
XIII. Mathematics, Grade 7

Grade 7 Mathematics Test

The spring 2010 grade 7 MCAS Mathematics test was based on learning standards in the Massachusetts *Mathematics Curriculum Framework* (2000). The *Framework* identifies five major content strands, listed below. Specific learning standards for grade 7 are found in the *Supplement to the Massachusetts Mathematics Curriculum Framework* (2004). Page numbers for the grades 7–8 *Framework* learning standards and for the grade 7 *Supplement* standards appear in parentheses.

- Number Sense and Operations (*Framework*, page 62; *Supplement*, page 11)
- Patterns, Relations, and Algebra (*Framework*, page 63; *Supplement*, page 12)
- Geometry (*Framework*, page 64; *Supplement*, pages 12–13)
- Measurement (*Framework*, page 65; *Supplement*, page 13)
- Data Analysis, Statistics, and Probability (*Framework*, page 66; *Supplement*, page 14)

The *Mathematics Curriculum Framework* and *Supplement* are available on the Department website at www.doe.mass.edu/frameworks/current.html.

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

The MCAS 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 limited English proficient students only, during both Mathematics test sessions. No other reference tools or materials were allowed.

Cross-Reference Information

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

Mathematics

SESSION 1

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

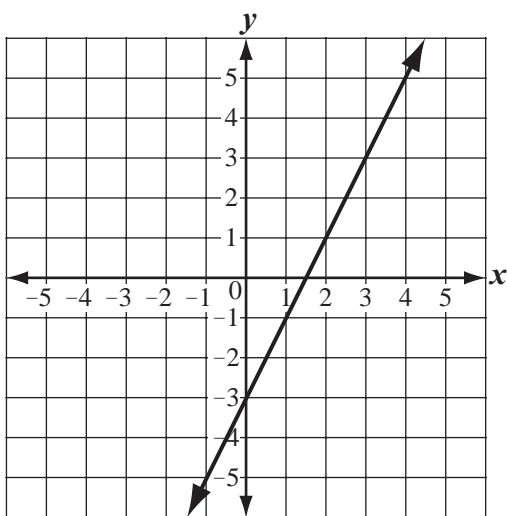
You may **not** use a calculator during this session.



DIRECTIONS

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

- 1 The graph below shows a linear relationship between x and y .



Which of the following statements describes the relationship between x and y ?

- A. As x increases by 1, y increases by 2.
- B. As x increases by 1, y decreases by 2.
- C. As x increases by 2, y increases by 1.
- D. As x increases by 2, y decreases by 1.

- 2 Which of the following fractions is greater than $\frac{3}{4}$ but less than $\frac{4}{5}$?

- A. $\frac{37}{50}$
- B. $\frac{19}{25}$
- C. $\frac{17}{20}$
- D. $\frac{7}{10}$

- 3 What is the value of the expression below?

$$|-16| - |8|$$

- A. -24
- B. -8
- C. 8
- D. 24

- 4 The table below shows the one-day changes in the prices of four different companies' stocks on Tuesday.

Stock Price Changes on Tuesday

Company	Amount of Price Change (in \$)
A	-1.32
B	+0.76
C	-0.83
D	+1.25

Which company's stock price changed the most on Tuesday?

- A. Company A
- B. Company B
- C. Company C
- D. Company D

- 5 Which of the following estimates is closest to the value of the expression below?

$$161.18 \div 7.8$$

- A. 0.02
- B. 0.2
- C. 2
- D. 20

- 6 The table below represents a linear relationship.

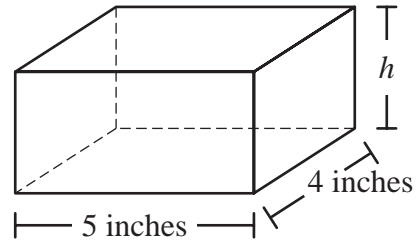
x	y
0	-3
2	2
4	7
6	12

Based on the table, what is the value of x when $y = 22$?

- A. 52
- B. 16
- C. 10
- D. 8

Question 7 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.

- 7 A rectangular prism and some of its dimensions are shown below.



The volume of the rectangular prism is 40 cubic inches. What is h , the height, in inches, of the rectangular prism?

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 Madison plans to sew one button and one ribbon on a clown costume. She has one each of the following colors of buttons in her pocket:

- black
- green
- red
- white

All the buttons are the same size and shape.

Madison will select one button from her pocket without looking.

- a. What is the probability that she will select a red button? Show or explain how you got your answer.

Madison has one each of the following colors of ribbon in a bag:

- black
- white
- yellow

All the ribbons are the same size and material.

She will select one button from her pocket and one ribbon from her bag without looking.

- b. Make an organized list or a tree diagram showing all the possible color combinations that Madison could select.
- c. What is the probability that Madison will select a black button and a black ribbon? Show or explain how you got your answer.
- d. What is the probability that Madison will select a button and a ribbon that are **different** colors from each other? Show or explain how you got your answer.

Mark your answers to multiple-choice questions 9 and 10 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 Amy used $2\frac{1}{2}$ cans of chicken broth to make soup. Each can contained $7\frac{1}{2}$ ounces of broth.

What was the total number of ounces of chicken broth that Amy used?

- A. 10 ounces
- B. $14\frac{1}{4}$ ounces
- C. 18 ounces
- D. $18\frac{3}{4}$ ounces

- 10 The number of different characters available for a computer game can be represented by 2^6 . What is the total number of different characters available for the computer game?

- A. 12
- B. 36
- C. 64
- D. 128

Mathematics

SESSION 2

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

You may use a calculator during this session.



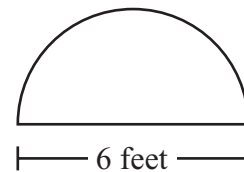
DIRECTIONS

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

- 11 A chef has a frying pan that weighs $1\frac{1}{2}$ pounds. Which of the following is closest to the weight, in kilograms, of the frying pan? (1 pound \approx 0.454 kilogram)

- A. 0.303 kilogram
- B. 0.681 kilogram
- C. 0.954 kilogram
- D. 1.046 kilograms

- 12 The top of an office desk is in the shape of a semicircle, as shown in the figure below.



Based on the dimension given in the figure, which of the following is closest to the area of the top of the office desk? (Use 3.14 for π .)

- A. 9.42 square feet
- B. 14.13 square feet
- C. 18.84 square feet
- D. 56.52 square feet

- 13 The manager of a theater surveyed 500 people to determine their favorite type of play. Each person selected one type of play. The manager started to make the circle graph below to show the results of her survey.

Favorite Type of Play



The percentage of people who selected drama was the same as the percentage of people who selected mystery. Based on the information in the circle graph, what was the total number of people who selected drama?

- A. 100
- B. 125
- C. 150
- D. 200

- 14 A sporting goods store charges different prices for sewing uppercase letters and lowercase letters on a jacket. The expression below shows the cost, in dollars, for sewing x uppercase letters and y lowercase letters.

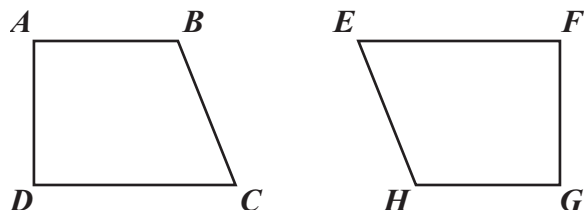
$$1.5x + 0.75y$$

What is the cost for sewing 2 uppercase letters and 10 lowercase letters on a jacket?

- A. \$3.75
- B. \$4.50
- C. \$10.50
- D. \$16.50

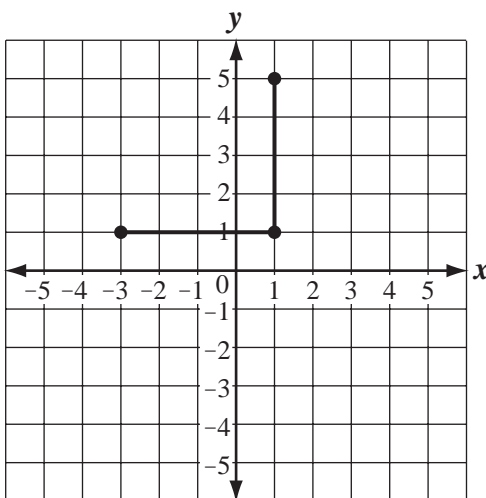
Questions 15 and 16 are short-answer questions. Write your answers to these questions in the boxes provided in your Student Answer Booklet. Do not write your answers in this test booklet. You may do your figuring in the test booklet.

- 15 Quadrilateral $ABCD$ is congruent to quadrilateral $GHEF$, as shown in the diagrams below.



Which side of quadrilateral $GHEF$ **must** be congruent to \overline{AB} ?

- 16 Two sides and three vertices of a square are shown on the coordinate plane below.



What are the coordinates of the fourth vertex of the square?

Question 17 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 17 in the space provided in your Student Answer Booklet.

17 An almanac states that it is possible to determine the temperature by counting the number of times a cricket chirps. To use cricket chirps to determine the temperature in degrees Celsius, the almanac gives the steps below.

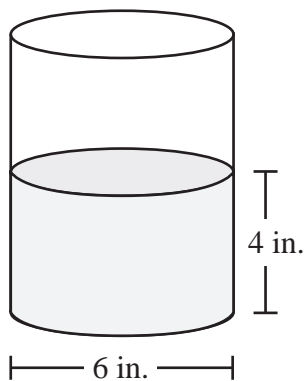
- Count the number of times a cricket chirps in 25 seconds.
 - Divide that number by 3.
 - Then add 4 to get the temperature in degrees Celsius.
- a. Use the information from the almanac to show that when a cricket chirps 27 times in 25 seconds, the temperature is 13 degrees Celsius.
- b. In your Student Answer Booklet, copy the table below, and fill in the missing numbers using the information from the almanac. Show or explain how you got your answers.

Number of Chirps in 25 Seconds	Temperature (degrees Celsius)
27	13
48	?
?	28

- c. Based on your table, write an expression that can be used to calculate the temperature in degrees Celsius when a cricket chirps n times in 25 seconds.

Mark your answers to multiple-choice questions 18 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.

- 18 Casey has a cylindrical container with an inside diameter of 6 inches. He filled it with water to a depth of 4 inches, as shown below.



To the nearest cubic inch, what is the volume of water in Casey’s container?
(Use 3.14 for π .)

- A. 75 cubic inches
- B. 113 cubic inches
- C. 151 cubic inches
- D. 452 cubic inches

- 19 Donnie has a spool that contains 18 yards of wire. What is the total number of inches of wire that the spool contains?

- A. 162
- B. 216
- C. 540
- D. 648

- 20 Fran had her picture taken at a studio. The table below shows the studio’s prices for purchasing a photo album plus different numbers of 5-inch by 7-inch prints.

Price List for Photo Album and Prints

Number of Prints	Total Price for Album Plus Prints
1	\$17
2	\$22
3	\$27
4	\$32

Based on the linear pattern shown in the table, what is the price for purchasing a photo album plus 6 of the prints?

- A. \$38
- B. \$42
- C. \$54
- D. \$66

- 21 A florist sells 8 roses for a total of \$10. Each rose costs the same amount. What is the cost of 12 roses?

- A. \$9.60
- B. \$10.40
- C. \$14.00
- D. \$15.00



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 2010 Released Items:
Reporting Categories, Standards, and Correct Answers*

Item No.	Page No.	Reporting Category	Standard	Correct Answer (MC/SA)*
1	199	<i>Patterns, Relations, and Algebra</i>	7.P.5	A
2	199	<i>Number Sense and Operations</i>	7.N.1	B
3	199	<i>Number Sense and Operations</i>	7.N.4	C
4	200	<i>Number Sense and Operations</i>	7.N.4	A
5	200	<i>Number Sense and Operations</i>	7.N.7	D
6	200	<i>Patterns, Relations, and Algebra</i>	7.P.4	C
7	201	<i>Measurement</i>	7.M.3	2 inches
8	202	<i>Data Analysis, Statistics, and Probability</i>	7.D.3	
9	203	<i>Number Sense and Operations</i>	7.N.9	D
10	203	<i>Number Sense and Operations</i>	7.N.5	C
11	204	<i>Measurement</i>	7.M.2	B
12	204	<i>Measurement</i>	7.M.3	B
13	205	<i>Data Analysis, Statistics, and Probability</i>	7.D.1	A
14	205	<i>Patterns, Relations, and Algebra</i>	7.P.2	C
15	206	<i>Geometry</i>	7.G.2	\overline{GH}
16	206	<i>Geometry</i>	7.G.4	$(-3, 5)$
17	207	<i>Patterns, Relations, and Algebra</i>	7.P.3	
18	208	<i>Measurement</i>	7.M.3	B
19	208	<i>Measurement</i>	7.M.1	D
20	209	<i>Patterns, Relations, and Algebra</i>	7.P.1	B
21	209	<i>Number Sense and Operations</i>	7.N.2	D

* Answers are provided here for multiple-choice items 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.

Grade 7 Mathematics
Spring 2010 Unreleased Common Items:
Reporting Categories and Standards

Item No.	Reporting Category	Standard
22	<i>Data Analysis, Statistics, and Probability</i>	7.D.2
23	<i>Patterns, Relations, and Algebra</i>	7.P.6
24	<i>Data Analysis, Statistics, and Probability</i>	7.D.3
25	<i>Number Sense and Operations</i>	7.N.3
26	<i>Patterns, Relations, and Algebra</i>	7.P.4
27	<i>Data Analysis, Statistics, and Probability</i>	7.D.1
28	<i>Patterns, Relations, and Algebra</i>	7.P.4
29	<i>Patterns, Relations, and Algebra</i>	7.P.2
30	<i>Measurement</i>	7.M.3
31	<i>Number Sense and Operations</i>	7.N.6
32	<i>Geometry</i>	7.G.2
33	<i>Data Analysis, Statistics, and Probability</i>	7.D.1
34	<i>Patterns, Relations, and Algebra</i>	7.P.3
35	<i>Patterns, Relations, and Algebra</i>	7.P.3
36	<i>Measurement</i>	7.M.1
37	<i>Patterns, Relations, and Algebra</i>	7.P.1
38	<i>Number Sense and Operations</i>	7.N.2
39	<i>Geometry</i>	7.G.6
40	<i>Data Analysis, Statistics, and Probability</i>	7.D.2
41	<i>Data Analysis, Statistics, and Probability</i>	7.D.2
42	<i>Number Sense and Operations</i>	7.N.2