XIII. Mathematics, Grade 7

Grade 7 Mathematics Test

Test Sessions and Content Overview

The spring 2016 grade 7 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 7 Mathematics test assessed 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.

Standards and reporting categories for the PARCC items in the grade 7 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 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 A game spinner is divided into 5 congruent sections and labeled, as shown below.
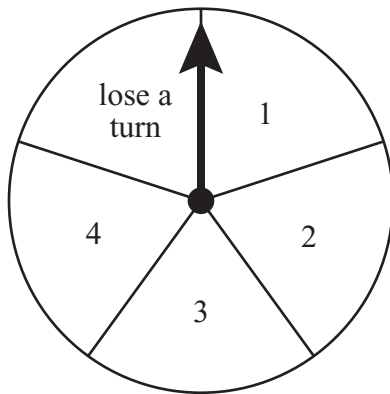
The arrow will be spun 100 times. Which of the following is most likely the number of times the arrow will stop on the section labeled "lose a turn"?

A. 10

B. 20

C. 25

D. 50

2 What is the value of the expression below?

$$\left|\,12\,\right| + \left|\,-15\,\right|$$

A. -27

B. -3

C. 3

D. 27

3 A store owner uses the expression below to calculate the sale price of each CD player he is discounting.

$$r - 0.2r$$

In the expression, r represents the regular price of a CD player. Which of the following is equivalent to the expression?

A. $0.1r$

B. $0.8r$

C. $0.9r$

D. $1.2r$

4 Coffee, tea, and pastries are sold at a coffee shop. Last week, $\frac{2}{5}$ of the coffee shop's profits were from coffee sales and $\frac{1}{3}$ of its profits were from tea sales. The rest of its profits were from pastry sales.

What fraction of the coffee shop's total profits last week were from pastry sales?

A. $\frac{1}{15}$

B. $\frac{2}{15}$

C. $\frac{4}{15}$

D. $\frac{11}{15}$

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

$$(3)(4)\left(-\frac{3}{4}\right)$$

A. $-12\left(-\frac{3}{4}\right)$

B. $-12\left(\frac{3}{4}\right)$

C. $-12 - \frac{3}{4}$

D. $-12 + \frac{3}{4}$

6 Which of the following numbers is between $4\frac{1}{3}$ and $4\frac{3}{5}$ on a number line?

A. 4.1

B. 4.2

C. 4.3

D. 4.4

Questions 7 and 8 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.

7 Marisol constructed a triangle. One angle in the triangle has a measure of 40°. Another angle in the triangle has a measure of 80°. What is the measure, in degrees, of the third angle in Marisol's triangle?

8 A barge traveled 30 miles up a river in 5 hours. What was the average rate of travel, in miles per hour, of the barge?

Mark your answer to multiple-choice question 9 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.

9 Which of the following expressions has a value of 1.25?

A. $(2.5)(-0.5)$

B. $-(2.5)(0.5)$

C. $(-2.5)(-0.5)$

D. $-(-2.5)(-0.5)$

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 A snow day occurs when school is canceled for the day because of bad winter weather. The box below shows the number of snow days at Andrew's school during each of the past six winters.

$$2, \; 5, \; 5, \; 3, \; 4, \; 5$$

a. For the past six winters, what was the median number of snow days per winter at Andrew's school? Show or explain how you got your answer.

b. For the past six winters, what was the mean number of snow days per winter at Andrew's school? Show or explain how you got your answer.

c. For the past six winters, what was the mean absolute deviation of the number of snow days per winter at Andrew's school? Show or explain how you got your answer.

Maria lives in another state. The box below shows the number of snow days at Maria's school during each of the past six winters.

$$0, \; 2, \; 9, \; 3, \; 1, \; 3$$

d. At which school, Andrew's or Maria's, is the number of snow days per winter more predictable? Explain your reasoning. Use specific data from **both** schools in your explanation.

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 Sophia needs $1\frac{1}{4}$ cups of honey to make 5 batches of snack bars. What is the number of cups of honey she will need to make 1 batch of snack bars?

A. $6\frac{1}{4}$

B. 4

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

D. $\frac{4}{25}$

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.
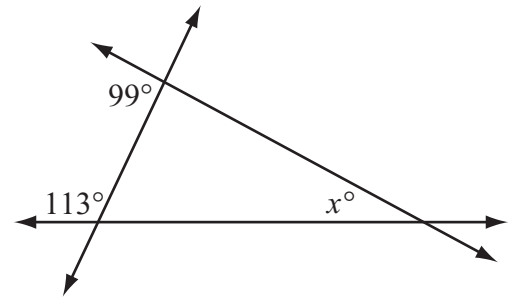
12 Adan has a map with the following scale.

Scale
$\frac{1}{2}$ inch : 50 miles

The distance on the map from Clarksville to Jackson is 2 inches. What is the actual distance from Clarksville to Jackson?

A. 25 miles

B. 50 miles

C. 100 miles

D. 200 miles

13 The diagram below shows three lines that intersect to form a triangle.

Based on the angle measures in the diagram, what is the value of x?

A. 32

B. 67

C. 81

D. 99

**14** The prices for different spices at a grocery store are shown in the table below.

Prices of Spices

Spice	Size	Price
cumin	1.5 ounces	$4.80
ginger	0.8 ounce	$3.60
nutmeg	1.8 ounces	$6.30
thyme	1.25 ounces	$4.50

Which of the following spices has the least price **per ounce**?
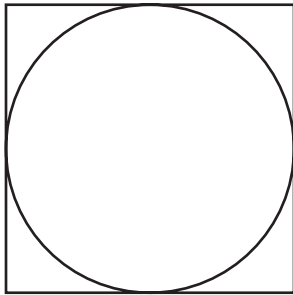
A. cumin

B. ginger

C. nutmeg

D. thyme

15 Mr. Kramer's patio is in the shape of a trapezoid. The trapezoid and its dimensions are shown below.
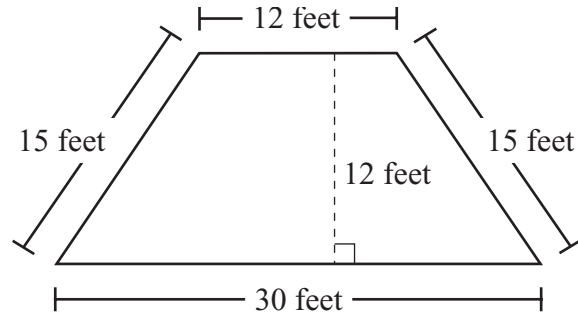
What is the area of the patio?

A. 144 square feet

B. 252 square feet

C. 315 square feet

D. 360 square feet

16 A circle inscribed in a square is shown below.

The area of the square is 81 square centimeters.

Which of the following is closest to the circumference, in centimeters, of the circle inscribed in the square? (Use 3.14 for π.)

A.   14.13
B.   28.26
C.   63.59
D. 127.17

17 Amin has 16 pots of equal size. He used 9 bags of potting soil to fill 12 of the pots. At that rate, how many bags of potting soil does Amin need to fill the remaining 4 pots?

A. 1

B. $1\frac{4}{5}$

C. 3

D. $5\frac{1}{3}$

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 Dana has 8 baseball cards, 10 football cards, 4 hockey cards, and 14 basketball cards. All the cards are the same size and shape. Dana will select one card at random. What is the probability that the card selected will be a hockey card?

Mark your answers to multiple-choice questions 19 and 20 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 bottle contains 120 fluid ounces of laundry detergent. Which of the following is closest to the number of liters in 120 fluid ounces?
(1 fluid ounce $\approx$ 0.0296 liter)

  A. 3.55 liters

  B. 4.05 liters

  C. 4.16 liters

  D. 4.47 liters

20 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.

5 in.
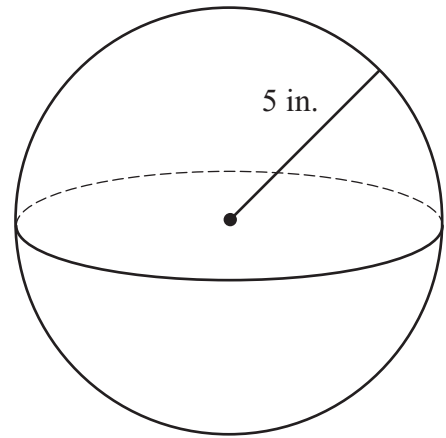
What is the surface area, in square inches, of the sphere?

  A. 40π

  B. 80π

  C. 100π

  D. 400π

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 Peter hired a cleaning company to clean his house. The cleaning company charges a fixed fee of $15 plus $17 per hour to clean a house.

a. Write an equation that can be used to determine c, the total amount in dollars that the cleaning company charges to clean a house in h hours.

b. The cleaning company charged a total of $83 to clean Peter's house. How many hours did it take to clean Peter's house? Show or explain how you got your answer.

A second cleaning company charges $20 per hour to clean a house. The second company does **not** charge a fixed fee in addition to their hourly rate.

c. For what number of hours is the total amount charged for cleaning a house the same for both companies? 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 . . . . $A = \pi r^2$

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
$C = \pi d$

$A = \pi r^2$

TOTAL SURFACE AREA FORMULAS

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

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

Grade 7 Mathematics
Spring 2016 Released Items:
Reporting Categories, Standards, and Correct Answers*

Item No.	Page No.	Reporting Category	Standard	Correct Answer (MC/SA)*
1	208	*Statistics and Probability*	SP.6	B
2	208	*The Number System*	NS.1	D
3	209	*Expressions and Equations*	EE.2	B
4	209	*The Number System*	NS.3	C
5	209	*The Number System*	NS.2	B
6	209	*The Number System*	NS.3	D
7	210	*Geometry*	G.2	60°
8	210	*Ratios and Proportional Relationships*	RP.2	6 miles per hour
9	211	*The Number System*	NS.2	C
10	212	*Statistics and Probability*	SP.4	
11	213	*Ratios and Proportional Relationships*	RP.1	C
12	214	*Ratios and Proportional Relationships*	RP.3	D
13	214	*Geometry*	G.5	A
14	215	*Ratios and Proportional Relationships*	RP.1	A
15	215	*Geometry*	G.6	B
16	216	*Geometry*	G.4	B
17	216	*Ratios and Proportional Relationships*	RP.3	C
18	217	*Statistics and Probability*	SP.7	1/9 or equivalent
19	218	*The Number System*	NS.3	A
20	218	*Geometry*	G.7	C
21	219	*Expressions and Equations*	EE.4	

* 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 2016 Unreleased Common Items:
Reporting Categories and Standards

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