XIII. Mathematics, 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 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 The depth of the water in a tank was 5 feet. At noon, Haley started draining water out of the tank at a steady rate, as shown by the graph below.
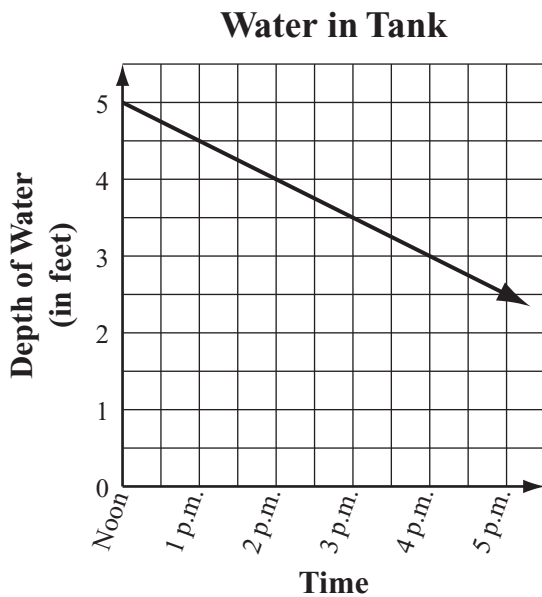
Water in Tank

Based on the rate shown by the graph, at what time will the depth of the water in the tank be 2 feet?

A. 2 p.m.

B. 4 p.m.

C. 6 p.m.

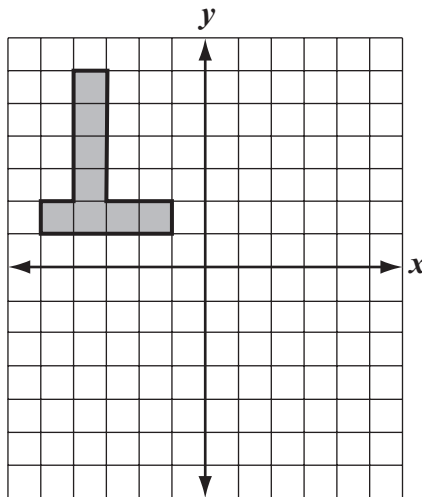D. 8 p.m.

2 What is the value of the expression below?
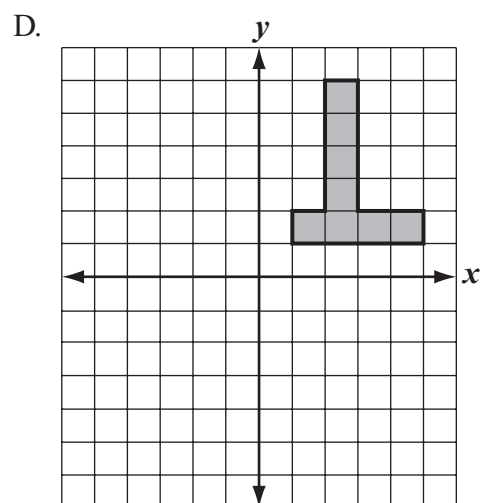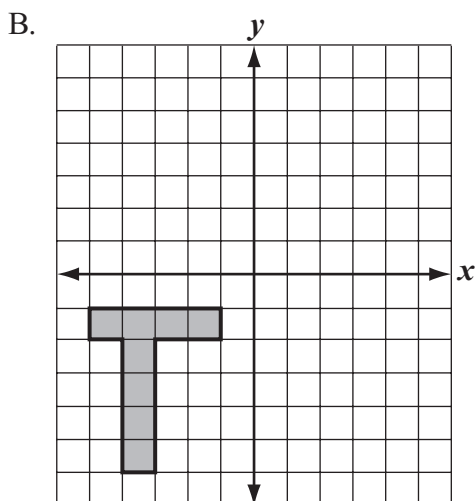
$$(2 + 5)^2$$

A. 14

B. 27

C. 29

D. 49

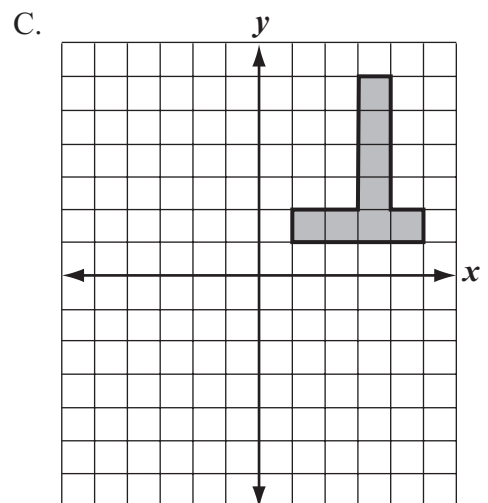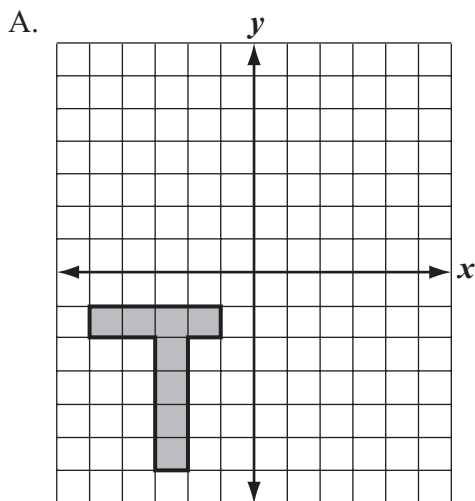**3** The tail of a comet can be up to 45,100,000 kilometers long. What is 45,100,000 written in scientific notation?

A. 4.51×10^8

B. 4.51×10^7

C. 4.51×10^6

D. 4.51×10^5

4   Angelie shaded a figure on a coordinate plane, as shown below.

Which of the following best represents the reflection of Angelie's figure across the *y*-axis?

A.

C.

B.

D.

5 Horseshoe Falls has an average water flow of 600,000 gallons per second. What is the average water flow of Horseshoe Falls in gallons per **minute**?

A. 10,000 gallons per minute

B. 100,000 gallons per minute

C. 3,600,000 gallons per minute

D. 36,000,000 gallons per minute

6 Which of the following has the greatest value?

A. $|10|$

B. $|12|$

C. $|-14|$

D. $|-8|$

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 The figure below is a quadrilateral.
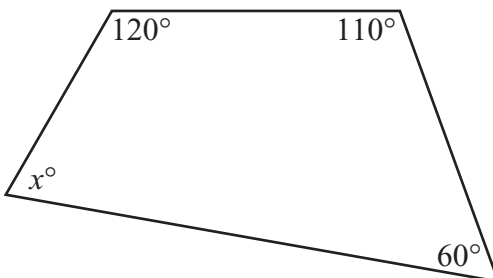
What is the value of x in the quadrilateral?

8 The table below shows the relationship between t, the number of tickets to a school social, and c, the total cost, in dollars, of the tickets.

Total Cost of Tickets

Number of Tickets (t)	Total Cost in Dollars (c)
1	5
2	10
3	15
4	20

Write an equation that represents the relationship between t and c for the data shown in the table.

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   Sandy purchased three trees.

- The price of the first tree was $63.50.

- The price of the second tree was equal to twice the price of the **first** tree.

- The price of the third tree was equal to $\frac{3}{4}$ of the price of the **second** tree.

a. What was the price of the second tree? Show or explain how you got your answer.

b. What was the price of the third tree? Show or explain how you got your answer.

c. What was the total of the prices of all three trees? Show or explain how you got your answer.

d. Sandy had to pay sales tax of 5% on her purchase. What was the total amount of Sandy's purchase of three trees, including tax? Show or explain how you got your answer.

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 Carly made 21 out of 83 shots while practicing basketball. Which of the following is closest to the percentage of shots that Carly made?

A. 20%

B. 25%

C. 30%

D. 40%

11 Heather asked her classmates if they went to a movie, a play, a concert, or any combination of those events during the last month. The Venn diagram below represents her data.

Students Attending Events

Movies   Plays

15   2   5

1

1   1

3
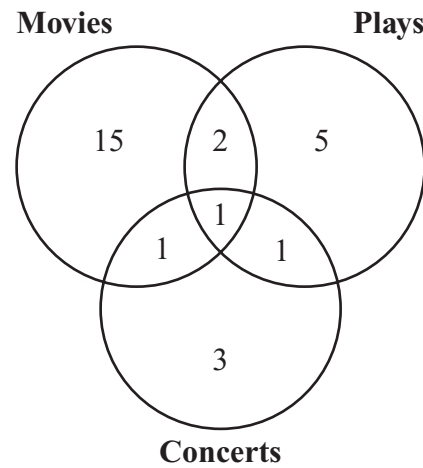
Concerts

Based on the diagram, what is the total number of Heather's classmates who went to a concert during the last month?

A. 3

B. 4

C. 5

D. 6

12 Sally found the following information about Massachusetts.

- The land area of Massachusetts is 7,804 square miles.

- The population of Massachusetts was 6,379,304 in 2001.

Population density is determined using the formula below.

population density = population ÷ land area

Based on the information that Sally found, which of the following estimates is closest to the population density of Massachusetts in 2001?

A. 1,000 people per square mile

B.   800 people per square mile

C.   640 people per square mile

D.   600 people per square mile

13 Steven has one bag that contains three table-tennis balls numbered 1, 2, and 3. He also has a second bag that contains four table-tennis balls lettered A, B, C, and D.
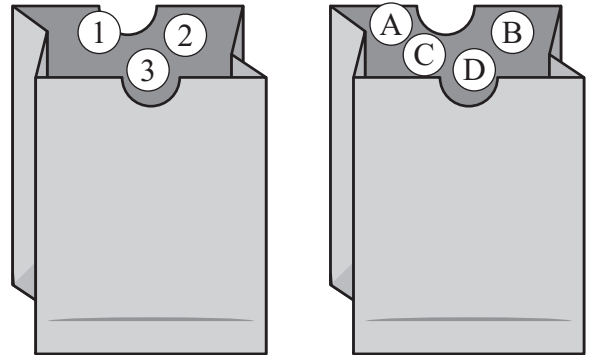
The organized list in the box below shows all of the possible combinations of numbers and letters that Steven can get when he selects one ball from each bag.

1 A	2 A	3 A
1 B	2 B	3 B
1 C	2 C	3 C
1 D	2 D	3 D

When Steven randomly selects one ball from each bag, what is the probability that he will select a table-tennis ball with a 1 on it and also a table-tennis ball with a B on it?

A. $\frac{1}{12}$
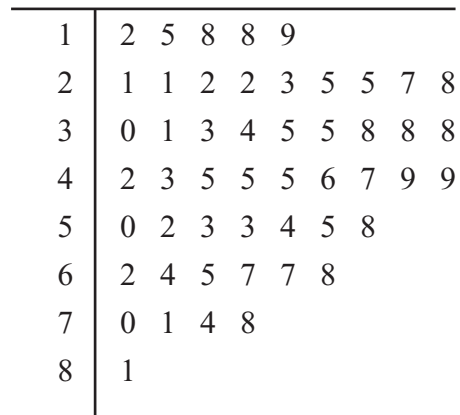
B. $\frac{1}{11}$

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

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

14 A bottle contains 0.375 liters of juice. Which of the following is another way to express 0.375?

A. $\frac{3}{75}$

B. $\frac{3}{8}$

C. $\frac{37}{50}$

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

15 The stem-and-leaf plot below shows the ages, in years, of people who attended the mayor's speech yesterday.

**Ages, in Years, of People
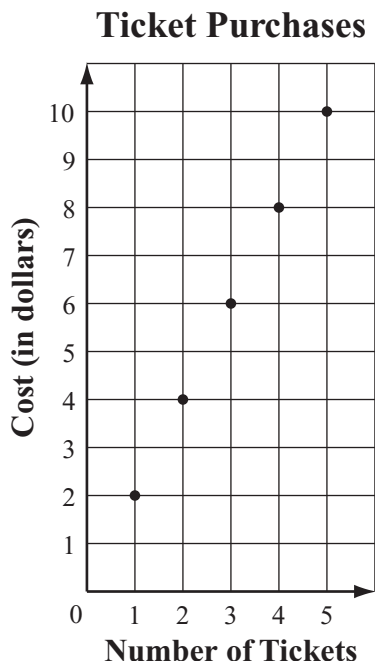Who Attended Mayor's Speech**

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

Key
2 | 4 represents 24

What is the total number of people younger than 30 years old who attended the speech?

A. 10

B. 14

C. 15

D. 23

16 The graph below represents the cost of purchasing different numbers of tickets to a school play.

Ticket Purchases

As the number of tickets purchased increases by 1, how does the cost of the ticket purchase change?

A. It increases by $0.50.

B. It increases by $1.00.

C. It increases by $2.00.

D. It increases by $4.00.

17 Hani divided a board that is 52 inches long into two equal pieces. To find the length of each piece, she used the division expression below.

$$52 \div 2$$

Which of the following expressions can also be used to find the length of each piece?

A. 2×52

B. $2 \div 52$

C. $52 \times \frac{1}{2}$

D. $52 \div \frac{1}{2}$

18 What is the value of the expression below when $x = 4$ and $y = 2$?

$$x^3 - 3y$$

A. 58

B. 32

C. 10

D. 6

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 All of the sweaters in a store are on sale for 10% less than the regular price. What is the sale price of a sweater with a regular price of $38?

20 What value of x makes the equation below true?

$$5x - 1 = 19$$

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   The figure below shows two intersecting lines.
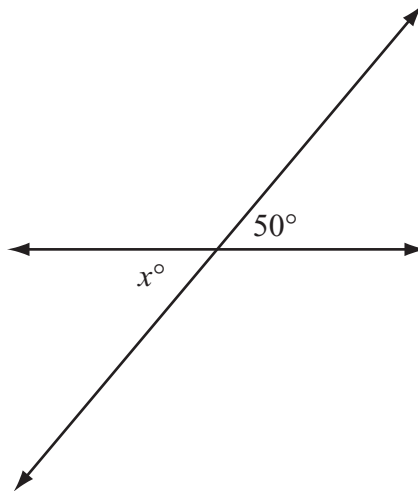
Based on the given angle measure, what is the value of x?

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   Mary took 7 hours to read a biography that had 210 pages.

a. What was Mary's average reading rate, in pages per hour? Show or explain how you got your answer.

b. In your Student Answer Booklet, copy the table below, and complete it using Mary's average reading rate from part (a).

Mary's Reading Rate

Number of Hours (x)	Number of Pages (y)
1	
2	
3	
4	

c. Write an equation that represents the relationship between x, the number of hours Mary read, and y, the number of pages she read.

d. How long will it take Mary to read 80 pages at the same average reading rate? Show or explain how you got your answer.

Mathematics

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 list below shows the number of minutes that Katie played in each basketball game last season.

> 35, 13, 34, 25, 35, 26

What was the mean number of minutes that Katie played per game?

A. 22 minutes

B. 28 minutes

C. 30 minutes

D. 35 minutes

24 Valerie and Grace have part-time jobs. Valerie earns $2 less per hour than Grace earns.

Let *g* represent Grace's hourly wage in dollars. Which of the following expressions represents Valerie's hourly wage?

A. $2g$

B. $2 - g$

C. $g - 2$

D. $g \div 2$

25 The principal of Washington Middle School surveyed students to determine how they got home from school on Monday. The graph below shows the results of this survey.
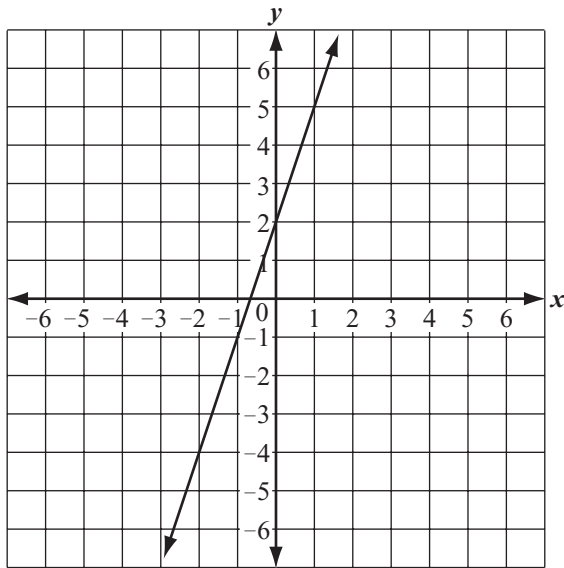
Students' Transportation from School on Monday
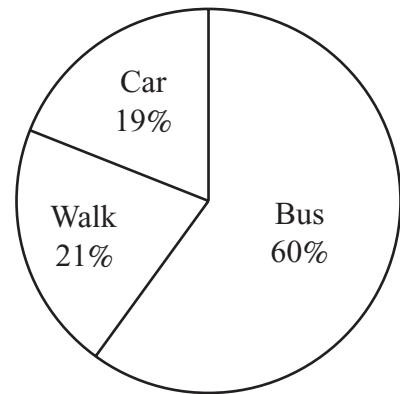
Of the students surveyed, 63 students said they walked home from school on Monday. What was the total number of students surveyed?

A. 63

B. 189

C. 210

D. 300

341

26 The graph below shows a relationship between values of *x* and *y*.

As the value of *x* increases from 0 to 1, what is the change in the value of *y*?

A. The value of *y* increases by 3.

B. The value of *y* decreases by 3.

C. The value of *y* increases by $\frac{1}{3}$.

D. The value of *y* decreases by $\frac{1}{3}$.

27 The interior of a picnic cooler is in the shape of a rectangular prism.

- It has a width of 6 inches.
- It has a length of 8 inches.
- It has a volume of 336 cubic inches.

What is the height of the interior of the picnic cooler?

A. 4 inches

B. 6 inches

C. 7 inches

D. 8 inches

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.

28   Ms. Larson gave a mathematics test to nine of the students in her class. Each student's score is listed in the box below.

85,   77,   88,   52,   82,   95,   93,   77,   80

a. Make a stem-and-leaf plot for these test scores. Be sure to include a key.

b. What is the median of these test scores? Show or explain how you got your answer.

c. The test score of one more student was added to the list. With the new score included, the median is 83. What score was added to the list? Show or explain how you got your answer.

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

29   The figure below is a rectangle with a semicircle at one of its ends.
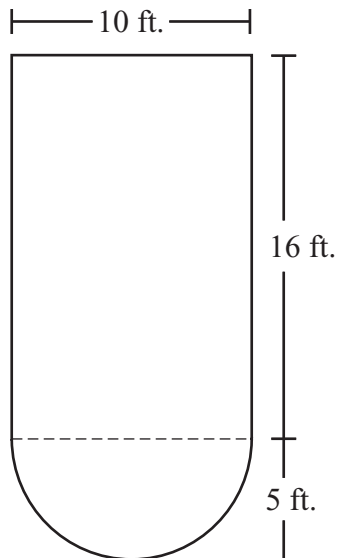
The radius of the semicircle is 5 feet, and the dimensions of the rectangle are 10 feet by 16 feet.

a. What is the diameter, in feet, of the semicircle? Show or explain how you got your answer.

b. What is the length, in feet, of the curved part of the semicircle? Show or explain how you got your answer. (Use 3.14 for π.)

c. What is the perimeter, in feet, of the figure? 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 Serita counted her heartbeats after running. In 15 seconds, she counted 33 heartbeats. At that rate, what was her number of heartbeats per **minute**?

A. 132

B. 220

C. 273

D. 495

31 The price that Economy Lawn Mowing charges to mow a lawn is equal to $\frac{2}{3}$ of the price charged by Farrell's Lawn Service.

If a represents the price charged by Farrell's Lawn Service, which of the following expressions represents the price that Economy Lawn Mowing charges?

A. $a - \frac{2}{3}$

B. $a + \frac{2}{3}$

C. $a \times \frac{2}{3}$

D. $a \div \frac{2}{3}$

32 Mary's chores include taking out the trash every third day and washing the dishes every fourth day. She took out the trash **and** washed the dishes on February 7.

Based on Mary's schedule for doing chores, what is the next date that she will do both chores on the same day?

A. February 10

B. February 12

C. February 14

D. February 19

33 A speedboat can travel at a rate of 40 miles per hour. At this rate, what is the distance that the speedboat will travel in 6 minutes?

A. 2.4 miles

B. 4.0 miles

C. 6.7 miles

D. 9.0 miles

34 In her pocket, Sheena has one state quarter for each of the states listed below.

- Massachusetts (MA)
- Connecticut (CT)
- New York (NY)
- Vermont (VT)

She randomly selects a quarter and returns it to her pocket. Then she does this a second time. The tree diagram below shows all of the possible combinations of quarters that Sheena can select.
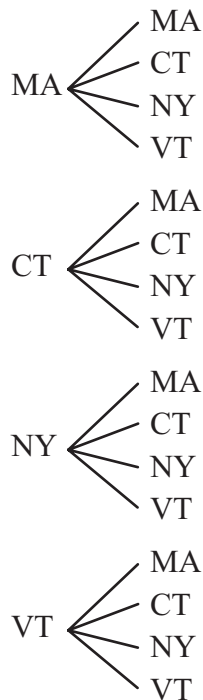
What is the probability that Sheena will select the Massachusetts quarter both times?

A. $\frac{1}{16}$

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

C. $\frac{1}{3}$

D. $\frac{1}{2}$

35 The flow rate of a river was measured in cubic feet per second at the same time each day over a five-day period. The table below lists the flow rates.

River Flow Rates

Day	Flow Rate (cubic feet per second)
1	145
2	150
3	145
4	149
5	136

What is the range of the river's flow rates, in cubic feet per second, for these five days?

A. 150

B. 136

C. 14

D. 9

36 At Burger Shack, the price of 2 hamburgers and 2 orders of fries is equal to the price of 3 hamburgers, as modeled below.

$$\text{🍔} + \text{🍔} + \text{🍟} + \text{🍟} = \text{🍔} + \text{🍔} + \text{🍔}$$

Key
🍔 represents the cost of a hamburger
🍟 represents the cost of an order of fries

Which of the following equations models the price of an order of fries in terms of the price of a hamburger at Burger Shack?

A. 🍟 = ◖

B. 🍟 = 🍔

C. 🍟 = 🍔 + ◖

D. 🍟 = 🍔 + 🍔

37 A new house was built on a lot in the shape of a trapezoid, as shown below.

325 feet

225 feet

75 feet
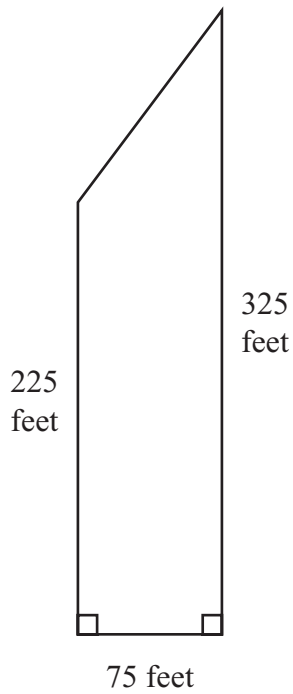
What is the area of the trapezoid?

A. 16,875 square feet
B. 17,200 square feet
C. 20,625 square feet
D. 24,375 square feet

38 Jamie made 7 paper airplanes in 2 minutes. She wants to make 10 paper airplanes.

If Jamie works at the same rate, which of the following proportions can be used to determine x, the number of minutes it will take her to make 10 paper airplanes?

A. $\dfrac{1}{10} = \dfrac{x}{2 + 7}$

B. $\dfrac{10}{1} = \dfrac{x}{2 + 7}$

C. $\dfrac{7}{2} = \dfrac{10}{x}$

D. $\dfrac{2}{7} = \dfrac{10}{x}$

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 Copy the *x*-axis and *y*-axis shown below onto the grid in your Student Answer Booklet.
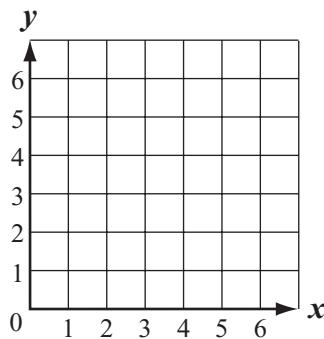
a. Plot and label point *P*(4, 6) and point *Q*(4, 2) on your grid.

b. Line segment *PQ* is one side of a rectangle. On your grid, draw rectangle *PQRS* with a length of 4 units and a width of 2 units.

- Label point *R* and point *S*.
- Write the coordinates of point *R* and point *S*.

c. On your grid, draw the two diagonals of rectangle *PQRS*. What are the coordinates of the point where the two diagonals intersect?

Grade 7 Mathematics
Spring 2007 Released Items:
Reporting Categories, Standards, and Correct Answers

Item No.	Page No.	Reporting Category	Standard	Correct Answer (MC/SA)*
1	329	*Patterns, Relations, and Algebra*	7.P.1	C
2	329	*Number Sense and Operations*	7.N.5	D
3	329	*Number Sense and Operations*	7.N.3	B
4	330	*Geometry*	7.G.6	C
5	331	*Measurement*	7.M.1	D
6	331	*Number Sense and Operations*	7.N.4	C
7	332	*Geometry*	7.G.1	70
8	332	*Patterns, Relations, and Algebra*	7.P.5	c = 5t or equivalent
9	333	*Number Sense and Operations*	7.N.9	
10	334	*Number Sense and Operations*	7.N.7	B
11	334	*Data Analysis, Statistics, and Probability*	7.D.1	D
12	335	*Number Sense and Operations*	7.N.8	B
13	335	*Data Analysis, Statistics, and Probability*	7.D.3	A
14	336	*Number Sense and Operations*	7.N.1	B
15	336	*Data Analysis, Statistics, and Probability*	7.D.1	B
16	337	*Patterns, Relations, and Algebra*	7.P.5	C
17	337	*Number Sense and Operations*	7.N.6	C
18	337	*Patterns, Relations, and Algebra*	7.P.2	A
19	338	*Number Sense and Operations*	7.N.9	$34.20
20	338	*Patterns, Relations, and Algebra*	7.P.4	4
21	339	*Geometry*	7.G.3	50
22	340	*Patterns, Relations, and Algebra*	7.P.3	
23	341	*Data Analysis, Statistics, and Probability*	7.D.2	B
24	341	*Patterns, Relations, and Algebra*	7.P.3	C
25	341	*Data Analysis, Statistics, and Probability*	7.D.1	D
26	342	*Patterns, Relations, and Algebra*	7.P.5	A
27	342	*Measurement*	7.M.3	C
28	343	*Data Analysis, Statistics, and Probability*	7.D.2	
29	344	*Measurement*	7.M.3	
30	345	*Number Sense and Operations*	7.N.2	A
31	345	*Patterns, Relations, and Algebra*	7.P.3	C
32	345	*Patterns, Relations, and Algebra*	7.P.1	D
33	345	*Number Sense and Operations*	7.N.2	B
34	346	*Data Analysis, Statistics, and Probability*	7.D.3	A
35	346	*Data Analysis, Statistics, and Probability*	7.D.2	C
36	347	*Patterns, Relations, and Algebra*	7.P.4	A
37	348	*Measurement*	7.M.3	C
38	348	*Patterns, Relations, and Algebra*	7.P.6	C
39	349	*Geometry*	7.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 Web site later this year.