

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 The first five terms in a quadratic sequence are shown below.

6, 9, 14, 21, 30, . . .

What is the next term in the sequence?

- A. 39
- B. 40
- C. 41
- D. 42

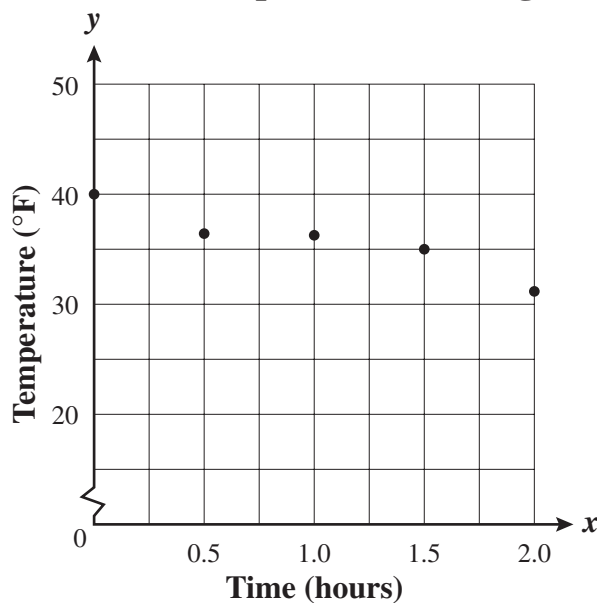
- 2 What is the value of the expression below?

$$\frac{15(4 + 8)}{2(2 + 1) - 1}$$

- A. 17
- B. 36
- C. 45
- D. 60

- 3 During the beginning of a recent storm, a weather broadcaster took temperature readings every half hour and plotted the data on the scatterplot below.

Storm Temperature Readings



Which of the following most closely approximates the equation of the line of best fit for the data?

- A. $y = -40x + 40$
- B. $y = -3x + 40$
- C. $y = 40x + 40$
- D. $y = 3x + 40$

- 4 Which of the following expressions has the **greatest** value?

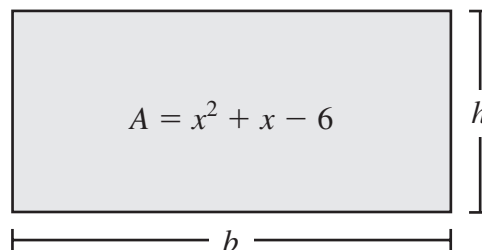
- A. $(6 + 6) \cdot 2 \div 3 - 1$
- B. $6 + 6 \cdot 2 \div 3 - 1$
- C. $6 + 6 \cdot 2 \div (3 - 1)$
- D. $6 + 6 \cdot (2 \div 3 - 1)$

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

$$(39 - 51)^3$$

- A. $|51 - 39|^3$
- B. $-(39 - 51)^3$
- C. $(51 - 39)^3$
- D. $-|39 - 51|^3$

- 6 A rectangle and an equation representing its area, A , are shown below.



Which of the following could represent b , the length of the base of the rectangle, and h , the height of the rectangle?

- A. $b = (x - 3); h = (x - 2)$
- B. $b = (x - 3); h = (x + 2)$
- C. $b = (x + 3); h = (x + 2)$
- D. $b = (x + 3); h = (x - 2)$

- 7 Laura correctly used a property of real numbers to calculate the exact value of the product shown below.

$$(840)(998)$$

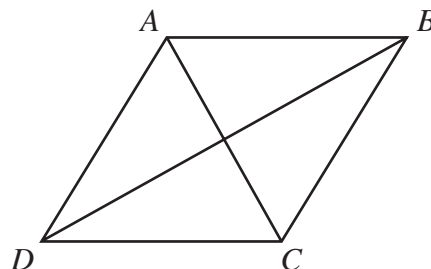
Which of the following demonstrates a property that Laura could have used?

- A. $(838)(1000)$
- B. $(838)(1000) + 2$
- C. $(840)(1000) - (840)(2)$
- D. $(840)(1000) - (2)(1000)$

- 8 Which of the following expressions has a value of 64?

- A. $(\sqrt[3]{64})^2$
- B. $(\sqrt[3]{64})^3$
- C. $(\sqrt[3]{64}) \div 3$
- D. $(\sqrt[3]{64}) \cdot 3$

- 9 Which of the following **must** be true for the rhombus shown below?



- A. $m\angle DAB = m\angle ABC$
- B. $m\angle DAB + m\angle ABC = 90^\circ$
- C. $m\angle DAC + m\angle BAC = 90^\circ$
- D. $m\angle DAC = m\angle BAC$

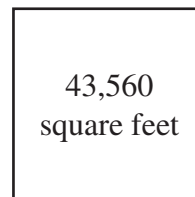
- 10 What is the value of the expression below?

$$|-10 + 6| - |3^2 - 5|$$

- A. -17
- B. -5
- C. 0
- D. 3

- 11 The town park is shaped like a square and has an area of 43,560 square feet, as shown below.

Town Park



The expression below can be used to find the length, in feet, of one side of the park.

$$\sqrt{43,560}$$

Which of the following is closest to the length of one side of the park?

- A. 100 feet
- B. 200 feet
- C. 300 feet
- D. 400 feet

- 12 Kara and Sonny went to see a movie at the local theater.
- Kara paid \$13.00 for 1 large box of popcorn and 2 large soft drinks.
 - Sonny paid \$8.50 for 1 large box of popcorn and 1 large soft drink.

In the system of equations below, p represents the cost of 1 large box of popcorn and s represents the cost of 1 large soft drink.

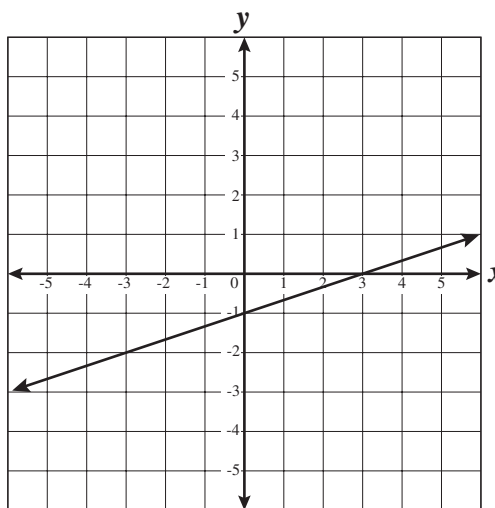
$$p + 2s = 13.00$$

$$p + s = 8.50$$

What is the value of p , the cost of 1 large box of popcorn?

- A. \$4.00
- B. \$4.25
- C. \$4.30
- D. \$4.50

- 13 A line is shown on the coordinate grid below.



Which of the following best represents an equation of this line?

- A. $y = -\frac{1}{3}x + 3$
- B. $y = -3x - 1$
- C. $y = \frac{1}{3}x - 1$
- D. $y = 3x + 3$

- 14 Cosmic Bowling Center has 100 bowling balls, and their weights range from 8 through 16 pounds. The frequency table below shows the number of balls by weight.

Number of Bowling Balls by Weight

Weight (pounds)	8	9	10	11	12	13	14	15	16
Number of Balls	13	4	9	3	10	2	18	17	24

What is the median weight per ball for the 100 bowling balls?

- A. 11 pounds
- B. 12 pounds
- C. 13 pounds
- D. 14 pounds

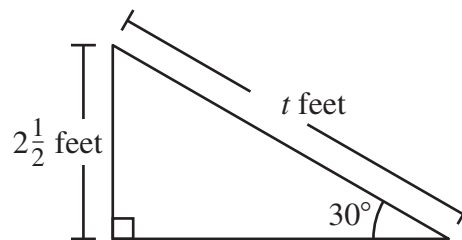
Questions 15 and 16 are short-answer questions. Write your answers to these questions in the boxes provided in your Student Answer Booklet. Do not write your answers in this test booklet. You may do your figuring in the test booklet.

- 15 What is the value of the expression below?

$$(8 - 4)^2 + 8 \div 4$$

- 16 Jeffrey wants to build a ramp to make it easier to load his lawn mower into the back of his truck. He drew the diagram below to help him design the ramp.

Jeffrey's Ramp Design



What is t , the length in feet of the ramp?

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** Ryan had \$800 of his summer job earnings remaining when school started. He plans to use this amount as spending money throughout the 10 months of his school year.
- Ryan will divide the \$800 into 10 equal amounts of \$80. If he completely spends \$80 during each month of his school year, how much of his earnings will remain at the end of the third month of his school year? Show or explain how you got your answer.
 - On the grid in your Student Answer Booklet, plot points with coordinates (x, y) in which x and y are defined as follows:
 - x = the number of months, in whole numbers, since school started, where $x = 0$ represents the start of the school year
 - y = the amount of Ryan's \$800 earnings that remains at the end of each month, assuming he completely spends \$80 each month of his school year

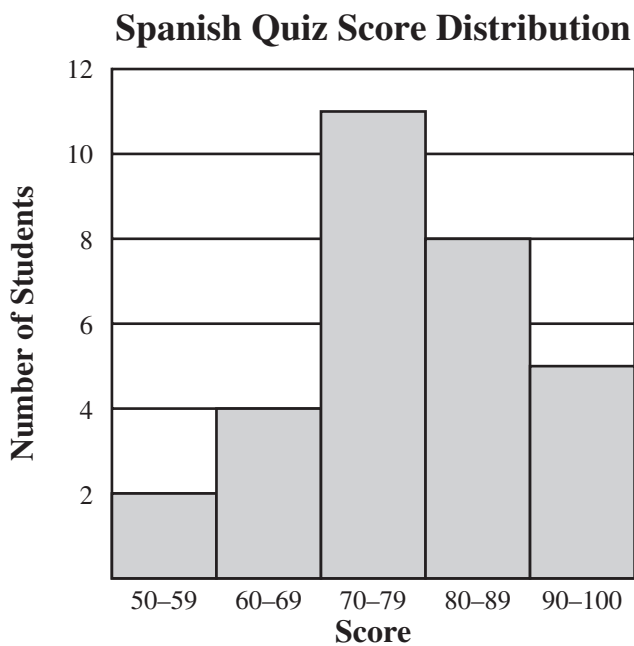
Be sure to label the x -axis and y -axis, indicate the scale on each axis, and include a title for your graph.

- Write an equation of the line that contains all of the points you plotted in part (b). Show or explain how you determined your equation.
- What is the **x -intercept** of the line represented by your equation in part (c)? Show or explain how you got your answer.
- Explain the meaning of the x -intercept you determined in part (d) in terms of the context of the problem.

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 The volume of Anand’s cube is 8 cubic centimeters. What is the total surface area, in square centimeters, of his cube?

- 19 Ms. Ruiz drew the histogram shown below on her board to display the score distribution for last week’s Spanish quiz.



What fraction of the students received a score of 70 or more?

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 Barry found the mistakes shown below when he checked his younger brother Rick's mathematics homework.

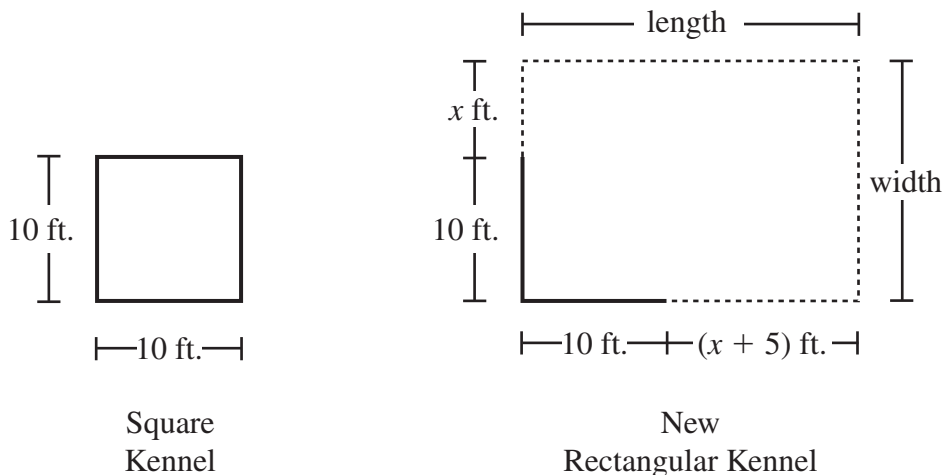
Rick's Homework Mistakes
Mistake A: $(x + y)^2 = x^2 + y^2$
Mistake B: $\frac{7w + z}{w} = 7 + z$
Mistake C: $n^2 + n + 1 = (n + 1)(n + 1)$

Barry explained that it would be possible to choose values for the variables, substitute them into Rick's equations, and show that the equations are **not** true.

- Barry asked his brother to let $x = 3$ and $y = 4$ and evaluate both sides of the equation in Mistake A.
 - What is the value of $(x + y)^2$ when $x = 3$ and $y = 4$? Show your work.
 - What is the value of $x^2 + y^2$ when $x = 3$ and $y = 4$? Show your work.
 - Use your calculations to explain Rick's mistake.
- In Mistake B, Rick divided incorrectly. Choose a value for w and a value for z and use them to show that $\frac{7w + z}{w}$ is **not** equal to $7 + z$. Show your work.
- In Mistake C, Rick factored incorrectly.
 - Choose a positive value for n and use it to show that $n^2 + n + 1$ is **not** equal to $(n + 1)(n + 1)$. Show your work.
 - Choose a negative value for n and use it to show that $n^2 + n + 1$ is **not** equal to $(n + 1)(n + 1)$. Show your work.

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

- 21 Mario keeps his dog in a kennel shaped like a square with 10-foot sides. He wants to increase the area of the square kennel by removing two sides of the square and adding fencing to make a new rectangular kennel. The dimensions of the square kennel and the new rectangular kennel are shown in the diagrams below.



- Write an expression in terms of x to represent the width, in feet, of the new rectangular kennel.
- Write an expression in terms of x to represent the length, in feet, of the new rectangular kennel.
- Use the expressions you wrote in part (a) and part (b) to write an equation for A , the area, in square feet, of the new rectangular kennel.
- Mario wants the new rectangular kennel to have an area of 300 square feet. If the value of A is 300 in the equation you wrote in part (c), what values of x will make the equation true? Show or explain how you got each of your answers.
- If the value of A is 300 in the equation you wrote in part (c), what should be the width and length, in feet, of Mario's new rectangular kennel? Show or explain how you got each of your answers.

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 Each year Jody receives a gift of money from her aunt. The amount is always equal to Jody's age that year, plus the amount of the gift she received the previous year, as shown in the table below.

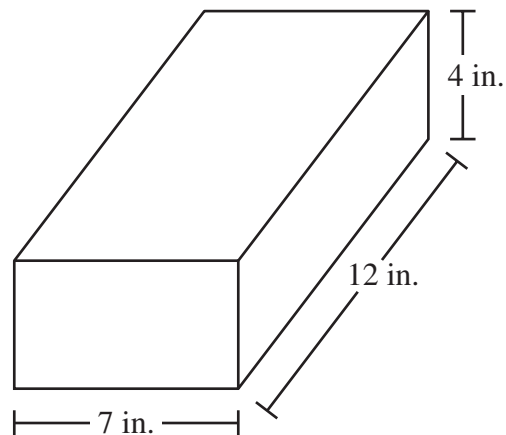
Jody's Gift from Her Aunt

Jody's Age (years)	1	2	3	4
Amount of Gift	\$1	\$3	\$6	\$10

If the pattern continues, what amount will Jody receive from her aunt when Jody's age is 8 years?

- A. \$36
- B. \$28
- C. \$21
- D. \$16

- 23 The diagram below shows a right rectangular prism that is 7 inches wide, 12 inches long, and 4 inches high.



What is the volume, in cubic inches, of the prism?

- A. 152
- B. 184
- C. 320
- D. 336

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

$$(x + 5)(2x - 3)$$

- A. $2x^2 + 7x - 15$
- B. $2x^2 - 7x - 15$
- C. $3x^2 + 7x - 15$
- D. $3x^2 - 7x - 15$

- 25 The stem-and-leaf plot below shows the prices, rounded to the nearest dollar, of 25 sweaters sold in the women’s department at a store.

**Sweater Prices
(in dollars)**

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

Key	
2 3	represents 23

What percent of the sweater prices are less than \$40?

- A. 17%
- B. 40%
- C. 50%
- D. 68%

- 26 Kevin used snowballs in the shape of a sphere to build a snowman. The radius of the largest snowball was 1.5 times the radius of the smallest snowball.

How many times greater was the volume of the largest snowball than the volume of the smallest snowball?

- A. 7.065
- B. 6.28
- C. 3.375
- D. 2.25

- 27 Shirley bought a newspaper every day for 40 weeks.

- Monday through Saturday, she paid \$0.35 each day for her newspaper.
- Each Sunday, she paid \$1.00 for her newspaper.

What total amount of money did Shirley pay for her newspapers during the 40-week period?

- A. \$42.10
- B. \$124.00
- C. \$242.10
- D. \$324.00

- 28 A square has a side of length 12 centimeters. Which of the following is closest to the length of a diagonal of the square?

- A. 12 cm
- B. 17 cm
- C. 21 cm
- D. 24 cm

- 29 The first four terms in a sequence, and the rules that define them, are shown below.

$$a_1 = 4$$

$$a_2 = 2a_1 + 3$$

$$a_3 = 2a_2 + 3$$

$$a_4 = 2a_3 + 3$$

What is the value of a_4 , the fourth term shown in the sequence above?

- A. 25
- B. 35
- C. 41
- D. 53

- 30 A local car dealership has 100 vehicles on its lot. The chart below shows the numbers of cars, vans, and trucks, both new and used.

Vehicles at Dealership

	Number of Cars	Number of Vans	Number of Trucks
New	4	7	9
Used	36	21	23

Based on the chart, what percent of the 100 vehicles are either new cars or new trucks?

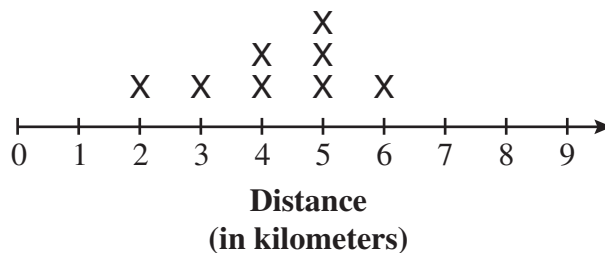
- A. 11%
- B. 13%
- C. 20%
- D. 59%

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** Julie is training for a 5-kilometer race. She plotted the distances she ran for each of her first 8 training runs on the line plot below.



- a. Determine each of the following for this data set. Show or explain how you got each of your answers.
- mean
 - median
 - mode

Julie still has 2 training runs remaining before the race. She wants to run a distance of 7, 8, or 9 kilometers for each of the remaining runs.

- b. What distances, in kilometers, could Julie run for her 2 remaining training runs so that the mean of the distances for all 10 training runs is 5 kilometers? Show or explain how you got your answers.
- c. Using your answers from part (b), determine the following for the data set that includes the distances of all 10 training runs. Show or explain how you got each of your answers.
- median
 - mode

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 Rectangle $ABCD$ is similar to rectangle $EFGH$.
- The length of each side of rectangle $EFGH$ is 2.4 times the length of the corresponding side of rectangle $ABCD$.
 - The perimeter of rectangle $ABCD$ is 120 feet.

What is the perimeter of rectangle $EFGH$?

- A. 288 feet
- B. 345.6 feet
- C. 576 feet
- D. 691.2 feet

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

$$(7a^2 + 5a + 3) + (-3a^2 + 2a - 4)$$

- A. $4a^2 + 7a - 1$
- B. $4a^2 + 7a + 1$
- C. $-4a^2 + 7a - 1$
- D. $-4a^2 + 7a + 1$

- 34 When Mr. Lee purchased his car, it had a value of \$15,000. In each of the first 2 years after he purchased it, its value decreased by 10% of the previous year's value, as shown in the table below.

Decrease in Value of Mr. Lee's Car

Number of Years After Purchase	Value of Car
0	\$15,000
1	\$13,500
2	\$12,150
3	?

If the value of Mr. Lee's car continues to decrease each year by 10% of the previous year's value, what will be the value of his car 3 years after he purchased it?

- A. \$1,215
- B. \$4,500
- C. \$10,500
- D. \$10,935

- 35 Which of the following properties of real numbers is demonstrated by the equation below?

$$a(x + y) = ax + ay$$

- A. associative property of addition
- B. commutative property of addition
- C. inverse property of addition
- D. distributive property

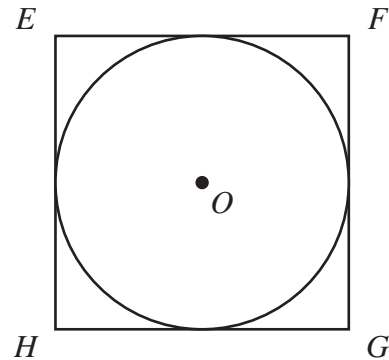
- 36 The coordinates of four points are given below.

$$\begin{array}{ll} A(3, 3) & A'(-3, 3) \\ B(4, -4) & B'(4, 4) \end{array}$$

Which of the following transformations maps \overline{AB} to $\overline{A'B'}$?

- A. reflection across the x -axis
- B. reflection across the y -axis
- C. 90° counterclockwise rotation about the origin
- D. 180° counterclockwise rotation about the origin

- 37 Circle O is inscribed in square $EFGH$, as shown below.



The circumference of circle O is 20 centimeters. Which of the following is closest to the perimeter of square $EFGH$?

- A. 24 cm
- B. 25.5 cm
- C. 27 cm
- D. 28.5 cm

- 38 A glass lampshade is in the shape of a right circular cone with radius, r , and slant height, ℓ , as given below.

$$r = 7.5 \text{ inches}$$

$$\ell = 12.5 \text{ inches}$$

Which of the following is closest to the lateral surface area of the lampshade?

- A. 236 sq. in.
- B. 295 sq. in.
- C. 412 sq. in.
- D. 589 sq. in.

- 39 A polygon was drawn on a piece of paper.

- Each of its interior angles has the same measure.
- The sum of the measures of its interior angles is 360° .

Which of the following could be the polygon?

- A. a rectangle
- B. a regular hexagon
- C. a regular pentagon
- D. an equilateral triangle

- 40 The years of canoeing experience for each of 30 people who plan to go on a canoe trip are shown in the table below.

Years of Canoeing Experience

Number of Years	Number of People
Less than 3	9
3 through 6	12
More than 6 but less than 9	3
9 or more	6

In a circle graph that correctly shows this data, what is the measure of the central angle of the sector labeled “9 or more”?

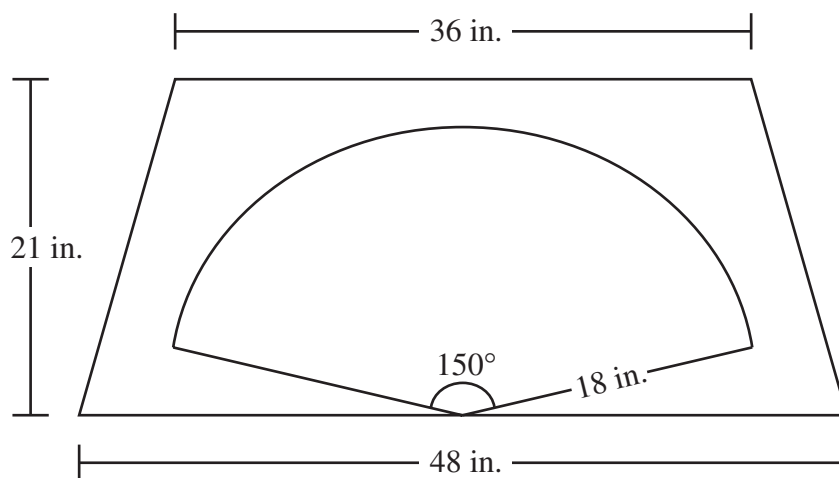
- A. 6°
- B. 20°
- C. 72°
- D. 108°

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** The rear window of Alex’s van is shaped like a trapezoid with an upper base measuring 36 inches, a lower base measuring 48 inches, and a height of 21 inches. An 18-inch rear window wiper clears a 150° sector of a circle on the rear window, as shown in the diagram below.

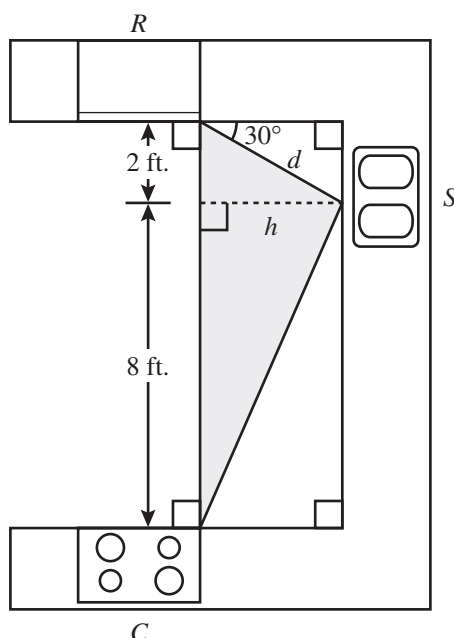


- a. What is the area, in square inches, of the entire trapezoidal rear window? Show or explain how you got your answer.
- b. What fractional part of a complete circle is cleared on the rear window by the 18-inch wiper? Show or explain how you got your answer.
- c. What is the area, in square inches, of the part of the rear window that is cleared by the wiper? Show or explain how you got your answer.
- d. What percent of the area of the entire rear window is cleared by the wiper? Show or explain how you got your answer.

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

- 42 The diagram below shows a kitchen floor plan. When architects design a kitchen, they often consider the distances between the following three major work locations shown in the diagram:
- the refrigerator, indicated by R
 - the sink, indicated by S
 - the cooking area, indicated by C

When these three locations are connected, a triangle known as the “Work Triangle” is formed. This is the area that has the highest amount of traffic in a kitchen. The shaded area in the diagram is the Work Triangle.



- a. What is d , the distance, in feet, along the side of the Work Triangle from the sink to the refrigerator? Show or explain how you got your answer.
- b. What is h , the height, in feet, of the Work Triangle? Show or explain how you got your answer.
- c. What is the area, in square feet, of the Work Triangle? Show or explain how you got your answer.