XIV. Mathematics, Grade 8

Grade 8 Mathematics Test

The spring 2011 grade 8 MCAS Mathematics test was based on learning standards in the Massachusetts *Mathematics Curriculum Framework* (2000). The *Framework* identifies five major content strands, listed below.

- Number Sense and Operations
- Patterns, Relations, and Algebra
- Geometry
- Measurement
- Data Analysis, Statistics, and Probability

The grades 7–8 learning standards for each of these strands appear on pages 62–66 of the *Mathematics Curriculum Framework*, which is 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 8 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 8 Mathematics test was provided with a plastic ruler and a grade 8 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

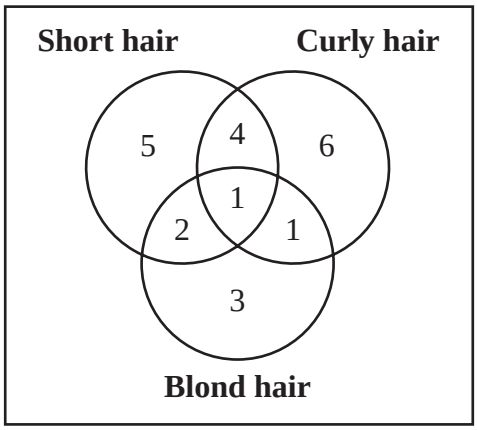
You may use your reference sheet and MCAS ruler during this session.
*You may **not** use a calculator during this session.*

DIRECTIONS

This session contains 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 The Venn diagram below shows the number of students in Mr. Jenson's class who have short hair, curly hair, blond hair, or any combination of these characteristics.

Mr. Jenson's Class



What is the total number of students in Mr. Jenson's class who have hair that is short but **not** blond?

A. 15
B. 9
C. 5
D. 3

2 A box is in the shape of a rectangular prism and has a volume of 360 cubic inches. The box has a width of 6 inches and a length of 10 inches.

What is the height of the box?

A. 6 inches
B. 10 inches
C. 23 inches
D. 36 inches

3 Jeff completed a hiking trail in t hours. Michelle completed the trail in half the time it took Jeff to complete it.

Which of the following expressions represents the time it took Michelle to complete the hiking trail?

A. $2 \cdot t$
B. $2 \div t$
C. $t - 2$
D. $t \div 2$

Question 4 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.

4 Susan bought a quart of milk for $0.99.

What was the cost, to the nearest cent, of one fluid ounce of the milk?
(1 quart = 32 fluid ounces)

Mark your answers to multiple-choice questions 5 through 7 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.

5 Tamara has a spinner divided into only red sections and blue sections. When the arrow on the spinner is spun 1 time, the probability that it will stop on a red section is $\frac{2}{3}$.

Tamara will spin the arrow on the spinner 3 times. Which of the following situations is most likely to occur?

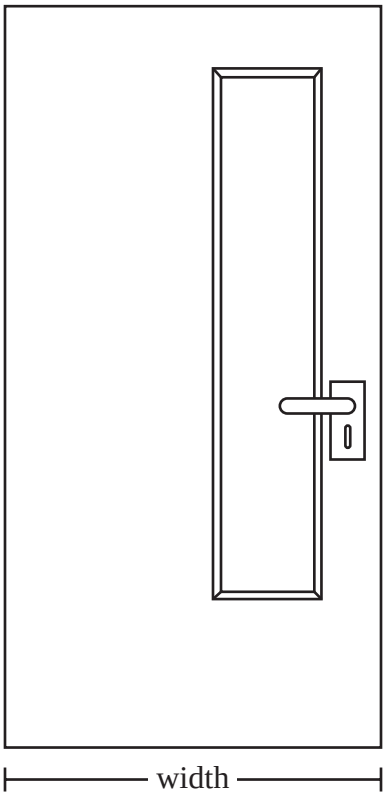
A. The arrow will stop on a red section 3 times and a blue section 0 times.

B. The arrow will stop on a red section 2 times and a blue section 1 time.

C. The arrow will stop on a red section 1 time and a blue section 2 times.

D. The arrow will stop on a red section 0 times and a blue section 3 times.

6 The width of a classroom door is indicated in the picture below.



Which of the following is most likely the width of the door?

A. 0.1 kilometer

B. 10 meters

C. 100 centimeters

D. 10,000 millimeters

7 The expression below represents the height, in feet, of a ball t seconds after it is thrown into the air.

$$96t - 16t^2$$

What is the height of the ball 3 seconds after it is thrown into the air?

A. 96 feet

B. 144 feet

C. 192 feet

D. 288 feet

Question 8 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.

8 What is the value of the expression below?

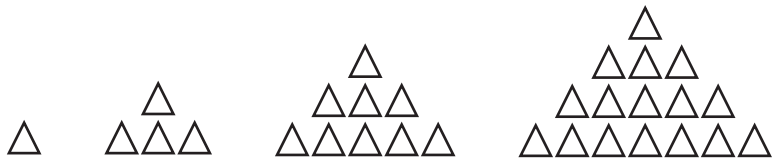
$$\left|-8\right| + \left|2\tfrac{1}{2}\right|$$

Question 9 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 9 in the space provided in your Student Answer Booklet.

9 Chris used triangles to make the first four steps of a pattern, as shown below.



Step 1 **Step 2** **Step 3** **Step 4**

The pattern continues to grow.

a. What will be the total number of triangles in Step 5 of the pattern? Show or explain how you got your answer.

b. Write an expression in terms of n that represents the total number of triangles in Step n of the pattern.

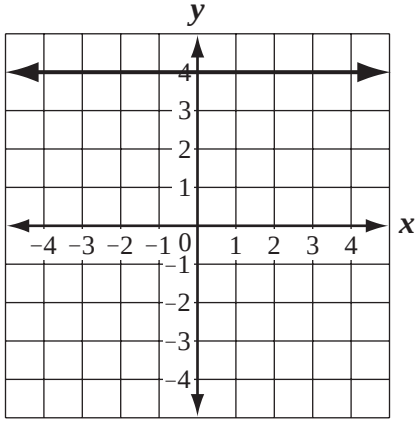
c. Use your expression from part (b) to find the total number of triangles in Step 10 of the pattern. Show or explain how you got your answer.

d. Chris made one step of the pattern that had 15 more triangles than the step before it. What step of the pattern had 15 more triangles than the step before it? Show or explain how you got your answer.

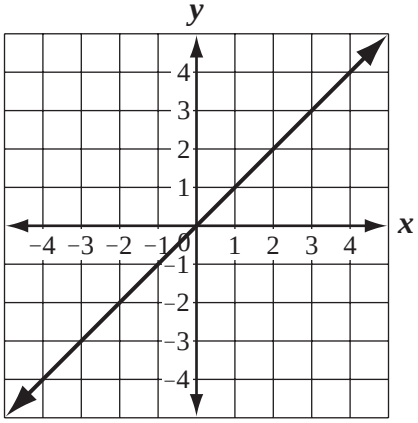
Mark your answer to multiple-choice question 10 in the space provided in your Student Answer Booklet. Do not write your answer in this test booklet. You may do your figuring in the test booklet.

10 Which graph has the line with the greatest slope?

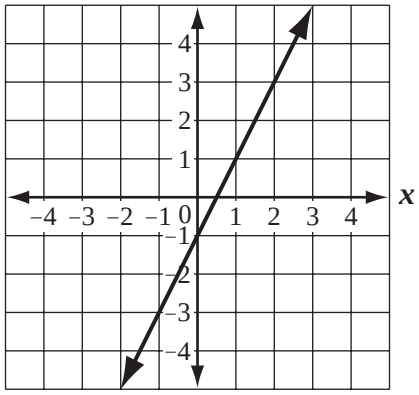
A.



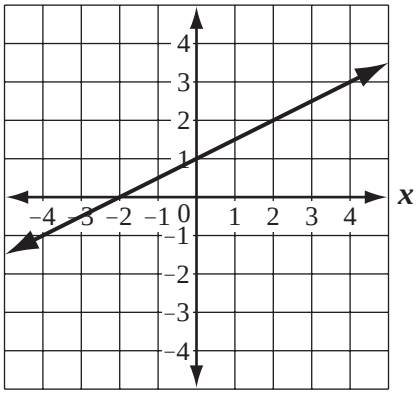
C.



B.



D.



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 The grand prize in a radio station contest is a cruise. At the end of the contest, a computer will randomly select the winner's destination, room location, and dinnertime from the options in the table below.

Cruise Options

Destination	Room Location	Dinnertime
Mexico	Deck 1	5:00–7:00 p.m.
Bermuda	Deck 2	7:00–9:00 p.m.
Alaska	Deck 3	
Canada	Deck 4	9:00–11:00 p.m.

What is the probability that the computer will select a cruise to Alaska with a room on Deck 2 and a dinnertime of 7:00–9:00 p.m.?

A. $\frac{1}{11}$

B. $\frac{1}{19}$

C. $\frac{1}{28}$

D. $\frac{1}{48}$

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

$$-5(1 - g)$$

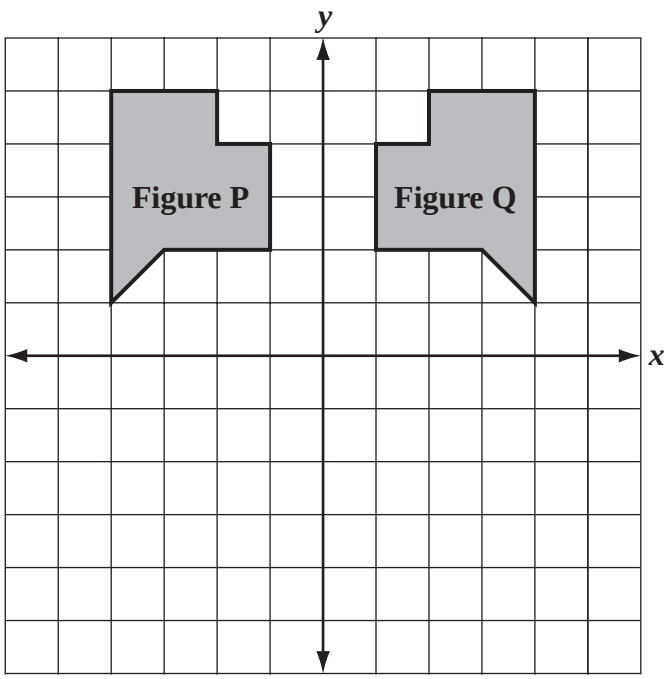
A. $-4 - g$

B. $-4 + 5g$

C. $-5 - g$

D. $-5 + 5g$

13 Lainey drew Figure P on a coordinate grid. Then she did a one-step transformation of Figure P to draw Figure Q, as shown below.



Which of the following one-step transformations of Figure P could Lainey have done to draw Figure Q?

A. reflection over the *x*-axis

B. reflection over the *y*-axis

C. rotation 180° clockwise

D. translation to the right

14 The table below shows the number of e-mail messages that Andrea received each day Monday through Thursday.

Andrea's E-mail Messages

Day	Number of E-mail Messages
Monday	4
Tuesday	8
Wednesday	3
Thursday	9
Friday	?

Andrea also received e-mail messages on Friday. The mean number of e-mail messages per day that she received Monday through Friday was exactly 7.

What was the total number of e-mail messages that Andrea received on Friday?

A. 7

B. 8

C. 10

D. 11

15 Mr. Danville teaches three drama classes.

- The first class has 24 students.
- The second class has 30 students.
- The third class has 18 students.

Mr. Danville wants to divide each class into groups so that every group in every class has the same number of students and there are no students left over.

What is the maximum number of students that he can put into each group?

A. 8

B. 6

C. 4

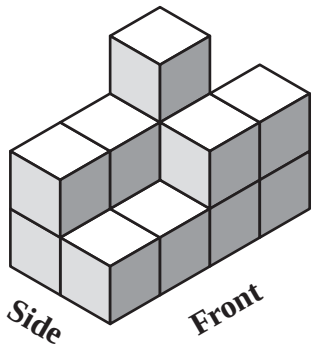
D. 2

Question 16 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.

16 The saguaro cactus can grow to a maximum height of 12 meters. What is the maximum height to the nearest foot of the saguaro cactus? (1 meter $\approx$ 3.28 feet)

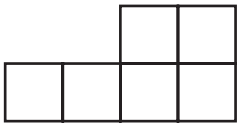
Mark your answers to multiple-choice questions 17 through 20 in the spaces provided in your Student Answer Booklet. Do not write your answers in this test booklet. You may do your figuring in the test booklet.

17 Phyllis made the stack of blocks shown below.

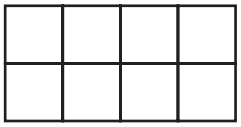


Which of the following figures shows the front view of the stack of blocks?

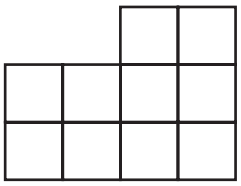
A.



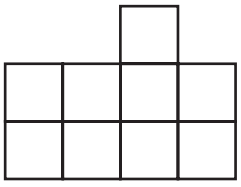
B.



C.



D.



18 Carlton traveled 225 miles in $4\frac{1}{2}$ hours. Phillip traveled the same distance at an average speed that was 10 miles per hour faster than Carlton's average speed.

What was the number of hours it took Phillip to travel 225 miles?

A. $2\frac{1}{4}$

B. $3\frac{1}{2}$

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

D. $4\frac{2}{5}$

19 A newspaper reporter surveyed 30 people after they cast their votes in a recent election. He created the stem-and-leaf plot below to display the ages of the voters surveyed.

Ages of Voters Surveyed

2	1 1 3 4 5
3	2 2 3 4 5 8 9
4	0 0 2 4 8 9
5	3 5 6 8 8 9
6	0 0 1 1
7	1
8	3

Key
5 | 1 represents 51

Which of the following is closest to the percent of the voters surveyed whose age was less than 41?

A. 40%

B. 47%

C. 53%

D. 60%

20 A rose garden is in the shape of a circle with a circumference of approximately 37.7 feet. Which of the following is closest to the diameter of the rose garden? (Use 3.14 for π.)

A. 6.0 feet

B. 11.8 feet

C. 12.0 feet

D. 18.9 feet

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 Leo works 22.5 hours each week and earns $9.48 per hour.

a. What amount of money does Leo earn each week? Show or explain how you got your answer.

Each week, $25.60 is taken out of Leo's earnings for taxes.

b. What percent of Leo's weekly earnings is taken out for taxes? Show or explain how you got your answer.

c. Leo wants to buy a car that costs $3000. He plans to save all of his earnings that remain **after** taxes are taken out. What is the minimum number of hours that Leo must work in order to save $3000 to buy the car? Show or explain how you got your answer.

Massachusetts Department of ELEMENTARY & SECONDARY EDUCATION

Massachusetts Comprehensive Assessment System
Grade 8 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 . . . . . $SA = 2\pi r^2 + 2\pi rh$

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

VOLUME FORMULAS

rectangular prism . . . . . $V = lwh$
OR
$V = Bh$
(B = area of a base)

cube . . . . . $V = s^3$
(s = length of an edge)

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

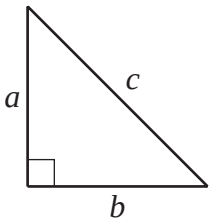
sphere . . . . . $V = \frac{4}{3}\pi r^3$

CIRCLE FORMULAS

$C = 2\pi r$
OR
$C = \pi d$

$A = \pi r^2$

PYTHAGOREAN THEOREM



$a^2 + b^2 = c^2$

Grade 8 Mathematics
Spring 2011 Released Items:
Reporting Categories, Standards, and Correct Answers*

Item No.	Page No.	Reporting Category	Standard	Correct Answer (MC/SA)*
1	226	*Data Analysis, Statistics, and Probability*	8.D.2	B
2	226	*Measurement*	8.M.3	A
3	226	*Patterns, Relations, and Algebra*	8.P.4	D
4	227	*Number Sense and Operations*	8.N.3	$0.03
5	228	*Data Analysis, Statistics, and Probability*	8.D.4	B
6	228	*Measurement*	8.M.1	C
7	229	*Patterns, Relations, and Algebra*	8.P.2	B
8	230	*Number Sense and Operations*	8.N.6	$10\frac{1}{2}$
9	231	*Patterns, Relations, and Algebra*	8.P.1	
10	232	*Patterns, Relations, and Algebra*	8.P.5	B
11	233	*Data Analysis, Statistics, and Probability*	8.D.4	D
12	233	*Patterns, Relations, and Algebra*	8.P.3	D
13	234	*Geometry*	8.G.6	B
14	234	*Data Analysis, Statistics, and Probability*	8.D.3	D
15	235	*Number Sense and Operations*	8.N.5	B
16	236	*Measurement*	8.M.2	39 feet
17	237	*Geometry*	8.G.8	D
18	237	*Measurement*	8.M.5	C
19	238	*Data Analysis, Statistics, and Probability*	8.D.2	B
20	238	*Measurement*	8.M.3	C
21	239	*Number Sense and Operations*	8.N.12	

***** 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 8 Mathematics
Spring 2011 Unreleased Common Items:
Reporting Categories and Standards

Item No.	Reporting Category	Standard
22	*Patterns, Relations, and Algebra*	8.P.4
23	*Number Sense and Operations*	8.N.10
24	*Number Sense and Operations*	8.N.1
25	*Number Sense and Operations*	8.N.4
26	*Patterns, Relations, and Algebra*	8.P.6
27	*Patterns, Relations, and Algebra*	8.P.9
28	*Patterns, Relations, and Algebra*	8.P.7
29	*Number Sense and Operations*	8.N.9
30	*Number Sense and Operations*	8.N.7
31	*Number Sense and Operations*	8.N.2
32	*Data Analysis, Statistics, and Probability*	8.D.3
33	*Number Sense and Operations*	8.N.3
34	*Patterns, Relations, and Algebra*	8.P.5
35	*Patterns, Relations, and Algebra*	8.P.10
36	*Measurement*	8.M.4
37	*Data Analysis, Statistics, and Probability*	8.D.2
38	*Geometry*	8.G.3
39	*Data Analysis, Statistics, and Probability*	8.D.3
40	*Geometry*	8.G.4
41	*Patterns, Relations, and Algebra*	8.P.8
42	*Measurement*	8.M.4