

Grade 10 Mathematics

SESSION 1

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



DIRECTIONS

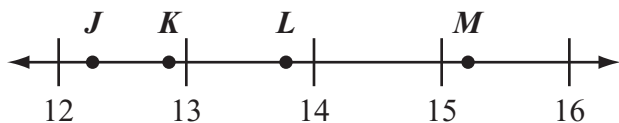
This session contains fourteen multiple-choice questions, four short-answer questions, and three open-response questions. Mark your answers to these questions in the spaces provided in your Student Answer Booklet.

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

$$x^6 \cdot x^2$$

- A. x^3
- B. x^4
- C. x^8
- D. x^{12}

- 2 Which point on the number line below is closest to the value of $\sqrt{152}$?



- A. point J
- B. point K
- C. point L
- D. point M

- 3 What is the value of the expression below?

$$\frac{1}{3} \cdot 6(4 + 9 + \sqrt{4 \cdot 9})$$

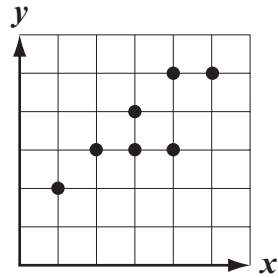
- A. 38
- B. 62
- C. 98
- D. 114

- 4 What is the smallest value of x that makes the inequality below true?

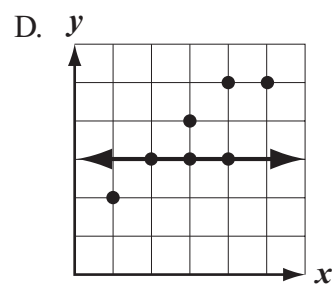
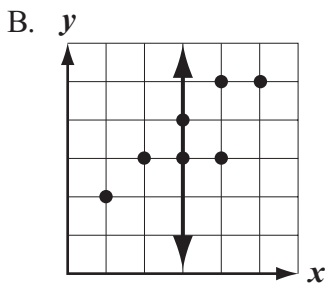
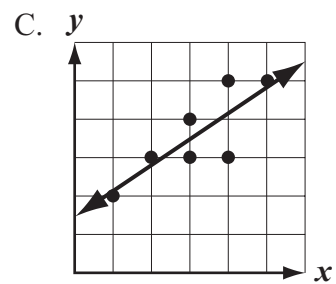
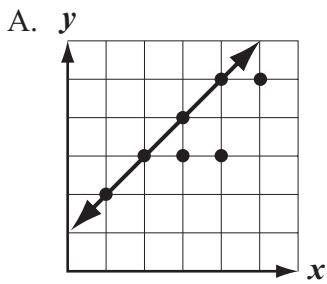
$$0.5x - 18 \geq -14$$

- A. 2
- B. 8
- C. 16
- D. 64

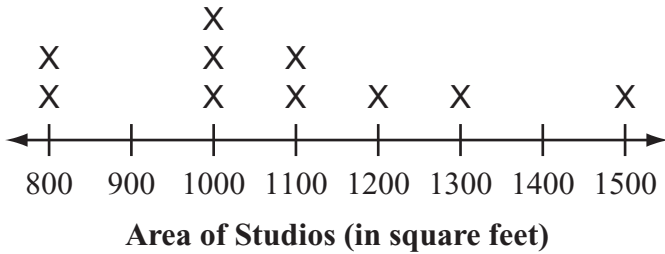
- 5 Carmen made the scatterplot shown below.



Which of the following shows the data in Carmen's scatterplot with a line of best fit?



- 6 The line plot below shows the area, in square feet, of each studio in an art center.



What is the mean area of the studios in the art center?

- A. 700 square feet
 - B. 1000 square feet
 - C. 1050 square feet
 - D. 1080 square feet
- 7 Which of the following is equivalent to the expression below?

$$(-0.4 - 2) + 1.3$$

- A. $1.3 - (0.4 - 2)$
- B. $(2 - 0.4) + 1.3$
- C. $1.3 + (-0.4 - 2)$
- D. $(-2 + 0.4) + 1.3$

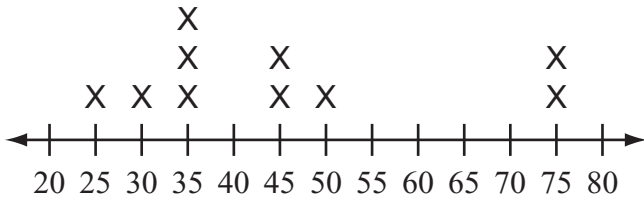
- 8 Which of the following expressions does **not** equal 0?

- A. $(6 - 2) - |2 - 6|$
- B. $(2 - 6) - |6 - 2|$
- C. $|6 - 2| - |2 - 6|$
- D. $|2 - 6| - |6 - 2|$

- 9 The volume of a cube is 231 cubic inches. Which of the following is closest to the length of each edge of the cube?

- A. 16 inches
- B. 15 inches
- C. 7 inches
- D. 6 inches

- 10 The line plot below shows the area, in square miles, of each town in a county.

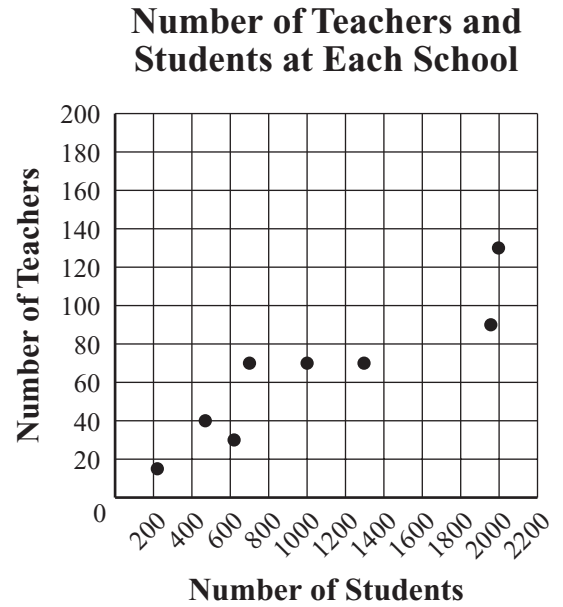


**Area of Each Town in a County
(in square miles)**

What is the median area, in square miles, of the towns in the county?

- A. 50
- B. 45
- C. 40
- D. 35

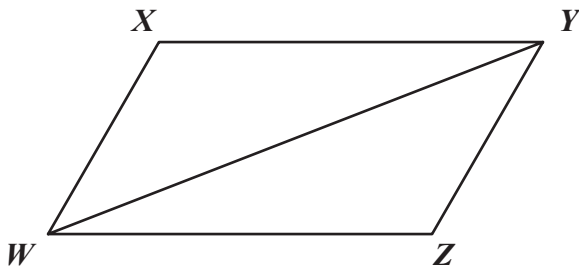
- 11 The scatterplot below shows the relationship between the number of teachers and the number of students at each school in one school district.



A new school for 1600 students will be built in the district. Based on the line of best fit for the scatterplot, which of the following is closest to the number of teachers that will work at the new school?

- A. 40
- B. 70
- C. 90
- D. 140

- 12 Parallelogram $WXYZ$ and diagonal \overline{WY} are shown in the diagram below.



Which of the following statements best proves that $\angle XWY \cong \angle ZYW$?

- A. If two parallel lines are cut by a transversal, then corresponding angles are congruent.
- B. If two parallel lines are cut by a transversal, then complementary angles are congruent.
- C. If two parallel lines are cut by a transversal, then alternate interior angles are congruent.
- D. If two parallel lines are cut by a transversal, then alternate exterior angles are congruent.

- 13 Mr. Thurman’s lawn is rectangular and has a width of 92 feet and a length of 147 feet. He is going to cover his entire lawn with grass seed.

One bag of grass seed costs \$53.47. The grass seed in one bag will cover an area of approximately 5000 square feet.

Which of the following estimates is closest to the total cost of the bags of grass seed Mr. Thurman will need to cover his lawn?

- A. \$100
- B. \$150
- C. \$200
- D. \$250

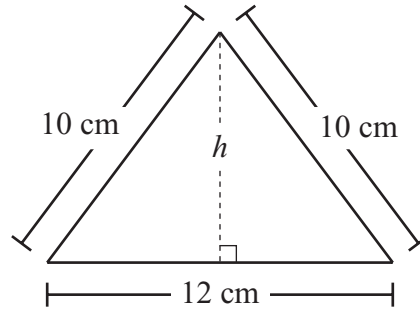
- 14 What is the value of x in the solution of the system of equations below?

$$\begin{aligned} 3x - 2y &= 6 \\ x + 2y &= 10 \end{aligned}$$

- A. 2
- B. 4
- C. 10
- D. 16

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 The diagram below shows a triangle and some of its measurements.



The triangle has an area of 48 square centimeters. What is h , the height, in centimeters, of the triangle?

- 16 What is the value of the expression below?

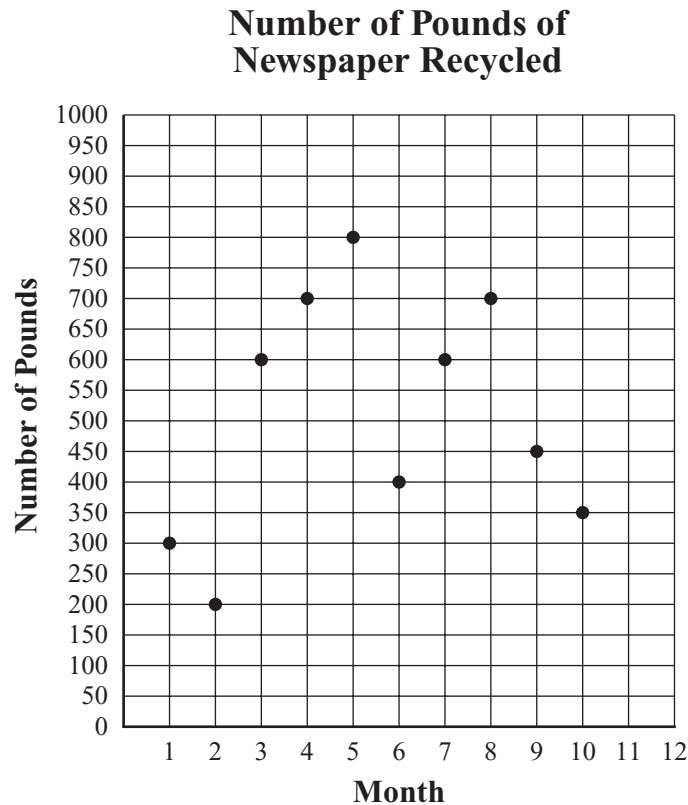
$$100 - 60 \div 4 \cdot 3$$

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 The scatterplot below shows the number of pounds of newspaper that a recycling club recycled per month for 10 months.



- What is the total number of months for which more than 500 pounds of newspaper was recycled per month?
- What is the range of the numbers of pounds of newspaper recycled per month for the 10 months? Show or explain how you got your answer.
- What is the median number of pounds of newspaper recycled per month for the 10 months? Show or explain how you got your answer.

During months 11 and 12, the club recycled a combined total of 600 pounds of newspaper. The range of the numbers of pounds of newspaper recycled per month for the 12 months is the same as the range for the 10 months.

- What is the median number of pounds of newspaper recycled per month for the 12 months? Show or explain how you got your answer.

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 What value of n makes the equation below true?

$$-2 \cdot n = n$$

- 19 What is the value of the expression below?

$$4|(-2)^3 - 1|$$

Questions 20 and 21 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 20 in the space provided in your Student Answer Booklet.

- 20** The table below shows the numbers of tickets **sold** for three professional baseball games at a stadium.

Baseball Game Ticket Sales

Day	Number of Tickets Sold
Friday	31,937
Saturday	28,359
Sunday	38,031

- a. **Estimate** the difference in the number of tickets sold for Friday’s game and the number of tickets sold for Sunday’s game. Show or explain how you got your estimate.

For Saturday’s game, the stadium ticket office sold 71.6% of the total number of tickets available.

- b. **Estimate** the total number of tickets that were available for Saturday’s game. Show or explain how you got your estimate.

The table below shows the prices of tickets that the stadium ticket office sells.

Prices of Tickets

Type of Ticket	Price
bleacher	\$11.25
pavilion	\$24.75
grandstand	\$53.75

An equal number of bleacher, pavilion, and grandstand tickets are available for each game.

- c. **Estimate** the average price, in dollars, of a ticket at the stadium. Show or explain how you got your estimate.
- d. Use your answer from part (c) to **estimate** the total amount of money, in dollars, the stadium ticket office received in ticket sales for the games on Friday, Saturday, and Sunday. Show or explain how you got your estimate.

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

- 21** A company packages barbeque sauce in two different-sized bottles, small and large. Although the label on each small bottle states that the bottle contains 18 ounces of sauce, the company allows a tolerance of plus or minus 0.25 ounce for the amount of sauce in each small bottle. In manufacturing, tolerance is the amount of error that is allowed in packaging a product.

- a. What is the maximum amount of sauce, in ounces, the company allows in each small bottle? Show or explain how you got your answer.

In the absolute-value inequality below, x represents the amount of sauce, in ounces, the company allows in each small bottle.

$$|x - 18| \leq 0.25$$

- b. Solve the absolute-value inequality. Show or explain how you got your answer.

The company also makes a large bottle of barbeque sauce.

- The label on the large bottle states that each bottle contains 24 ounces of sauce.
 - The minimum amount of sauce allowed in each large bottle is 23.55 ounces.
 - The maximum amount of sauce allowed in each large bottle is 24.45 ounces.
- c. What is the tolerance, in ounces, the company allows for the large bottle? Show or explain how you got your answer.
- d. Write an absolute-value inequality that represents y , the amount of sauce, in ounces, the company allows in the large bottle.

Grade 10 Mathematics

SESSION 2

You may use your reference sheet during this session.

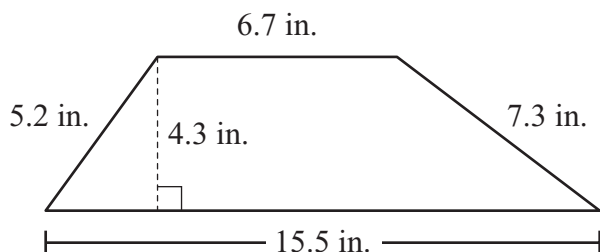
You may use a calculator during this session.



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 The diagram below shows a trapezoid and its dimensions.



What is the area of the trapezoid?

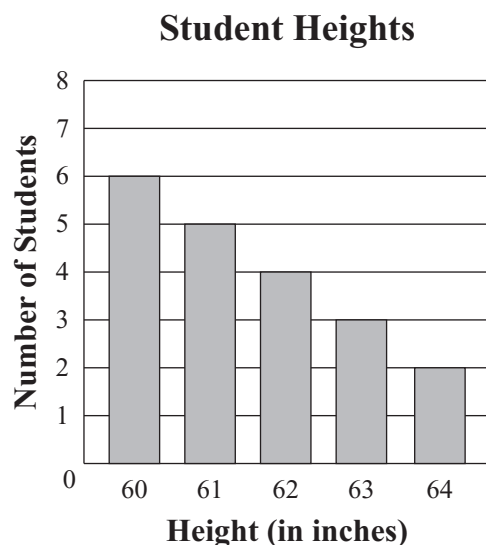
- A. 95.46 in.^2
- B. 57.72 in.^2
- C. 47.73 in.^2
- D. 34.70 in.^2

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

$$(6x - 4y + 9) + (-3x - 2y)$$

- A. $3x - 2y + 9$
- B. $3x - 6y + 9$
- C. $9x - 2y + 9$
- D. $9x - 6y + 9$

- 24 A teacher recorded the height of each student in a class. The bar graph below shows the number of students at each height.



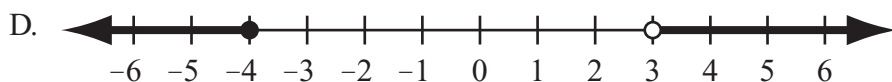
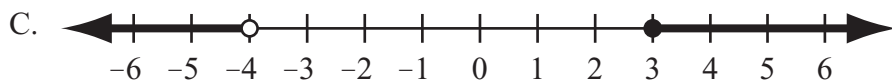
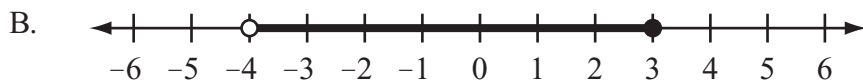
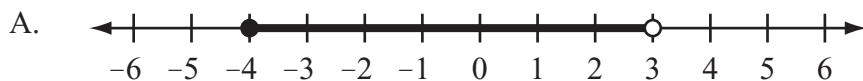
Which statement about the data in the bar graph is true?

- A. The mean is greater than the mode.
- B. The median is greater than the mean.
- C. The median is the middle number on the vertical axis.
- D. The mode is the largest number on the horizontal axis.

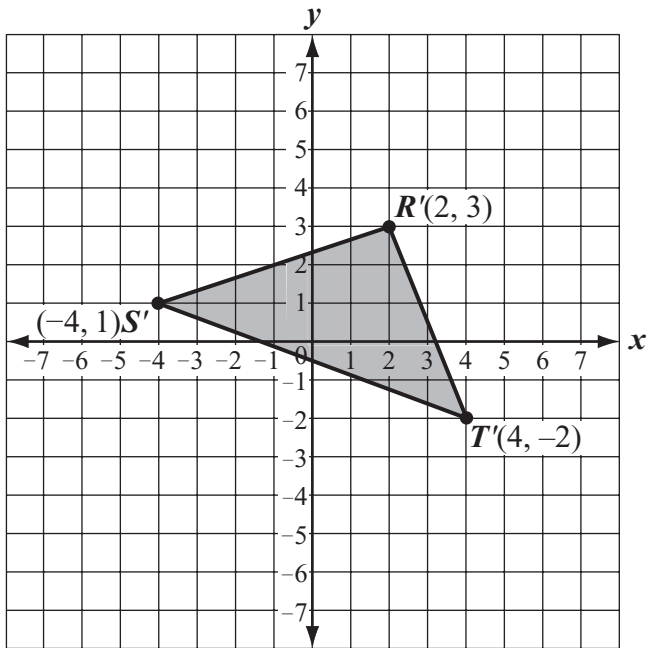
- 25 An inequality is shown below.

$$-2 < 2x + 6 \leq 12$$

Which of the following graphs represents the solution to the inequality?



- 26 Triangle $R'S'T'$ is shown on the coordinate grid below.



Triangle $R'S'T'$ is the image of triangle RST after triangle RST was translated 3 units to the right and 4 units up.

What were the coordinates of point R before the translation?

- A. (6, 6)
- B. (5, 7)
- C. (-2, 0)
- D. (-1, -1)

- 27 The table below shows the ranges of the numbers of miles that 14 different cars were driven between oil changes.

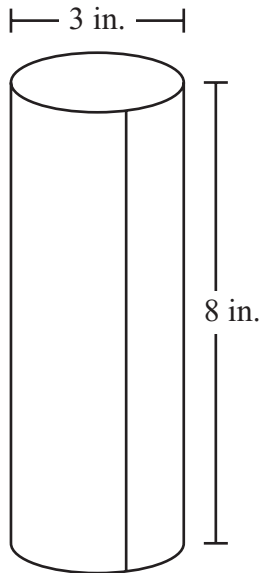
Miles Driven between Oil Changes

Range of Miles Driven	Number of Cars
1–2,000	2
2,001–4,000	5
4,001–6,000	4
6,001–8,000	2
8,001–10,000	1

Which of the following is the greatest possible median number of miles driven between oil changes?

- A. 10,000
- B. 7,000
- C. 6,000
- D. 5,000

- 28 The diagram below shows a piece of paper that has been rolled to form a right circular tube.



Based on the dimensions in the diagram, which of the following is closest to the lateral surface area of the outside of the tube?

- A. 75 sq. in.
- B. 82 sq. in.
- C. 151 sq. in.
- D. 207 sq. in.

- 29 Brooke rides her bicycle each day. On Monday, she rode the length of Maple Street in 0.4 hour at a constant speed of 15 miles per hour.

What is Brooke's constant speed if she rides the length of Maple Street on Tuesday in 0.3 hour?

- A. 21 miles per hour
- B. 20 miles per hour
- C. 11 miles per hour
- D. 6 miles per hour

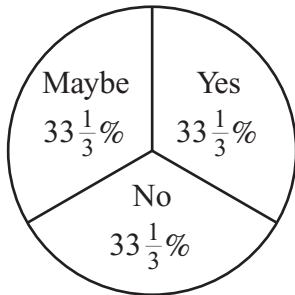
- 30 Suzanna surveyed some students to find out if they would attend the homecoming game. The table below shows the students' responses.

Homecoming Game Survey

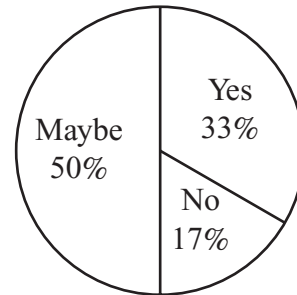
Student Response	Number of Students
yes	23
no	12
maybe	30

Which of the following circle graphs **best** represents the information in the table?

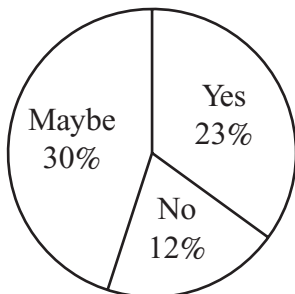
A. **Homecoming Game Survey**



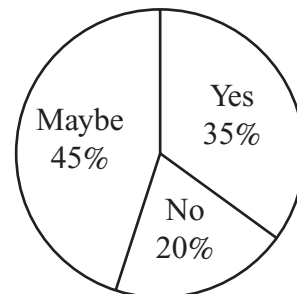
C. **Homecoming Game Survey**



B. **Homecoming Game Survey**



D. **Homecoming Game Survey**



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 Katya wants to earn \$1500 this summer by doing yard work. She plans on working 125 hours over the summer.

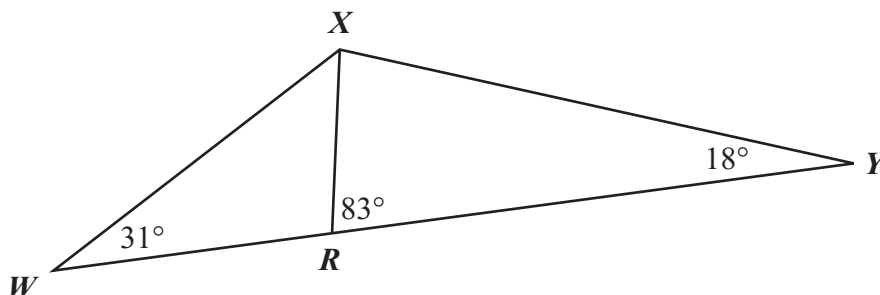
- a. Based on her plan, what is the rate, in dollars per hour, that Katya must charge customers for doing yard work to earn \$1500 over the summer? Show or explain how you got your answer.

Katya also wants to enroll in a summer class at a local college. As a result, she will have to work 50 hours less than the total number of hours she had originally planned.

- b. What is the rate, in dollars per hour, that Katya must charge customers for doing yard work to still earn \$1500? Show or explain how you got your answer.
- c. Write an equation that represents the relationship between x , the number of hours Katya will have to work, and y , the rate she must charge customers to earn \$1500.
- d. Explain how a change in x , the number of hours Katya will have to work, affects y , the rate she will have to charge customers to earn \$1500, in your equation from part (c).

Mark your answers to multiple-choice questions 32 through 40 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.

- 32 The diagram below shows $\triangle WXY$. Point R lies on \overline{WY} .



Based on the angle measures in the diagram, what is $m\angle WXR$?

- A. 52°
- B. 83°
- C. 97°
- D. 131°

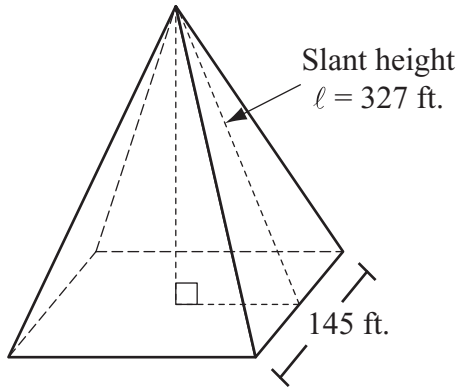
- 33 The first five terms of a geometric sequence are shown below.

$$-\frac{25}{2}, \frac{125}{4}, -\frac{625}{8}, \frac{3125}{16}, -\frac{15625}{32}, \dots$$

What is the common ratio of the sequence?

- A. $\frac{5}{2}$
- B. $\frac{2}{5}$
- C. $-\frac{2}{5}$
- D. $-\frac{5}{2}$

- 34 A right square pyramid and some of its dimensions are shown in the diagram below.



What is the lateral surface area of the pyramid?

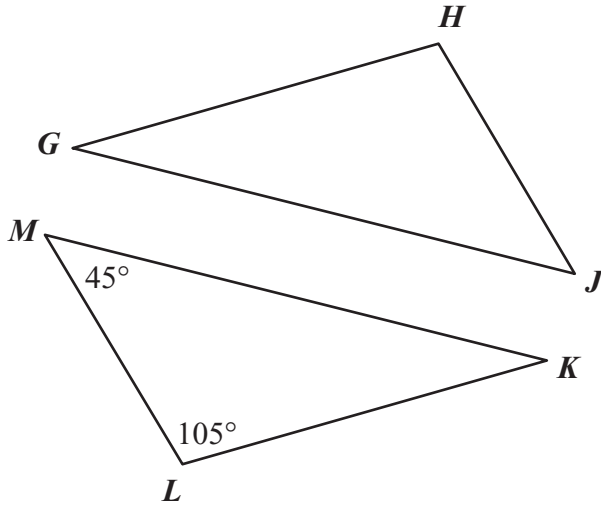
- A. 47,415 sq. ft.
- B. 68,440 sq. ft.
- C. 94,830 sq. ft.
- D. 115,855 sq. ft.

- 35 Which of the following is equivalent to the expression below for all positive values of x ?

$$\frac{x^2 + x - 6}{x^2 + 5x + 6}$$

- A. -1
- B. $-\frac{6}{11}$
- C. $\frac{x - 2}{x + 2}$
- D. $\frac{(x + 3)(x - 2)}{(x + 6)(x - 1)}$

- 36 Triangles GHI and KLM are congruent. The triangles and some of their angle measures are shown in the diagram below.



Based on the angle measures in the diagram, what is $m\angle JGH$?

- A. 30°
- B. 35°
- C. 40°
- D. 45°

- 37 The distance traveled by a student walking at a constant rate varies directly with the amount of time the student walks. The student walked $1\frac{2}{3}$ miles in $\frac{2}{3}$ hour.

Which of the following represents the relationship between d , the distance in miles walked by the student, and t , the amount of time in hours the student walked?

- A. $d = \frac{5}{2}t$
- B. $d = \frac{7}{3}t$
- C. $d = \frac{10}{9}t$
- D. $d = \frac{2}{5}t$

- 38 The diameter of a sphere is 30 centimeters. Which of the following is closest to the surface area of the sphere?

- A. 377 square centimeters
- B. 2,827 square centimeters
- C. 11,310 square centimeters
- D. 45,239 square centimeters

- 39 The table below shows the distances jumped by 6 Olympic gold medalists.

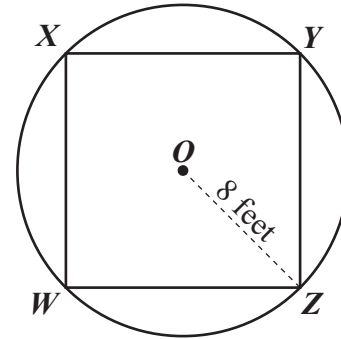
Distances Jumped by Gold Medalists

Gold Medalist	Distance (meters)
Frank Irons	7.48
Albert Gutterson	7.60
William Petersson	7.15
DeHart Hubbard	7.44
Ed Hamm	7.73
Ed Gordon	7.64

What was the median distance jumped by the gold medalists listed in the table?

- A. 7.30 meters
- B. 7.34 meters
- C. 7.51 meters
- D. 7.54 meters

- 40 Square $WXYZ$ is inscribed in circle O , which has a radius of 8 feet, as shown below.



Which of the following is closest to the length of \overline{WZ} ?

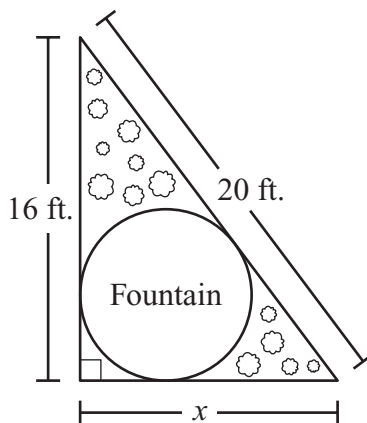
- A. 8.0 feet
- B. 11.3 feet
- C. 13.9 feet
- D. 16.0 feet

Questions 41 and 42 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 41 in the space provided in your Student Answer Booklet.

- 41 A flower bed in the shape of a right triangle has a circular fountain in it. The flower bed and some of its measurements are shown in the diagram below.



The perimeter of the flower bed is 48 feet.

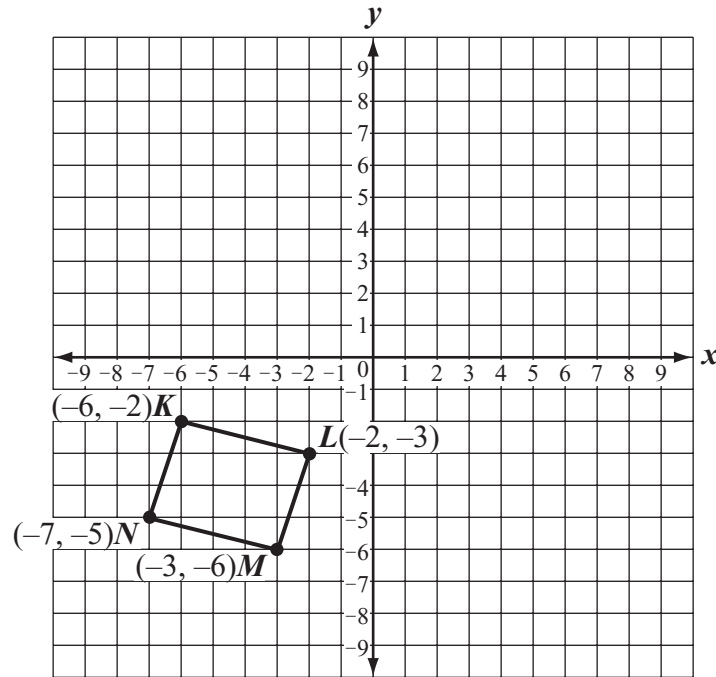
- What is x , the length in feet of the third side of the flower bed? Show or explain how you got your answer.
- What is the area, in square feet, of the flower bed, including the fountain? Show or explain how you got your answer.

The circumference of the fountain is 8π feet.

- What is the radius, in feet, of the fountain? Show or explain how you got your answer.
- What is the area, in square feet, of the flower bed, **not** including the fountain? Show or explain how you got your answer.

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

- 42 Quadrilateral $KLMN$ is shown on the coordinate grid below.



Copy the coordinate grid and quadrilateral $KLMN$ exactly as shown onto the grid in your Student Answer Booklet.

Quadrilateral $KLMN$ will be translated 9 units up.

- On your grid, draw quadrilateral $K'L'M'N'$, the image of quadrilateral $KLMN$ after it has been translated 9 units up. Be sure to label the vertices.

Quadrilateral $K'L'M'N'$ will be reflected over the y -axis.

- On your grid, draw quadrilateral $K''L''M''N''$, the image of quadrilateral $K'L'M'N'$ after it has been reflected over the y -axis. Be sure to label the vertices.
- Explain whether a 180° rotation of quadrilateral $KLMN$ about the origin would result in vertices with the same coordinates as $K''L''M''N''$.

Quadrilateral $K''L''M''N''$ will be rotated 90° clockwise about point M'' to create quadrilateral $K'''L'''M'''N'''$.

- What are the coordinates of point K''' ?

Grade 10 Mathematics
Spring 2013 Released Items:
Reporting Categories, Standards, and Correct Answers*

Item No.	Page No.	Reporting Category**	Standard**	Correct Answer (MC/SA)*	2000 Standard***
1	262	<i>Algebra and Functions</i>	8.EE.1	C	10.P.4
2	262	<i>Number and Quantity</i>	8.NS.2	A	10.N.3
3	262	<i>Number and Quantity</i>	7.EE.3	A	10.N.2
4	262	<i>Algebra and Functions</i>	A-REI.3	B	10.P.6
5	263	<i>Statistics and Probability</i>	S-ID.6	C	10.D.2
6	264	<i>Statistics and Probability</i>	6.SP.5	D	10.D.1
7	264	<i>Number and Quantity</i>	7.EE.3	C	10.N.1
8	264	<i>Number and Quantity</i>	7.NS.3	B	10.N.2
9	264	<i>Number and Quantity</i>	8.NS.2	D	10.N.3
10	265	<i>Statistics and Probability</i>	6.SP.5	C	10.D.1
11	265	<i>Statistics and Probability</i>	S-ID.6	C	10.D.2
12	266	<i>Geometry</i>	8.G.5	C	10.G.3
13	266	<i>Number and Quantity</i>	7.EE.3	B	10.N.4
14	266	<i>Algebra and Functions</i>	A-REI.6	B	10.P.8
15	267	<i>Geometry</i>	7.G.6	8 cm	10.M.1
16	267	<i>Number and Quantity</i>	7.EE.3	55	10.N.2
17	268	<i>Statistics and Probability</i>	S-ID.2		10.D.1
18	269	<i>Algebra and Functions</i>	A-REI.3	n = 0	10.P.6
19	269	<i>Number and Quantity</i>	7.NS.3	36	10.N.2
20	270	<i>Number and Quantity</i>	7.EE.3		10.N.4
21	271	<i>Algebra and Functions</i>	A-REI.3		10.P.6
22	272	<i>Geometry</i>	7.G.6	C	10.M.1
23	272	<i>Algebra and Functions</i>	A-APR.1	B	10.P.3
24	272	<i>Statistics and Probability</i>	6.SP.5	A	10.D.1
25	273	<i>Algebra and Functions</i>	A-REI.3	B	10.P.6
26	274	<i>Geometry</i>	G-CO.5	D	10.G.9
27	274	<i>Statistics and Probability</i>	S-ID.2	D	10.D.1
28	275	<i>Geometry</i>	7.G.6	A	10.M.2
29	275	<i>Algebra and Functions</i>	A-CED.1	B	10.P.7
30	276	<i>Statistics and Probability</i>	6.SP.4	D	10.D.1
31	277	<i>Algebra and Functions</i>	A-CED.2		10.P.7
32	278	<i>Geometry</i>	8.G.5	A	10.G.5
33	278	<i>Algebra and Functions</i>	F-BF.2	D	10.P.1
34	279	<i>Geometry</i>	7.G.6	C	10.M.2
35	279	<i>Algebra and Functions</i>	A-SSE.2	C	10.P.4
36	280	<i>Geometry</i>	G-SRT.5	A	10.G.4
37	280	<i>Algebra and Functions</i>	A-CED.2	A	10.P.7
38	280	<i>Geometry</i>	7.G.7	B	10.M.2
39	281	<i>Statistics and Probability</i>	6.SP.5	D	10.D.1
40	281	<i>Geometry</i>	G-SRT.6	B	10.G.6
41	282	<i>Geometry</i>	7.G.4		10.M.1
42	283	<i>Geometry</i>	G-CO.5		10.G.9

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

** The Reporting Category and Standard columns refer to the current (2011) curriculum framework for Mathematics. More information about reporting categories for Mathematics is available on the Department's website at <http://www.doe.mass.edu/mcas/tdd/math.html?section=testdesign>.

*** The Department is providing the standard from the previous (2000) curriculum framework for Mathematics for reference purposes.