Mathematics

SESSION 1

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

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

1 A landing pad for a helicopter is in the shape of a circle with a radius of 7 meters. Which of the following is closest to the area of the landing pad?

A. 44 square meters

B. 154 square meters

C. 205 square meters

D. 308 square meters

2 Alison's car gets about 32 miles per gallon of gas. If gas prices range from $1.80 to $2.10 a gallon, which of the following is closest to the amount of money Alison will spend on gas for a 1200-mile road trip this summer?

A. $40

B. $55

C. $75

D. $240

3 A book is 1 inch thick, not including the cover. If the book contains 364 sheets of paper, which measure is closest to the thickness of one sheet of paper?

A. 0.003 in.

B. 0.030 in.

C. 0.300 in.

D. 0.364 in.

4 The table below shows a linear relationship between *x* and *y*.

x	y
−7	a
−3	10
−1	6
0	4
5	−6

What is the value of *a*?

A. −18

B. −14

C. 14

D. 18

5 What is the simplified form of the expression $\sqrt{450}$?

A. $15\sqrt{2}$

B. $45\sqrt{2}$

C. $75\sqrt{2}$

D. $225\sqrt{2}$

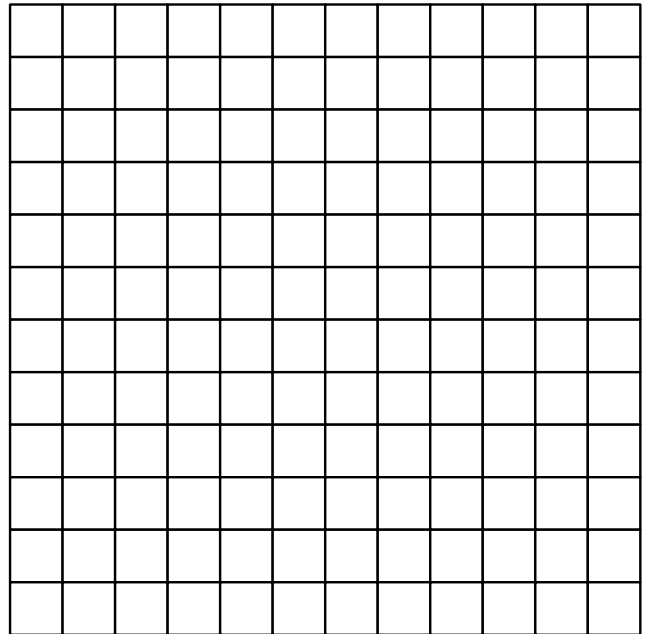**6** Each of the following statements is true.

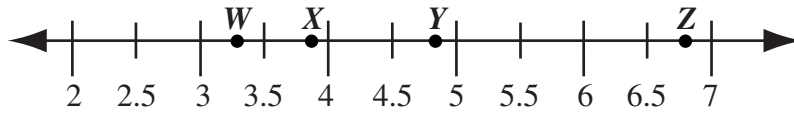$$16^x = 4$$
$$9^x = 3$$
$$4^x = 2$$

What is the value of 3^x?

A. 1

B. $\sqrt{2}$

C. $\sqrt{3}$

D. 9

You may want to use the grid below to answer question 7.

7 On the coordinate plane, what is the distance between the points (3, 4) and (11, 10)?

A. 10

B. 7

C. 5

D. 14

**8**   Which point most closely indicates the location of $\sqrt[3]{60}$ on the number line below?

A. *W*

B. *X*

C. *Y*

D. *Z*

9   In the figure shown below, triangle *TUV* is formed by joining the midpoints of the sides of equilateral triangle *QRS*. Triangle *WYZ* is formed by joining the midpoints of the sides of triangle *TUV*.
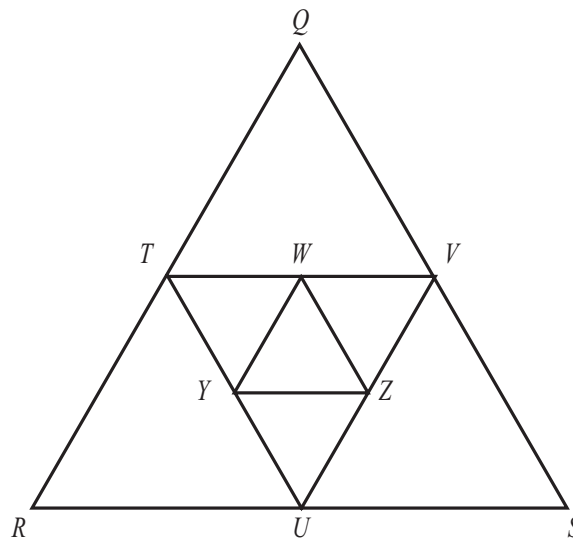
If the area of triangle *QRS* is 64 square inches, what is the area of triangle *WYZ*?

A. 1 square inch

B. 4 square inches

C. 8 square inches

D. 16 square inches

10 Joshua spun the arrow on each spinner shown below exactly once. He recorded the sum of the resulting two numbers.
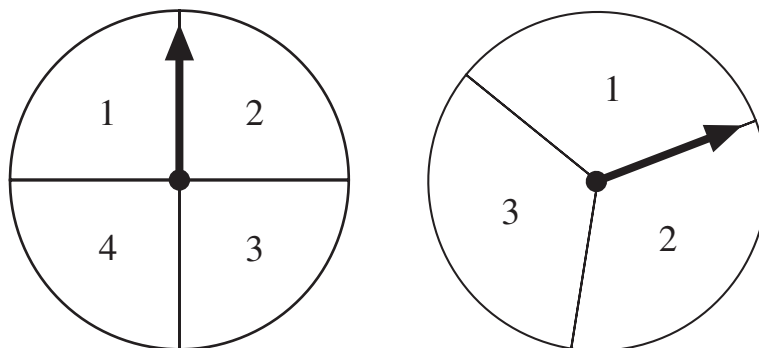
What is the probability that the sum of the resulting two numbers will be 2?

A. $\dfrac{1}{12}$

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

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

D. $\dfrac{7}{12}$

11 A rectangle has a perimeter of 44 inches and an area of 72 square inches. What are the lengths of the sides of the rectangle?

A. 2 inches and 36 inches

B. 4 inches and 18 inches

C. 8 inches and 9 inches

D. 11 inches and 11 inches

12 The right cylinder and right cone shown below have the same radius and volume. The cylinder has a height of 12 inches.
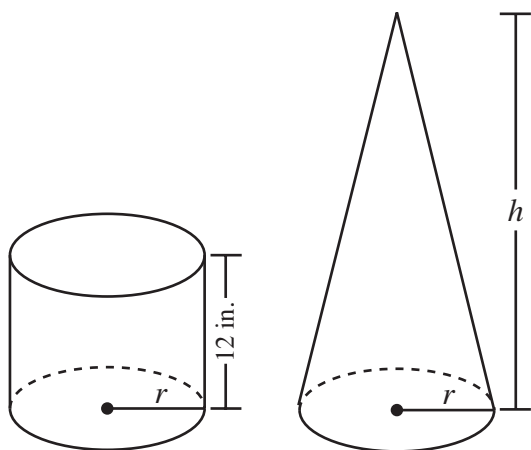
What is h, the height of the cone?

A. 18 inches

B. 24 inches

C. 36 inches

D. 42 inches

13 The volume of a rectangular prism is $(6n^3 - 4n)$. The height of the prism is $(-2n)$. What is the area of the base of the prism?

A. $3n^2 - 2$

B. $-3n^2 + 2$

C. $-3n^2$

D. $3n^2$

14 Which of the following is closest to the value of $\dfrac{7 - \sqrt{2}}{2}$?

A. 1.1

B. 2.8

C. 6.0

D. 6.3

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 What is the solution to the equation $\sqrt{x} = 16$?

16 The volume of the ice cream cone in the diagram below is 12π cubic centimeters. If the height of the ice cream cone is 9 centimeters, what is the diameter of the opening of the cone?

9 centimeters
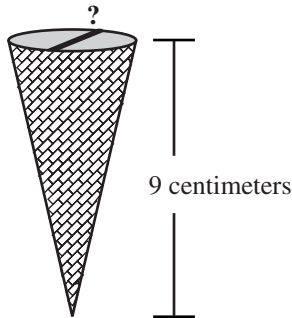
Question 17 is an open-response question.

- **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 Larissa plans to select one of the two mobile phone services described in the chart below. Each of the two companies charges a fixed monthly fee plus an additional charge for each minute in excess of the free time allowance.

Mobile Phone Service

Company	Monthly Fee	Free Minute Allowance per Month	Cost for Each Additional Minute
Cellco	$35	300	$0.08
Firstfone	$22	400	$0.15

Larissa plans to use her mobile phone as her only phone and predicts that she will use it between 600 and 900 minutes per month. To find t, the total monthly charge for each company based on m minutes of phone use, Larissa wrote the two equations shown below.

$$\text{Cellco:} \quad t = 35 + (m - 300)(0.08) \quad \text{for } m \geq 300$$

$$\text{Firstfone:} \quad t = 22 + (m - 400)(0.15) \quad \text{for } m \geq 400$$

a. Which is the less expensive plan for 600 minutes of phone use per month? Show or explain how you obtained your answer.

b. Which is the less expensive plan for 900 minutes of phone use per month? Show or explain how you obtained your answer.

c. Determine the number of minutes for which the monthly charges for the two companies would be exactly the same amount. Show or explain how you obtained your answer.

d. How can Larissa use the results for parts a, b, and c to make her selection of a cell phone company? Explain your reasoning.

Questions 18 and 19 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.

18 In the figure below, *A*, *C*, and *D* are collinear, the area of $\triangle ABC$ is 24 square centimeters, and the area of $\triangle ABD$ is 40 square centimeters. If the measure of $\overline{AB}$ is 8 centimeters, what is the length of $\overline{DC}$?
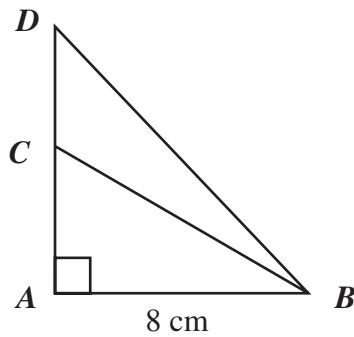
19 The line plot below shows the average daily temperature in a city for each day during the month of April.

Average Daily Temperatures (°F)
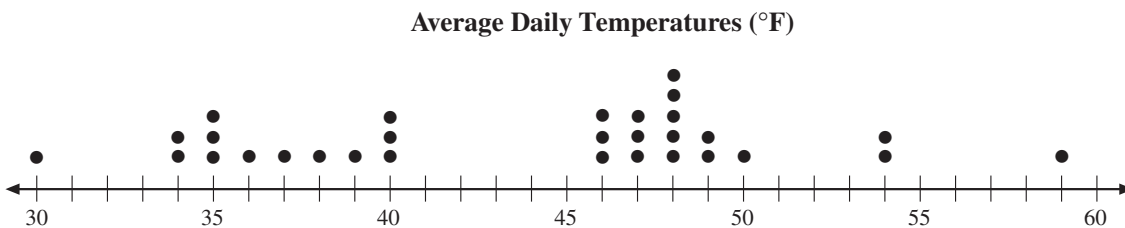
What was the median temperature?

Questions 20 and 21 are open-response questions.

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

20 Use the following sums to answer question 20.

$$\frac{1}{4} + \frac{3}{4} = 1$$

$$\frac{1}{6} + \frac{3}{6} + \frac{5}{6} = \frac{3}{2}$$

$$\frac{1}{8} + \frac{3}{8} + \frac{5}{8} + \frac{7}{8} = 2$$

$$\frac{1}{10} + \frac{3}{10} + \frac{5}{10} + \frac{7}{10} + \frac{9}{10} = \frac{5}{2}$$

a. Write the next series of fractions in the pattern and find its sum. Show or explain how you got your answer.

b. What is the denominator of the series of fractions in the pattern that has a sum of 4? Show or explain how you got your answer.

c. What is the sum of the series of fractions in the pattern in which the first term is $\frac{1}{36}$? Show or explain how you got your answer.

d. If the denominator is an even number, n, what is the sum of the series in terms of n? Show or explain how you got your answer.

Write your answer to question 21 in the space provided in your Student Answer Booklet.

21   The highest possible score on a college admissions mathematics examination is 800. The stem-and-leaf plot shows the scores for a group of 20 students who were granted early admission to their chosen universities.

Stem	Leaf
68	0 5 5
70	0 0 5 5
71	5
73	0 0 5
74	0 5
75	0 5
78	0 0 5
80	0 0

Key
68	0 = 680

a. What is the median score for these 20 students? Show or explain how you obtained your answer.

b. What is the range of the scores for these 20 students? Show or explain how you obtained your answer.

c. What are the lower (first) quartile and the upper (third) quartile?

d. Make a box-and-whisker plot that displays the same data given in the stem-and-leaf plot above. Be sure to label the minimum, the lower quartile, the median, the upper quartile, and the maximum on your box-and-whisker plot.

Mathematics

SESSION 2

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

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

22 Water is flowing from a 1.5-inch nozzle with water pressure of 65 pounds per square inch. The rate (in gallons per minute) at which the water flows from this nozzle is represented by the expression $29.7 \times (1.5)^2 \sqrt{65}$. What is the approximate rate at which the water flows?

A. 239 gallons per minute

B. 293 gallons per minute

C. 359 gallons per minute

D. 539 gallons per minute

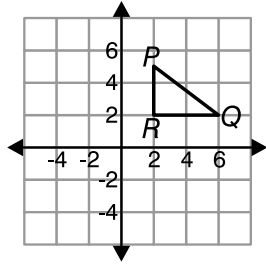**23** What is the first term in the exponential sequence below?

$$\{\_\_\_, \_\_\_, \_\_\_, 81, 243, 729, \dots\}$$

A. 1

B. 3

C. 9

D. 27

24 Which of the following equations is **false** for all positive values of n?
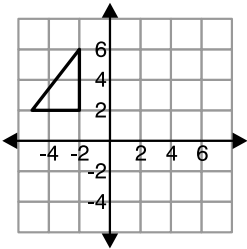
A. $n^2 = n(n)$

B. $n^2 = n(-n)$

C. $n^2 = -n(-n)$

D. $n^2 = \sqrt{n^4}$

204

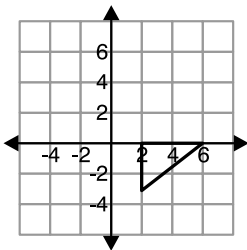**25** The diagram below shows ΔPQR on a coordinate plane.

Which of the following is the result of a reflection of ΔPQR?
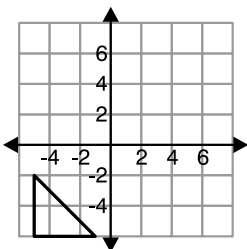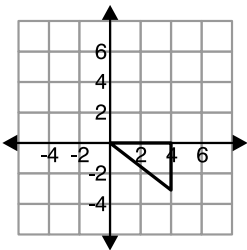
A.

B.

C.

D.

26 The probability that a customer will bring 1, 2, 3, 4, 5, or 6 items to the express lane in a grocery store is shown in the chart below.

Items Brought to an Express Lane

Number of Items	Probability
1	14%
2	11%
3	8%
4	11%
5	31%
6	25%

What is the probability that a customer will bring less than 5 items to the express lane?

A. 0.11

B. 0.31

C. 0.44

D. 0.75

**27** What is the slope of the line defined by the equation shown below?

$$5x + 2y = 10$$

A. $-\dfrac{2}{5}$

B. $-\dfrac{5}{2}$

C. $\dfrac{5}{2}$

D. $\dfrac{2}{5}$

28 Tina solved a quadratic equation and found the solutions to be $-\dfrac{3}{2}$ and 6. Which of

the following is equivalent to the quadratic equation that Tina solved?
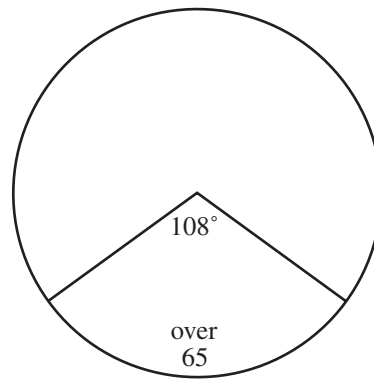
A. $(x - 6)(3x + 2) = 0$

B. $(x - 6)(2x + 3) = 0$

C. $(x + 6)(2x - 3) = 0$

D. $(x + 6)(3x - 2) = 0$

29 Amy drew a circle graph to represent the ages of people who were surveyed for a consumer group. Of those surveyed, 30% were over the age of 65. Which one of the following graphs best represents the survey results?
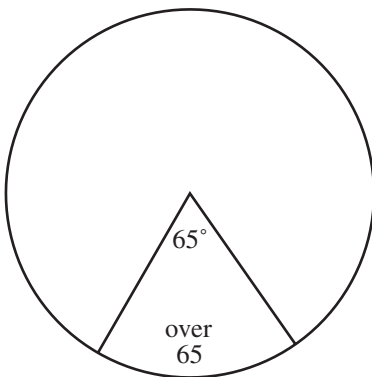
A.

30°

over
65

C.

108°

over
65

B.

65°

over
65

D.

120°

over
65
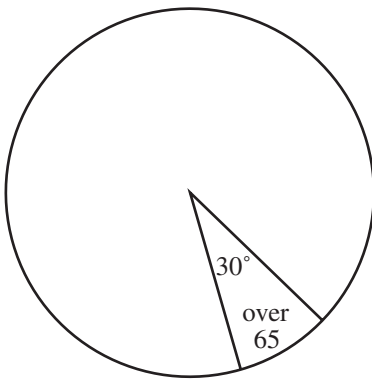
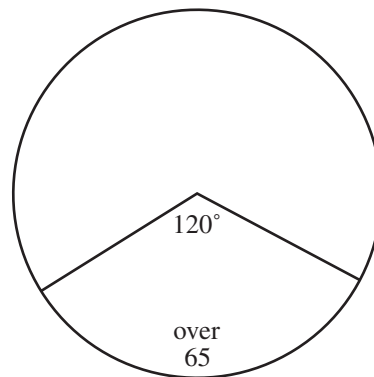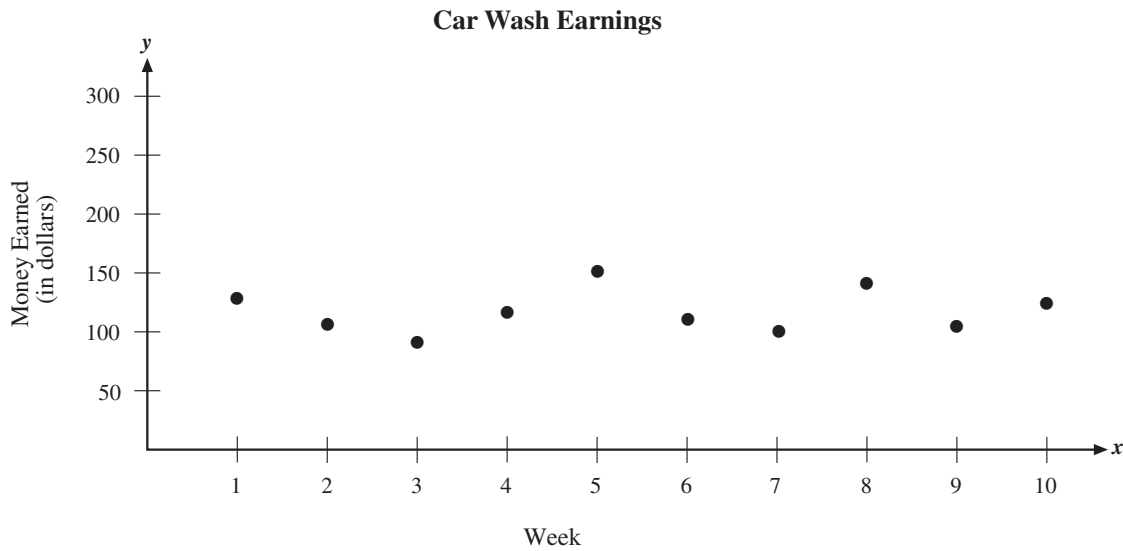**30** The students at Albemarle High held a car wash each week for 10 weeks to earn money for the student council. The students made the scatter plot below to represent the amount of the money they earned each week.

Car Wash Earnings

Which of the following equations **best** represents the line of best fit for these data?

A. $y = 110$

B. $y = 110x$

C. $y = x + 55$

D. $y = -x + 55$

Question 31 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.**
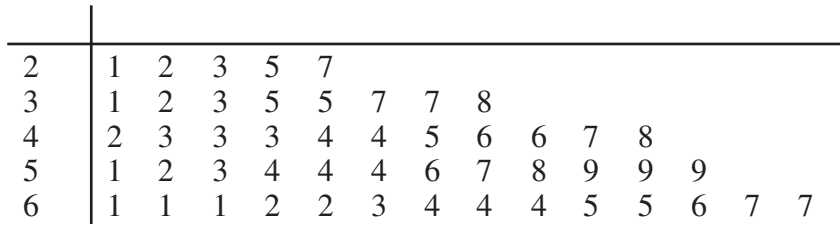- **If you do the work in your head, explain in writing how you did the work.**

Write your answer to question 31 in the space provided in your Student Answer Booklet.

31   An art collector paid $7,000 for two paintings, a portrait and a landscape, at the same auction. Each painting cost $3,500.

    a. The collector predicts that the portrait will increase in value by $600 per year. If she is correct, how many years after the date of purchase will the value of the portrait painting first be at least twice its original cost? Show or explain how you obtained your answer.

    b. Two years after the date of purchase, the portrait was appraised at $4900. What was the percent of increase from the collector's purchase price to the appraised value? Show or explain how you obtained your answer.

    c. The collector predicts that the value of the landscape painting will increase by 15% per year. If she is correct, what will its value be one year after the date of purchase? Show or explain how you obtained your answer.

    d. Assume that the landscape painting continues to increase in value according to the collector's prediction. How many years from the date of purchase will its value first be twice its original cost? Show or explain how you obtained your answer.

Mark your answers to multiple-choice questions 32 through 40 in the spaces provided in your Student Answer Booklet.

32 The stem-and-leaf plot below shows the ages of 50 teachers in the Bernard Township school system.

Ages of 50 Teachers in the Bernard Township School System

```
2 | 1  2  3  5  7
3 | 1  2  3  5  5  7  7  8
4 | 2  3  3  3  4  4  5  6  6  7  8
5 | 1  2  3  4  4  4  6  7  8  9  9  9
6 | 1  1  1  2  2  3  4  4  4  5  5  6  7  7
```

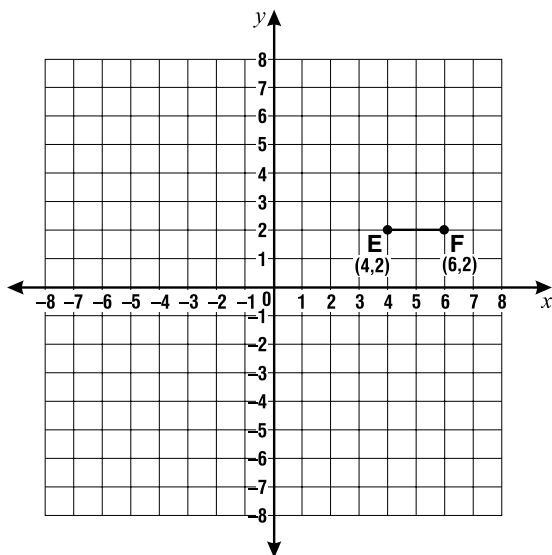| Key |
|-----|
| $6|1 = 61$ |

Based on the stem-and-leaf plot, what percent of the teachers are over 50 years of age?

A. 26%

B. 47%

C. 51%

D. 52%

33 The diagram below shows the location of $\overline{EF}$ on a coordinate plane.

Suppose that $\overline{EF}$ is rotated 180° clockwise about the origin. What are the coordinates of the image of point E?

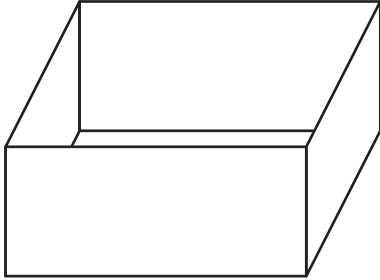A. $(-2, -4)$

B. $(-4, -2)$

C. $(4, -2)$

D. $(-4, 2)$

34 The trapezoid pictured below has the measurements shown.
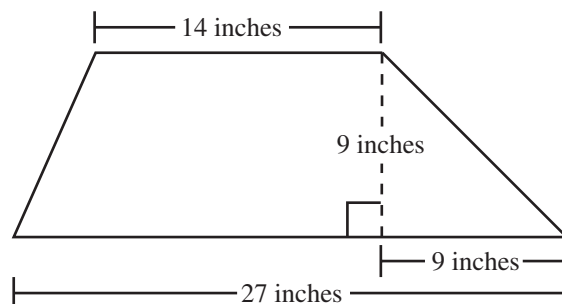
Which measure is closest to the perimeter of the trapezoid?

A. 41 inches

B. 59 inches

C. 64 inches

D. 66 inches

35 Jennifer keeps a box under her bed to store clothes. The box is in the shape of a rectangular prism as shown in the figure below.

Jennifer's sister, Molly, made a box that had the same height as Jennifer's box. Molly, however, realized that she could triple the length and double the width and it would still fit under her bed.

What is the ratio of the volume of Molly's box to the volume of Jennifer's box?

A. 6:1

B. 12:1

C. 36:1

D. 216:1

36 The perimeter of a child's rectangular play yard is 64 yards. The length and width of the yard are consecutive odd integers. If the length (x) is the longer of the two dimensions, what is the width of the play yard?

A. 15 yards

B. 17 yards

C. 31 yards

D. 33 yards

37 The mean exam score for 31 students in a geometry class was 79. The median exam score for the same set of students was 75. Two additional students took the exam at a later time and scored 65 and 93. How did the mean and median change when these two additional scores were included?

A. The median increased and the mean stayed the same.

B. The median stayed the same and the mean increased.

C. The median and the mean both stayed the same.

D. The median and the mean increased.

38 Julia and Marcia bought identically priced cans of chili and identically priced jars of salsa to make a dip.

- Julia bought 3 cans of chili and 2 jars of salsa for $10.07.

- Marcia bought 2 cans of chili and 4 jars of salsa for $12.98.

Which of the following systems of equations could be used to find x, the cost of one can of chili, and y, the cost of one jar of salsa?

A. $x + y = 10.07$
   $x + y = 12.98$

B. $10.07x + 12.98y = 11$
   $x + y = 11$

C. $2x + 4y = 10.07$
   $2x + 3y = 12.98$

D. $3x + 2y = 10.07$
   $2x + 4y = 12.98$

39 Jenny studied the effect of light on plant growth. She graphed a scatterplot to represent her data.

Effect of Light on Plant Growth
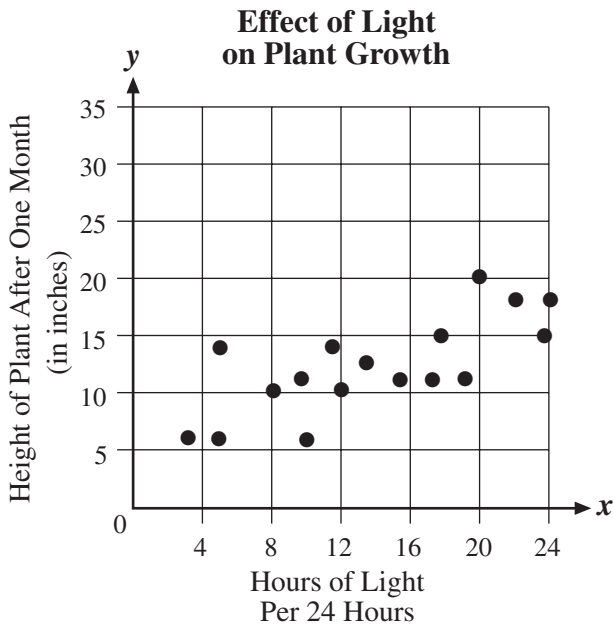
Which of the following **best** represents the equation for the line of best fit for the data shown?

A. $y = -0.4x + 5$

B. $y = 0.4x + 5$

C. $y = -4x + 5$

D. $y = 4x + 5$

40 A cup in the shape of a cone has a height of 8 units and a radius of 4 units as shown in the figure below. The water in the cup reaches a height of 5 units.
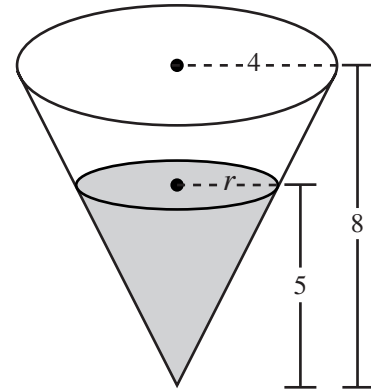
What is the value of r, the radius of the surface of the water?

A. 1.6 units

B. 2.5 units

C. 6.4 units

D. 10.0 units

Questions 41 and 42 are open-response questions.

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

41 When a map of the Caribbean Sea is placed on a grid, Island A is represented by A (2, 1), and Island B is represented by B (6, 4). Graph and label these points on the grid in your Student Answer Booklet.

a. What is the length of line segment $\overline{AB}$ on the grid? Show or explain how you got your answer.

b. If each unit on the grid represents 12 actual miles, what is the shortest distance in miles from Island A to Island B? Show or explain how you got your answer.

c. On the same map and grid, Island C is represented by C (2, 3). Graph point C on the same grid used in part a. What is the least possible number of miles in a complete round trip of the three islands? (From A to B to C and back to A). Show or explain your answer.

Write your answer to question 42 in the space provided in your Student Answer Booklet.

42 A can shaped like a right circular cylinder holds 2 pounds of coffee and has a diameter of 6 inches and a height of $6\frac{1}{4}$ inches.
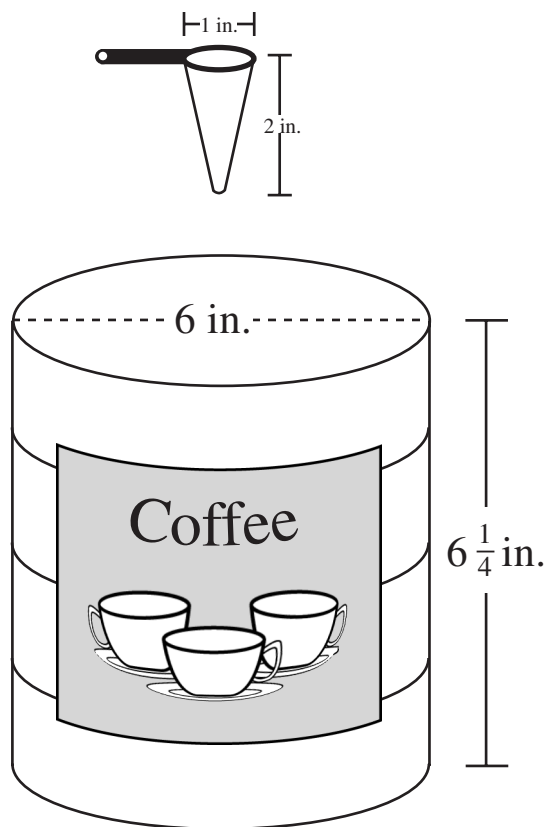
a. What is the total surface area of the coffee can? Show or explain how you obtained your answer.

b. What is the volume of the can? Show or explain how you obtained your answer.

c. A conical scoop is used to remove coffee from the can and place it into a coffee maker. The scoop has a 1-inch diameter and a 2-inch height. If one level scoop is used to make each cup of coffee, how many cups of coffee can be made from a full 2-pound can of coffee? Show or explain how you obtained your answer.

Grade 10 and Retest Mathematics
Spring 2003 Released Items:
Reporting Categories, Standards, and Correct Answers

Item No.	Page No.	Reporting Category	Standard	Correct Answer (MC/SA)*
1	194	*Measurement*	10.M.1	B
2	194	*Number Sense and Operations*	10.N.4	C
3	194	*Number Sense and Operations*	10.N.4	A
4	194	*Patterns, Relations, and Algebra*	10.P.7	D
5	195	*Number Sense and Operations*	10.N.2	A
6	195	*Patterns, Relations, and Algebra*	10.P.1	C
7	195	*Geometry*	10.G.7	A
8	196	*Number Sense and Operations*	10.N.3	B
9	196	*Geometry*	10.G.4	B
10	197	*Data Analysis, Statistics, and Probability*	8.D.4	A
11	197	*Patterns, Relations, and Algebra*	10.P.7	B
12	198	*Measurement*	10.M.2	C
13	198	*Patterns, Relations, and Algebra*	10.P.3	B
14	198	*Number Sense and Operations*	10.N.3	B
15	199	*Number Sense and Operations*	10.N.3	256
16	199	*Patterns, Relations, and Algebra*	10.P.7	4 centimeters
17	200	*Patterns, Relations, and Algebra*	10.P.8	
18	201	*Measurement*	10.M.1	4 centimeters
19	201	*Data Analysis, Statistics, and Probability*	10.D.1	46° F
20	202	*Patterns, Relations, and Algebra*	10.P.1	
21	203	*Data Analysis, Statistics, and Probability*	10.D.1	
22	204	*Number Sense and Operations*	10.N.4	D
23	204	*Patterns, Relations, and Algebra*	10.P.1	B
24	204	*Number Sense and Operations*	10.N.1	B
25	205	*Geometry*	10.G.9	B
26	205	*Data Analysis, Statistics, and Probability*	8.D.4	C
27	205	*Patterns, Relations, and Algebra*	10.P.2	B
28	206	*Patterns, Relations, and Algebra*	10.P.5	B
29	206	*Data Analysis, Statistics, and Probability*	10.D.1	C
30	207	*Data Analysis, Statistics, and Probability*	10.D.2	A
31	208	*Number Sense and Operations*	8.N.12	
32	209	*Data Analysis, Statistics, and Probability*	10.D.1	D
33	210	*Geometry*	10.G.9	B
34	210	*Measurement*	10.M.1	C
35	211	*Measurement*	10.M.3	A
36	211	*Patterns, Relations, and Algebra*	10.P.7	A
37	211	*Data Analysis, Statistics, and Probability*	10.D.1	C
38	211	*Patterns, Relations, and Algebra*	10.P.8	D
39	212	*Data Analysis, Statistics, and Probability*	10.D.2	B
40	212	*Geometry*	10.G.4	B
41	213	*Geometry*	10.G.7	
42	214	*Measurement*	10.M.2	

* 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 website later this year.