9 from each side, and then divide each side by 3
C. multiply each side by 3, and then add 9 to each side
D. divide each side by 3, and then subtract 9 from each side

16 The price, c, in dollars, of a winter coat that Jamal wants to buy has been discounted 20%. The expression below can be used to find the discounted price, in dollars, of the coat.

$$1c - 0.20c$$

Which of the following expressions shows another way to determine the discounted price, in dollars, of the coat?

A. $0.80c$
B. $1.20c$
C. $80c$
D. $120c$

Question 17 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.

17 A hummingbird beats its wings about 75 times in one second. Based on this rate, what is the number of times a hummingbird beats its wings in one minute?

Question 18 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 18 in the space provided in your Student Answer Booklet.

18 Susan put blue tiles, green tiles, and yellow tiles into a bag. All the tiles are the same size and shape. Susan will select one tile from the bag without looking, record its color, and then put the tile back into the bag. She will repeat this experiment 240 times. Based on the number of tiles of each color in the bag, Susan predicted the results shown in the frequency table below.

Predicted Results

Color of Tile	Frequency
blue	120
green	40
yellow	

a. Based on the table, what is the best prediction for the number of times Susan will select a yellow tile from the bag? Show or explain how you got your answer.

A total of 12 tiles are in the bag.

b. Based on the table, determine the number of blue tiles, the number of green tiles, and the number of yellow tiles that are in Susan's bag. Show or explain how you got **each** of your answers.

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 What is the total number of unique triangles with side lengths of 4 centimeters, 5 centimeters, and 10 centimeters that can be drawn?

A. 3
B. 2
C. 1
D. 0

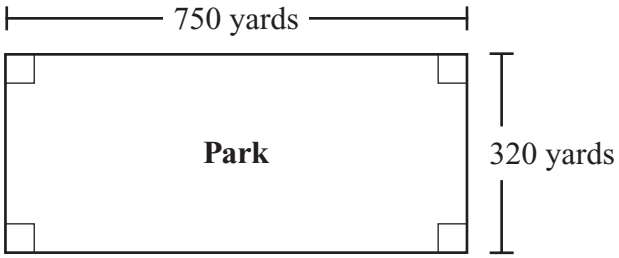
20 The formula for finding the surface area of a sphere that has a radius r is shown in the box below.

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

A baseball has a diameter of 7.4 centimeters. Which of the following is closest to the surface area of the baseball? (Use 3.14 for π.)

A. 93 square centimeters
B. 172 square centimeters
C. 186 square centimeters
D. 688 square centimeters

21 A park is in the shape of a rectangle. The park and its measurements are shown in the diagram below.



What is the area, in square yards, of the park?

A. 1,070
B. 2,140
C. 120,000
D. 240,000

MASSACHUSETTS DEPARTMENT OF ELEMENTARY AND SECONDARY EDUCATION

Massachusetts Comprehensive Assessment System
Grade 7 Mathematics Reference Sheet

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 2014 Released Items:
Reporting Categories, Standards, and Correct Answers*

Item No.	Page No.	Reporting Category	Standard	Correct Answer (MC/SA)*
1	203	*Ratios and Proportional Relationships*	RP.3	C
2	203	*Expressions and Equations*	EE.4	D
3	204	*Expressions and Equations*	EE.3	B
4	204	*Geometry*	G.4	C
5	205	*Geometry*	G.5	57
6	205	*Expressions and Equations*	EE.1	$6y + x$ or $x + 6y$
7	206	*Ratios and Proportional Relationships*	RP.2	B
8	206	*The Number System*	NS.1	C
9	206	*The Number System*	NS.2	A
10	207	*The Number System*	NS.1	
11	208	*Ratios and Proportional Relationships*	RP.2	A
12	209	*Statistics and Probability*	SP.8	C
13	210	*Geometry*	G.1	A
14	211	*Ratios and Proportional Relationships*	RP.3	C
15	211	*Expressions and Equations*	EE.4	B
16	211	*Expressions and Equations*	EE.2	A
17	212	*Ratios and Proportional Relationships*	RP.1	4500
18	213	*Statistics and Probability*	SP.7	
19	214	*Geometry*	G.2	D
20	214	*Geometry*	G.7	B
21	214	*Geometry*	G.6	D

***** 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 2014 Unreleased Common Items:
Reporting Categories and Standards

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