
VIII. Mathematics, Grade 8 □

Grade 8 Mathematics Test □

The spring 2005 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 grade 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 Web site at www.doe.mass.edu/frameworks/math/2000/final.pdf.

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 *Framework* content strands listed above.

Test Sessions and Content Overview

The MCAS Grade 8 Mathematics Test included two separate test sessions. Each session included multiple-choice and open-response questions. Session 1 also included short-answer questions.

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.

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. No other reference tools or materials were allowed.

The use of bilingual word-to-word dictionaries was allowed for limited English proficient students only, during both Mathematics test sessions.

Cross-Reference Information

The table at the conclusion of this chapter indicates each item's reporting category and the *Framework* learning standard it assesses. The correct answers for multiple-choice and short-answer questions are also displayed in the 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 fifteen multiple-choice questions, five short-answer questions, and two open-response questions. Mark your answers to these questions in the spaces provided in your Student Answer Booklet.

- 1 Noel is a computer repairman. To fix a computer, he charges a customer \$40 per hour, plus a fixed fee of \$15 for the service call, as represented by the equation below.

$$y = 40x + 15$$

In the equation, what is represented by the variable x ?

- A. the number of hours Noel worked
- B. the amount Noel charged per hour
- C. the fixed fee for the service call
- D. the total cost of the repair job

- 2 If $x = 2$ and $y = 4$, what is the value of the following expression?

$$x - 5y$$

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

- 3 The stem-and-leaf plot below shows the number of people using a skateboard park on 13 different days.

Number of Skateboard Park Users

3	0 2
4	2 3 5 6
5	1 4 4 6
6	1 2 4

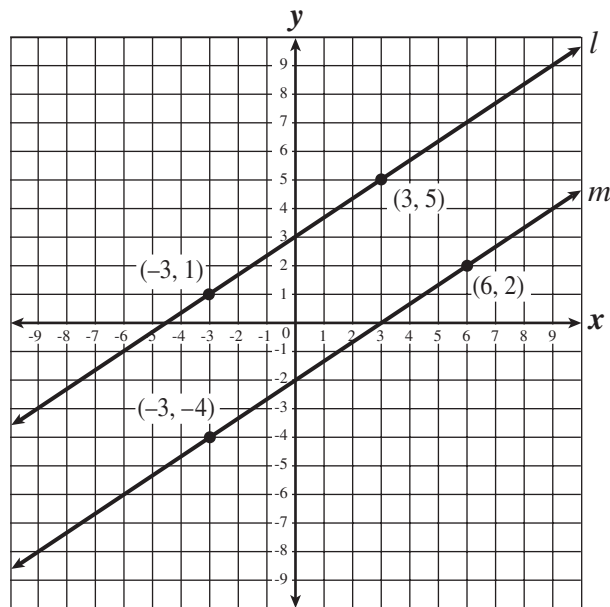
Key

4 | 3 represents 43

What is the range of the data in the stem-and-leaf plot?

- A. 29
- B. 31
- C. 32
- D. 34

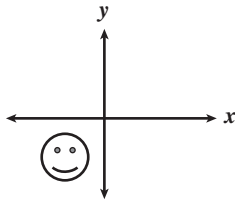
- 4 The coordinate grid below shows the graphs of two lines: line l and line m .



Which of the following is a true statement about the relationship between line l and line m ?

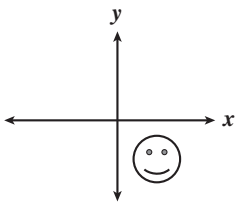
- A. The slope of line l is greater than the slope of line m .
- B. The x -intercept of line m is greater than the x -intercept of line l .
- C. The y -intercept of line m is greater than the y -intercept of line l .
- D. The slope of line m is greater than the slope of line l .

- 5 The coordinate plane shown below has a figure in the third quadrant.

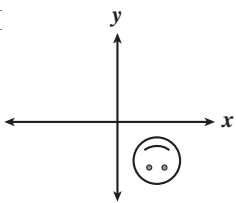


Which of the following shows the same figure after it has been reflected across the y -axis and then reflected across the x -axis?

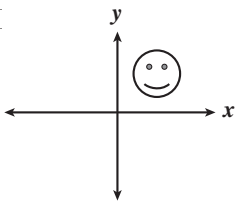
A.



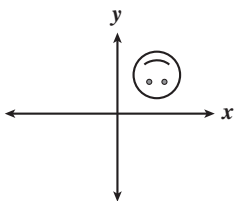
B. □



C. □



D.



- 6 The first number in a pattern is 50. To go from one number in the pattern to the next number, the rule is to **divide by 5**. What is the fourth number in the pattern?

A. $\frac{1}{5}$ □

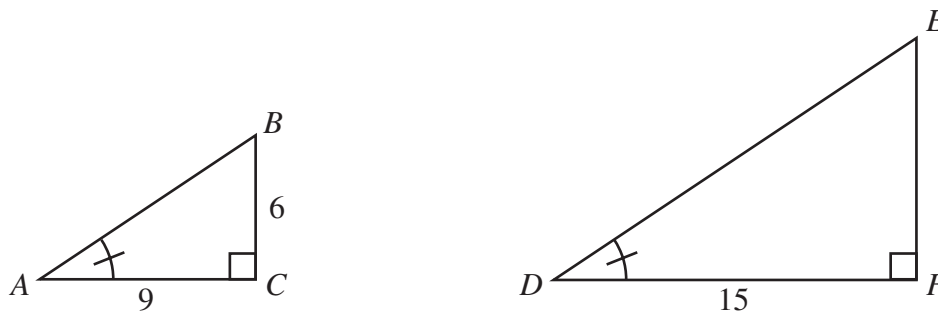
B. $\frac{2}{5}$ □

C. $\frac{3}{2}$ □

D. $\frac{5}{2}$ □

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 In the diagram below, $\triangle ABC$ and $\triangle DEF$ are similar triangles with the dimensions shown, in units.



What is the length, in units, of \overline{EF} ?

- 8 What is the solution to the equation shown below?

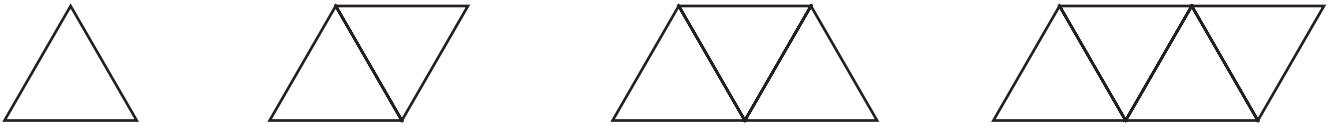
$$\frac{5}{6}x + 4 = 19$$

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** Jian made some designs using equilateral triangles, as shown below. He noticed that as he added new triangles, there was a relationship between n , the number of triangles, and p , the outer perimeter of the design.



The table below lists the outer perimeters for the designs shown. □

Number of Triangles	1	2	3	4	...	n
Outer Perimeter (in units)	3	4	5	6	...	p

- If the pattern is continued, what would be the outer perimeter of a design using 10 triangles?
- Write a rule for finding p , the outer perimeter for a design that uses n triangles.
- On the grid in your Student Answer Booklet, draw a scatterplot on a coordinate plane that shows the relationship between the number of triangles and the outer perimeter of the design. Be sure to label the axes.

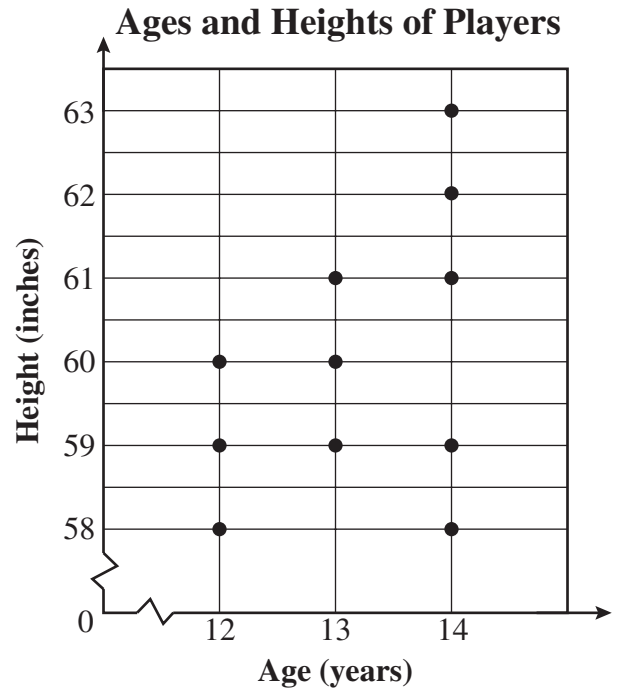
Mark your answers to multiple-choice questions 10 through 18 in the spaces provided in your Student Answer Booklet. Do not write your answers in this test booklet. You may do your figuring in the test booklet.

- 10 Which of the following is equivalent to the expression below?

$$(2^5)(2^6)$$

- A. 2^{11}
- B. 2^{30}
- C. 4^{11}
- D. 4^{30}

- 11 The scatterplot below shows the ages and heights of 11 players on the school football team. Each dot represents one player.



What is the total number of 14-year-olds who are **more than** 60 inches tall?

- A. 0
- B. 2
- C. 3
- D. 5

- 12 What is the solution to the equation below?

$$\frac{y}{-7} = 21$$

- A. $y = -3$
- B. $y = 3$
- C. $y = 147$
- D. $y = -147$

- 13 The results of four games played by a school's baseball team are shown in the table below.

Scores of the School Baseball Team's Four Games

Game	Home Team	Visiting Team
1	9	1
2	6	8
3	2	5
4	7	6

In which game was the positive difference in scores the **least** between the winning team and the losing team?

- A. Game 1
- B. Game 2
- C. Game 3
- D. Game 4

14 Which of the following is equivalent to multiplying any number, n , by 2?

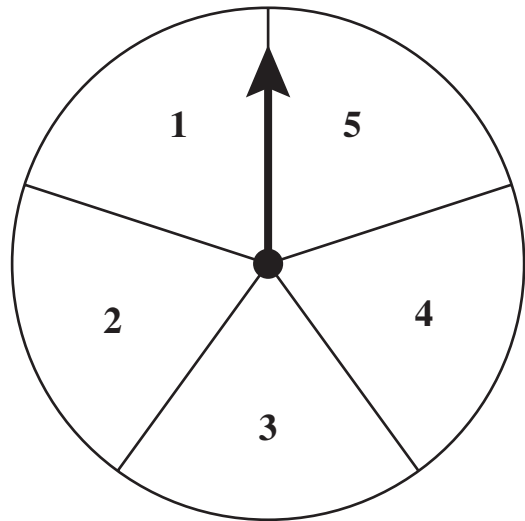
- A. dividing n by $\frac{1}{2}$
- B. dividing n by 2 □
- C. dividing n by $-\frac{1}{2}$ □
- D. dividing n by -2

15 Which of the following is equivalent to the expression below? □

$$-\frac{1}{2}(6 - 8x)$$

- A. □ $-3 + 4x$
- B. □ $3 + 4x$
- C. □ $-3 - 8x$
- D. □ $3 - 8x$

16 To win a game, Yepa must get a sum of 8 on her next two spins of the arrow on the spinner shown below. All the sections of the spinner are of equal size.



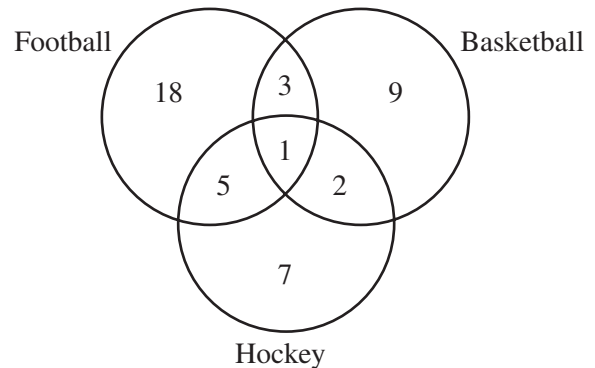
What is the probability that the results of Yepa's next two spins will have a sum of 8?

- A. □ 0
- B. □ $\frac{1}{25}$
- C. □ $\frac{3}{25}$
- D. □ $\frac{8}{25}$

17 The number 18 has a total of 6 factors: 1, 2, 3, 6, 9, and 18. What is the total number of factors that the number 130 has?

- A. 4
- B. 6
- C. 8
- D. 13

18 Coach Wilson constructed a Venn diagram that shows the number of eighth-grade athletes who play football, basketball, and hockey.



Which phrase best identifies the number 5 shown in the diagram?

- A. the total number of athletes who do not play all three sports
- B. the total number of athletes who play both football and hockey, but not basketball
- C. the total number of athletes who play either football or hockey, but not both
- D. the total number of athletes who do not play basketball

Questions 19 and 20 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.

19 What is 30% of 600?

20 Chan is designing a new swimming pool that will have a length of 34 feet. He plans to make a scale drawing of the pool. In his drawing, $\frac{1}{4}$ inch represents 1 foot. What should be the length, in **inches**, of Chan's scale drawing of the pool?

Question 21 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.

- 21** What is the value of the following expression?

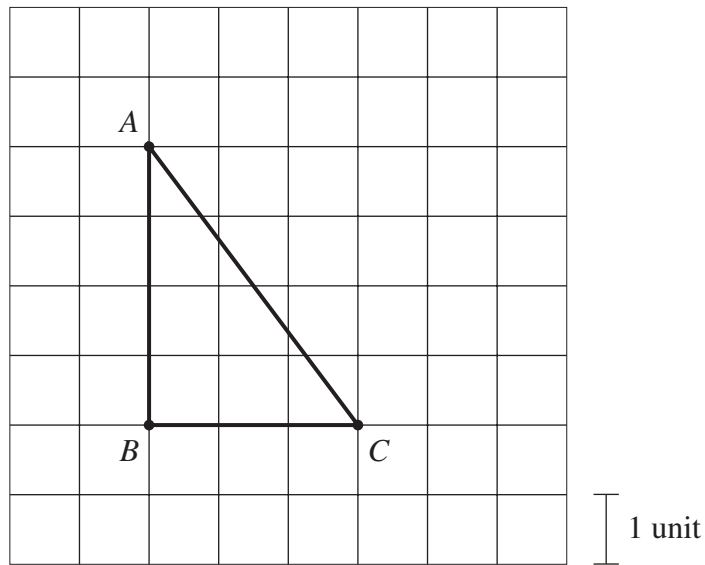
$$|-5| + |-5| - |-3|$$

Question 22 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 22 in the space provided in your Student Answer Booklet.

- 22 The diagram below shows right triangle ABC drawn on a unit grid.



- What is the length, in units, of line segment AC ? Show or explain how you got your answer.
- What is the area, in square units, of triangle ABC ? Show or explain how you got your answer.
- In your Student Answer Booklet, draw a rectangle that has the same area in square units as triangle ABC . Be sure to label the dimensions of your rectangle.

SESSION 2

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

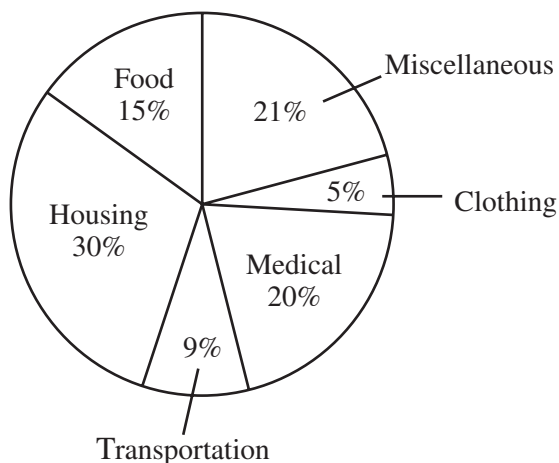


DIRECTIONS

This session contains fourteen multiple-choice questions and three open-response questions. Mark your answers to these questions in the spaces provided in your Student Answer Booklet.

- 23** The graph below shows a family's annual expenses.

Family Annual Expenses



If the family's annual income is \$40,000, what is the family's annual expense for housing?

- A. \$120
- B. \$3,000
- C. \$12,000
- D. \$30,000

- 24** In a recent year, there were 1682 students enrolled in Amherst College in Amherst, Massachusetts. The ratio of the number of students to the number of faculty members was approximately 15:2.

Based on this ratio, which of the following is closest to the number of faculty members that year?

- A. 310
- B. 220
- C. 120
- D. 110

- 25** Kristen was x inches tall a year ago. Since then, she has grown taller and is now y inches tall. Which of the following represents the number of inches Kristen grew during the past year?

- A. $x + y$
- B. $x - y$
- C. $y - x$
- D. $y \div x$

- 26 Three friends played a video game. Naomi won the greatest number of points. The chart below shows the results of the game.

Results of Video Game

Player	Number of Points
Naomi	4,500
Darla	2,000
Isaac	3,500

What fraction of the total number of points were won by Naomi?

- A. $\frac{4}{5}$
B. $\frac{9}{20}$
C. $\frac{9}{11}$
D. $\frac{11}{20}$

- 27 Which of the following numbers is a solution for the inequality shown below?

$$7(2x - 3) > 49$$

- A. 10
B. 5
C. 0
D. -6

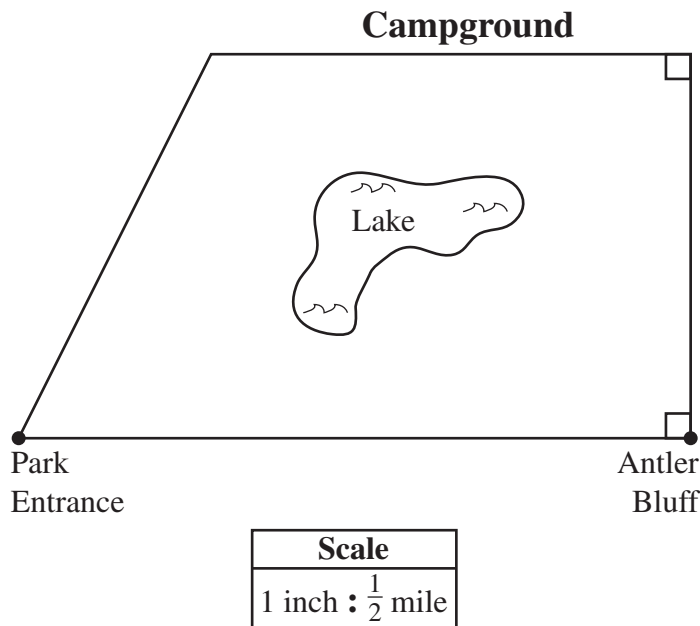
Questions 28 and 29 are open-response questions.

- **BE SURE TO ANSWER AND LABEL ALL PARTS OF EACH 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 28 in the space provided in your Student Answer Booklet.

Use your MCAS ruler to answer question 28.

- 28 The scale map below shows a campground in a state park.



- a. □ Based on the scale, what is the distance, in **miles**, from the park entrance to Antler Bluff? Show or explain how you got your answer.
- b. □ What is the area, in **square miles**, of the campground? Show or explain how you got your answer.

Write your answer to question 29 in the space provided in your Student Answer Booklet.

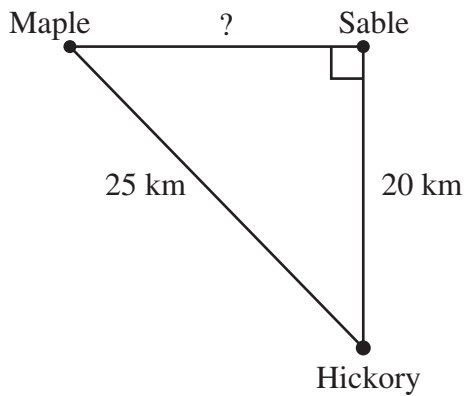
- 29 Glenn bowls in a bowling league every Saturday morning. Last Saturday, the scores from Glenn's first 3 bowling games were 141, 128, and 157.
- What is the mean of the scores from Glenn's first 3 games? Show or explain how you got your answer.
 - Glenn will bowl a fourth game. What will he have to bowl in his fourth game to have a mean of 150 for the 4 games? Show or explain how you got your answer.
 - Each player in Glenn's bowling league is given a handicap, which allows players of different abilities to compete equally. A player's handicap is determined with the following formula.

A player's handicap is equal to 80 percent of the difference between the player's average (mean) and 220.

Miguel is Glenn's teammate. If Miguel's average (mean) is 130, what is his handicap? Show or explain how you got your answer.

Mark your answers to multiple-choice questions 30 through 38 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.

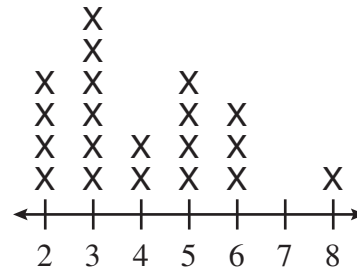
- 30 The roads connecting the three towns on the map below form a right triangle. Two of the distances are given.



Based on the distances given on the map, what is the distance between Maple and Sable?

- A. 12 km
- B. 15 km
- C. 16 km
- D. 19 km

- 31 The line plot below shows the number of people in each student's household for a class of students.



Number of People in Student Households

What is the mean number of people in households for this class of students?

- A. 3
 - B. 3.5
 - C. 4
 - D. 6
- 32 Which of the following is **not** an irrational number?
- A. π
 - B. $\sqrt{3}$
 - C. $\sqrt{8}$
 - D. $2\sqrt{4}$

- 33** The Madhany family traveled 3560 miles on a trip across the United States. Since one mile is about 1.6 kilometers, which of the following is closest to the total number of kilometers in 3560 miles?
- A. 5700 kilometers
 - B. 4540 kilometers
 - C. 3558 kilometers
 - D. 2225 kilometers

- 34** Sari deposited \$150.00 in a savings account that earns interest at a rate of 6% compounded annually. The table below shows her account balance at the end of each of three years.

**End-of-Year
Account Balances**

Year	Balance
1	\$159.00
2	\$168.54
3	\$178.65

If Sari makes no additional deposits or withdrawals, which of the following will be closest to her account balance at the end of year 6?

- A. \$184.65
- B. \$189.37
- C. \$200.73
- D. \$212.77

- 35** On Monday, Chris and Ravi went to the gym. Chris plans to return every second day. Ravi plans to return every fourth day. If they follow their plans, what is the **next** day of the week they will both be at the gym on the same day?
- A. Wednesday
 - B. Thursday
 - C. Friday
 - D. Saturday

- 36 The chart below shows the cost of the four different-sized boxes of chicken nuggets that are available at The Chicken Shack.

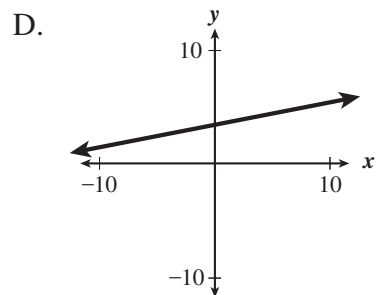
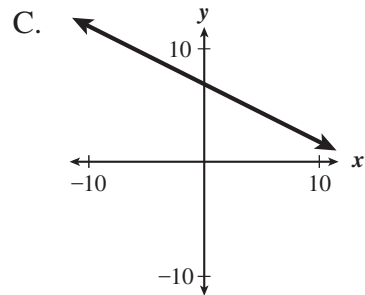
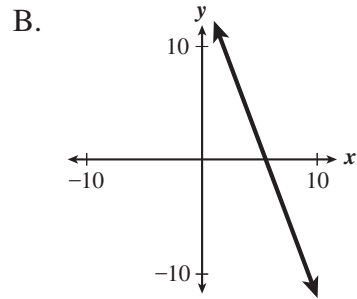
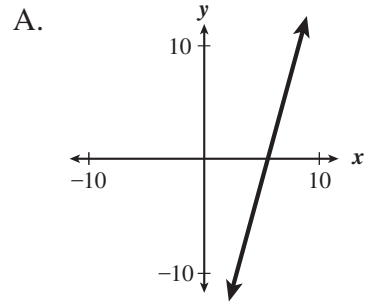
Box Sizes and Costs of Chicken Nuggets

Box Size	Number of Nuggets in Box	Cost of Box (dollars)
Kid	5	1.29
Small	9	2.09
Medium	15	3.19
Large	22	4.99

Which of the following box sizes has the **least** cost per nugget?

- A. Kid
 - B. Small
 - C. Medium
 - D. Large
- 37 Which of the following is equivalent to 20 centimeters?
- A. 2000 millimeters
 - B. 200 millimeters
 - C. 20 millimeters
 - D. 2 millimeters

- 38 Which of the lines graphed below has the greatest positive slope?

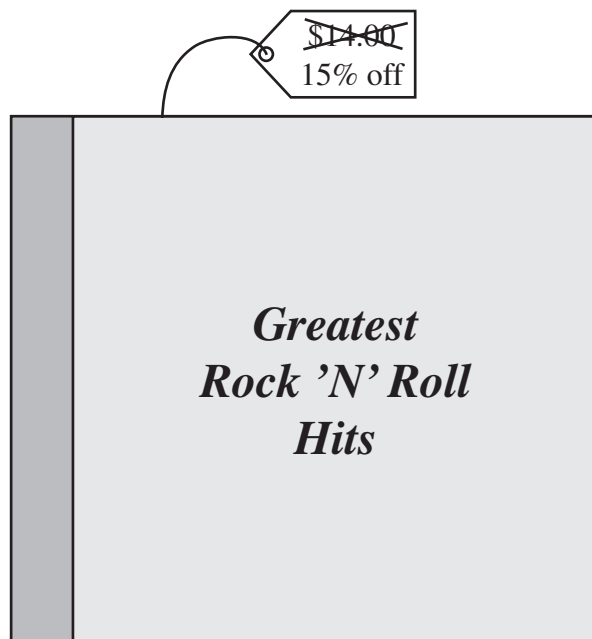


Question 39 is an open-response question.

- **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 39 in the space provided in your Student Answer Booklet.

- 39 Andrea works as a cashier in a music store. A customer wants to pay for a CD that is on sale for 15% off the regular price of \$14.00.



The cash register is broken, and Andrea must calculate the price of the CD using only a calculator.

- What is the sale price of the CD? Show or explain how you got your answer.
- Andrea needs to add 7% sales tax to the sale price of the CD. What should Andrea charge the customer for the CD, including tax? Show or explain how you got your answer.
- The customer told Andrea that she could save time by just taking 8% off the regular price of the CD, because $15\% - 7\%$ is 8%. Is the customer right? Explain your reasoning.



Massachusetts Comprehensive Assessment System □ Grade 8 Mathematics Reference Sheet □

PERIMETER FORMULAS

square..... $P = 4s$

rectangle $P = 2b + 2h$

triangle..... $P = a + b + c$

CIRCLE FORMULAS

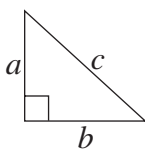
circle $C = 2\pi r$

OR □

$$C = \pi d \square$$

$$A = \pi r^2$$

PYTHAGOREAN THEOREM



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

CONVERSIONS

1 mile = 5280 feet

1 square mile = 640 acres

AREA FORMULAS

square..... $A = s^2 \square$

rectangle..... $A = bh \square$

OR □

$$A = lw$$

triangle..... $A = \frac{1}{2}bh$

circle $A = \pi r^2 \square$

trapezoid $A = \frac{1}{2}h(b_1 + b_2) \square$

VOLUME FORMULAS

rectangular prism $V = Bh$
(B = area of base)

cone..... $V = \frac{1}{3}\pi r^2 h \square$

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

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

Grade 8 Mathematics □
Spring 2005 Released Items: □
Reporting Categories, Standards, and Correct Answers □

Item No.	Page No.	Reporting Category	Standard	Correct Answer (MC/SA)*
1	180	<i>Patterns, Relations, and Algebra</i>	8.P.6	A
2	180	<i>Patterns, Relations, and Algebra</i>	8.P.2	A
3	180	<i>Data Analysis, Statistics, and Probability</i>	8.D.3	D
4	181	<i>Patterns, Relations, and Algebra</i>	8.P.10	B
5	182	<i>Geometry</i>	8.G.6	D
6	182	<i>Patterns, Relations, and Algebra</i>	8.P.1	B
7	183	<i>Measurement</i>	8.M.4	10
8	183	<i>Patterns, Relations, and Algebra</i>	8.P.7	18
9	184	<i>Patterns, Relations, and Algebra</i>	8.P.1	
10	185	<i>Number Sense and Operations</i>	8.N.7	A
11	185	<i>Data Analysis, Statistics, and Probability</i>	8.D.2	C
12	186	<i>Patterns, Relations, and Algebra</i>	8.P.7	D
13	186	<i>Data Analysis, Statistics, and Probability</i>	8.D.2	D
14	187	<i>Number Sense and Operations</i>	8.N.9	A
15	187	<i>Patterns, Relations, and Algebra</i>	8.P.3	A
16	187	<i>Data Analysis, Statistics, and Probability</i>	8.D.4	C
17	188	<i>Number Sense and Operations</i>	8.N.5	C
18	188	<i>Data Analysis, Statistics, and Probability</i>	8.D.2	B
19	189	<i>Number Sense and Operations</i>	8.N.10	180
20	189	<i>Measurement</i>	8.M.1	$8\frac{1}{2}$ inches
21	190	<i>Number Sense and Operations</i>	8.N.6	7
22	191	<i>Geometry</i>	8.G.4	
23	192	<i>Number Sense and Operations</i>	8.N.10	C
24	192	<i>Number Sense and Operations</i>	8.N.3	B
25	192	<i>Patterns, Relations, and Algebra</i>	8.P.4	C
26	193	<i>Number Sense and Operations</i>	8.N.1	B
27	193	<i>Patterns, Relations, and Algebra</i>	8.P.7	A
28	194	<i>Measurement</i>	8.M.3	
29	195	<i>Data Analysis, Statistics, and Probability</i>	8.D.3	
30	196	<i>Geometry</i>	8.G.4	B
31	196	<i>Data Analysis, Statistics, and Probability</i>	8.D.3	C
32	196	<i>Number Sense and Operations</i>	8.N.2	D
33	197	<i>Measurement</i>	8.M.2	A
34	197	<i>Patterns, Relations, and Algebra</i>	8.P.1	D
35	197	<i>Number Sense and Operations</i>	8.N.5	C
36	198	<i>Number Sense and Operations</i>	8.N.3	C
37	198	<i>Measurement</i>	8.M.1	B
38	198	<i>Patterns, Relations, and Algebra</i>	8.P.5	A
39	199	<i>Number Sense and Operations</i>	8.N.10	

* 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 shaded cells, will be posted to the Department's Web site later this year.