## XIV. Mathematics, Grade 8

## Grade 8 Mathematics Test

The spring 2010 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 <br> 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 and two short-answer questions. Mark your answers to these questions in the spaces provided in your Student Answer Booklet.

1 The list below shows the number of pages Marian read in her library book each day for one week.

$$
11,13,11,15,20,17,11
$$

What is the mode of the number of pages that Marian read each day?
A. 9
B. 11
C. 13
D. 14

2 Dan earned some money working for his uncle. He spent $\frac{1}{3}$ of the money on magazines and $\frac{1}{4}$ of the money on a snack. Which of the following fractions represents the part of Dan's money he did not spend?
A. $\frac{5}{12}$
B. $\frac{1}{2}$
C. $\frac{2}{3}$
D. $\frac{5}{7}$

3 Which of the following inequalities is true?
A. $\sqrt{3}>\pi$
B. $\sqrt{9}>\pi$
C. $\sqrt{5}>2$
D. $\sqrt{6}>3$

4 The table below shows a linear pattern.

| Term | 1 | 2 | 3 | $\ldots$ | $n$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Value | 5 | 7 | 9 | $\ldots$ | $?$ |

Which of the following expressions represents the value of the $n$th term in the pattern?
A. $n+2$
B. $2 n+3$
C. $3 n+2$
D. $4 n+1$

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 What is the solution to the equation below?

$$
3 x+9=-6
$$

Mark your answers to multiple-choice questions 6 and 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.

6 The students in an eighth-grade class had a dance. They spent $\$ 500$ for a local band. The equation below can be used to find the total profit, $y$, if the students sold $x$ tickets to the dance.

$$
y=4 x-500
$$

What does the 4 represent in the equation?
A. the price per ticket
B. the cost of the band
C. the number of tickets sold
D. the profit made from selling $x$ tickets

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 Mr. Jamison is the principal at a new school with an enrollment of 430 students. He surveyed $10 \%$ of the students at his school to find out which colors they would like as the school colors.

What is the number of students in the sample size of the principal's survey?

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 The rate of interest paid on savings accounts at a bank increased by $\frac{1}{2} \%$. Which of the following shows
$\frac{1}{2} \%$ written as a decimal?
A. 0.0012
B. 0.005
C. 0.12
D. 0.5

10 What is the value of the expression below?

$$
|8|+|-3|-|7|
$$

A. -12
B. -2
C. 4
D. 18

# Mathematics <br> 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 two open-response questions. Mark your answers to these questions in the spaces provided in your Student Answer Booklet.

11 The table below shows the area of a trapezoid when the lengths of the bases stay the same but the height is changed.

## Area of Trapezoid

| Height <br> (in meters) | Area <br> (in square meters) |
| :---: | :---: |
| 3 | 7.5 |
| 5 | 12.5 |
| 7 | 17.5 |
| 9 | 22.5 |

What is the area of the trapezoid when the height is 17 meters?
A. 47.5 square meters
B. 42.5 square meters
C. 39.5 square meters
D. 37.5 square meters

12 A box of identically shaped light bulbs contains the following:

- 11 red light bulbs
- 13 blue light bulbs
- 10 green light bulbs
- 16 orange light bulbs

If 1 light bulb is chosen at random from the box, what is the probability that it will be green?
A. $\frac{1}{4}$
B. $\frac{1}{5}$
C. $\frac{1}{10}$
D. $\frac{1}{50}$

13 Elena and Kristen started new jobs at the same time. The table below shows their annual salaries for the first 4 years.

Annual Salaries

| Number of <br> Years | Elena's <br> Salary | Kristen's <br> Salary |
| :---: | :---: | :---: |
| 1 | $\$ 15,000$ | $\$ 22,000$ |
| 2 | $\$ 17,500$ | $\$ 23,000$ |
| 3 | $\$ 20,000$ | $\$ 24,000$ |
| 4 | $\$ 22,500$ | $\$ 25,000$ |
| 5 |  |  |
| 6 |  |  |

Elena's salary continued to increase by the same amount each year, and Kristen's salary continued to increase by the same amount each year. Which of the following statements is true for year 6 ?
A. Elena's salary was $\$ 30,000$.
B. Kristen's salary was $\$ 26,000$.
C. Elena's salary was $\$ 500$ more than Kristen's salary.
D. Kristen's salary was $\$ 500$ more than Elena's salary.

Question 14 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.

14 David drew $\triangle A B C$ on a coordinate plane, as shown below.


David reflected $\triangle A B C$ over the $x$-axis. What are the coordinates of the image of point $A$ ?

Mark your answers to multiple-choice questions 15 through 17 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.

15 The chart below shows the number of goals scored by the Sharks soccer team and their opponents for 5 games.

## Goals Scored by Sharks and Opponents

| Game | Number of Goals <br> Scored by the Sharks | Number of Goals <br> Scored by Opponents |
| :---: | :---: | :---: |
| 1 st | 5 | 3 |
| 2 nd | 4 | 0 |
| 3 rd | 3 | 2 |
| 4 th | 4 | 6 |
| 5 th | 5 | 1 |

In what percent of the games did the Sharks score more goals than their opponents?
A. $40 \%$
B. $50 \%$
C. $80 \%$
D. $100 \%$

16 The relationship between the perimeter and side length of a regular hexagon is shown on the graph below.

## Relationship between

## Perimeter and Side Length

 of a Regular Hexagon

What happens to the perimeter of a regular hexagon as its side length increases by 1 ?
A. The perimeter increases by 1 .
B. The perimeter increases by 2 .
C. The perimeter increases by 3 .
D. The perimeter increases by 6 .

17 The formula below can be used to find $S$, the sum of all integers from 1 to $n$, where $n$ is any positive integer.

$$
S=\frac{n(n+1)}{2}
$$

What is the value of $S$ when $n=50$ ?
A. 1250
B. 1275
C. 2500
D. 2550

## 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 A cafeteria has a recycling container for cans. The recycling container has a lid that is in the shape of a circle with an opening in the center that is also in the shape of a circle. The lid and some of its dimensions are shown in the diagram below.


The shaded part of the diagram represents the opening in the lid.
a. What is the circumference, in inches, of the lid of the recycling container? Show or explain how you got your answer. (Use 3.14 for $\pi$.)
b. What is the area, in square inches, of the lid, including the opening? Show or explain how you got your answer. (Use 3.14 for $\pi$.)
c. What is the area, in square inches, of the lid, not including the opening? Show or explain how you got your answer. (Use 3.14 for $\pi$.)

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 The mean height, in inches, of 5 girls on the middle school basketball team is exactly 66 inches. The table below lists the heights of 4 of the girls.

Girls' Heights

| Name | Height <br> (in inches) |
| :--- | :---: |
| Jessica | 65 |
| Ali | 65 |
| Sina | 70 |
| Amanda | 66 |
| Becky | $?$ |

Which of the following is the height of Becky?
A. 64 inches
B. 65.5 inches
C. 66 inches
D. 66.5 inches

20 What is $150 \%$ of 48 ?
A. 72
B. 32
C. 7.2
D. 3.2

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 Danielle measured two of the computer screens in her school's computer lab. The two screens and some of their dimensions are shown below.


Screen 1


Screen 2
a. What is the area, in square inches, of Screen 1? Show or explain how you got your answer.
b. What is $x$, the diagonal length in inches of Screen 1? Show or explain how you got your answer.
c. Which computer screen, Screen 1 or Screen 2, has the greater area? Show your work or explain how you got your answer.

## Massachusetts Comprehensive Assessment System Grade 8 Mathematics Reference Sheet

## PERIMETER FORMULAS

square. $\qquad$ $P=4 s$
rectangle. $\qquad$

$$
P=2 b+2 h
$$

OR

$$
P=2 l+2 w
$$

triangle $P=a+b+c$

## AREA FORMULAS

OR

$$
A=l w
$$

parallelogram.... $A=b h$
triangle . . . . . . . . . $A=\frac{1}{2} b h$
trapezoid. ....... $A=\frac{1}{2} h\left(b_{1}+b_{2}\right)$
circle. ........... $A=\pi r^{2}$

## TOTAL SURFACE AREA FORMULAS

rectangular prism . . $S A=2(l w)+2(h w)+2(l h)$
cylinder $\qquad$

$$
S A=2 \pi r^{2}+2 \pi r h
$$

sphere

$$
S A=4 \pi r^{2}
$$

$$
\begin{aligned}
& \text { square........... } A=s^{2} \\
& \text { rectangle } \\
& A=b h
\end{aligned}
$$

## VOLUME FORMULAS

rectangular prism $\ldots . . V=l w h$
OR

$$
\begin{gathered}
V=B h \\
(B=\text { area of a base })
\end{gathered}
$$

cube.

$$
V=s^{3}
$$

$$
(s=\text { length of an edge })
$$

cylinder $\qquad$
sphere

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

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

| Item No. | Page No. | Reporting Category | Standard | Correct Answer (MC/SA)* |
| :---: | :---: | :---: | :---: | :---: |
| 1 | 215 | Data Analysis, Statistics, and Probability | 8.D. 3 | B |
| 2 | 215 | Number Sense and Operations | 8.N. 12 | A |
| 3 | 215 | Number Sense and Operations | 8.N. 2 | C |
| 4 | 215 | Patterns, Relations, and Algebra | 8.P. 4 | B |
| 5 | 216 | Patterns, Relations, and Algebra | 8.P. 7 | $x=-5$ |
| 6 | 217 | Patterns, Relations, and Algebra | 8.P. 6 | A |
| 7 | 217 | Number Sense and Operations | 8.N. 9 | C |
| 8 | 218 | Data Analysis, Statistics, and Probability | 8.D. 1 | 43 |
| 9 | 219 | Number Sense and Operations | 8.N. 1 | B |
| 10 | 219 | Number Sense and Operations | 8.N. 6 | C |
| 11 | 220 | Patterns, Relations, and Algebra | 8.P. 1 | B |
| 12 | 220 | Data Analysis, Statistics, and Probability | 8.D. 4 | B |
| 13 | 221 | Patterns, Relations, and Algebra | 8.P. 10 | C |
| 14 | 222 | Geometry | 8.G. 6 | $(1,-2)$ |
| 15 | 223 | Data Analysis, Statistics, and Probability | 8.D. 2 | C |
| 16 | 224 | Patterns, Relations, and Algebra | 8.P.8 | D |
| 17 | 224 | Patterns, Relations, and Algebra | 8.P. 2 | B |
| 18 | 225 | Measurement | 8.M. 3 |  |
| 19 | 226 | Data Analysis, Statistics, and Probability | 8.D. 3 | A |
| 20 | 226 | Number Sense and Operations | 8.N. 10 | A |
| 21 | 227 | Geometry | 8.G. 4 |  |

* 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 2010 Unreleased Common Items:
Reporting Categories and Standards

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

