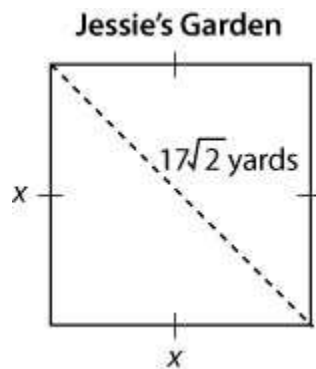


Directions: Answer the following question(s).

- 1 Let r be a rational number and s be an irrational number. Prove that the sum $r + s$ is an irrational number. Show all your steps.
- 2 The length, in millimeters, of each side of a square-shaped electronic chip is a rational number. Which statement is true about the length of the diagonal of the chip?
- A. The length of the diagonal is irrational since the length of the diagonal is the product of a rational number and an irrational number.
- B. The length of the diagonal is irrational since the length of the diagonal is the product of two rational numbers.
- C. The length of the diagonal is rational since the length of the diagonal is the product of a rational number and an irrational number.
- D. The length of the diagonal is rational since the length of the diagonal is the product of two rational numbers.
- 3 Brock claims that the circumference of a circle, $2\pi r$, where r is the radius of the circle, is always irrational because it is a multiple of π . Is his claim correct? Explain your answer.
- 4 The length of the diagonal of Jessie's garden is shown in the diagram below.



If Jessie's garden is shaped like a square, which of the statement is TRUE? (Note that the perimeter of the garden is measured in yards and the area in yards².)

- A. The perimeter and the area of Jessie's garden are both rational numbers.
- B. The perimeter and the area of Jessie's garden are both irrational numbers.
- C. The perimeter of Jessie's garden is a rational number, but the area of her garden is an irrational number.
- D. The perimeter of Jessie's garden is an irrational number, but the area of her garden is a rational number.

Directions: Answer the following question(s).

5 For all non-zero integers A , B , C , and D , $\frac{A}{B} + \frac{C}{D} = \frac{AD}{BD} + \frac{BC}{BD}$. Therefore, $\frac{A}{B} + \frac{C}{D} = \frac{(AD + BC)}{BD}$. Which sentence BEST describes this statement and conclusion?

- A. The sum of two rational numbers is rational.
- B. The sum of two irrational numbers is rational.
- C. The sum of two rational numbers is irrational.
- D. The sum of two irrational numbers is irrational.

6 An engineer is designing a cylinder-shaped structure using the formula shown below. As shown, an approximation of $\frac{22}{7}$ for π is used in the formula.

$$V = \frac{22}{7}r^2h$$

The engineer is considering using different values for r , the radius in meters, and h , the height in meters. Which pair of values makes V , the volume in cubic meters, an irrational number?

- A. $r = 3$ and $h = \sqrt{15}$
- B. $r = 3$ and $h = 6.54$
- C. $r = \sqrt{11}$ and $h = 6.54$
- D. $r = \sqrt{11}$ and $h = \sqrt{9}$

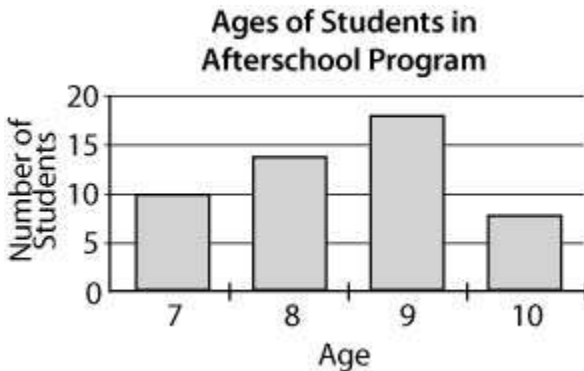
7 A square kitchen tile has an area of 20 inches². Explain how to find the exact perimeter of the tile, including appropriate units, and then discuss about whether this value is a rational or an irrational rational number. Show your work.

8 A square has an area of 2 cm².

- Explain how the perimeter of the square may be determined. Show your work.
- Is the perimeter of the square rational or irrational? Justify your answer.

Directions: Answer the following question(s).

- 9 Look at the bar graph below.



Which statement is an accurate interpretation of the scale of the graph?

- A. There were no more than 20 students in each age category.
- B. There were at least 10 students in each age category.
- C. There were more than 20 students in each age category.
- D. The numbers of students in each age category differed by at least 10.

- 10 While riding on a carousel, Angela travels a distance of 65 meters every 15 seconds. What is her speed in kilometers per hour?

- A. 3.9 km/hr
- B. 14.4 km/hr
- C. 15.6 km/hr
- D. 156.0 km/hr

- 11 It takes 6 gallons of water to fill a cooler. A leak developed in the bottom of the cooler when it was full, and 10 hours later it was empty. At what average rate in ounces per hour did the water leak from the cooler?

- A. 0.6
- B. 12.8
- C. 21.3
- D. 76.8

- 12 Jaden is in charge of building a dance floor for the school dance. He wants to build the largest dance floor that he can while staying within the budget. His plan is to buy wooden planks and lay them side by side on the grass just outside the gym. A plank that 2 inches thick, 4 inches wide, and 8 feet long costs \$3.25. How large of a dance floor, in square yards, can he build with \$526.50?

Directions: Answer the following question(s).

13 A scientist is going to measure how fast the height of a bamboo plant is increasing.

Select all the units the scientist could use to describe the rate.

- A. months
- B. inches
- C. weeks per inch
- D. inches per month
- E. centimeters per inch

14 The net force on an object is the product of the object's mass and its acceleration.

$$F = ma$$

- F = force, in Newtons (N)
- m = mass, in kilograms (kg)
- a = acceleration, in meters per square second (m/s^2).

An object has a mass of 3,000 g and an acceleration of 15 m/s^2 . What is the force on the object?

- A. 5 N
- B. 45 N
- C. 200 N
- D. 45,000 N

15 A certain exercise ball starts off with no air in it. The radius of the ball would become 37.5 centimeters when fully inflated with air. Which unit is the most appropriate for estimating the amount of air needed to fully inflate the ball?

- A. cubic meters
- B. meters
- C. cubic centimeters
- D. centimeters

Directions: Answer the following question(s).

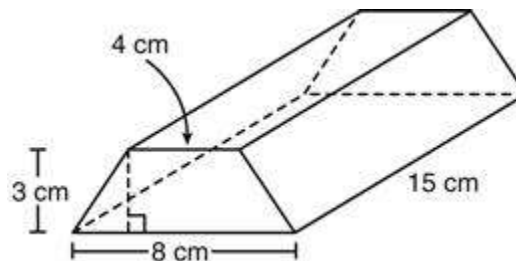
- 16 The graph shows how the amount Amanda earns each day depends on the number of hours she works.



What is the meaning of the point (0, 0) on the graph?

- A. If Amanda works 0 hours on a certain day, she earns \$0.
- B. If Amanda works 10 hours on a certain day, she earns \$160.
- C. Amanda earns \$0 per hour.
- D. Amanda earns \$16 per hour.

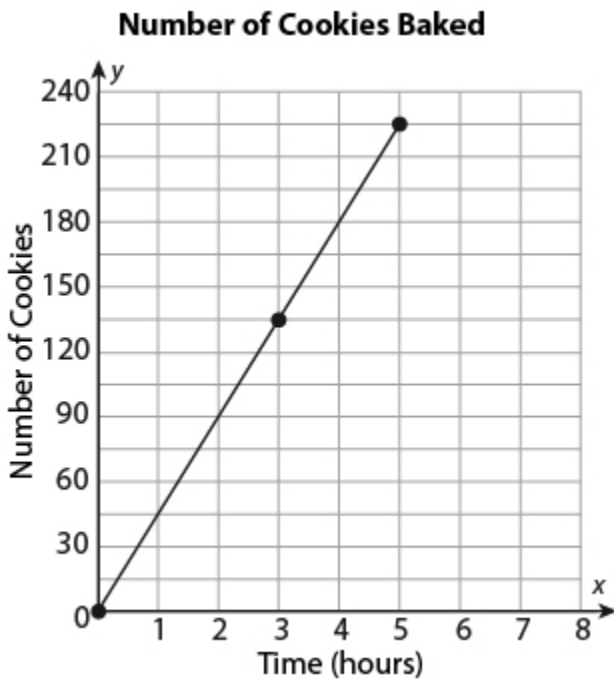
- 17 Which units of measure are appropriate for finding the surface area of the figure?



- A. square centimeters
- B. cubic centimeters
- C. centimeters
- D. millimeters

Directions: Answer the following question(s).

- 18 The graph below represents the number of cookies Tara can bake using 8 pounds of sugar over a period of time.



Which unit would be appropriate for the rate of change in the graph?

- A. $\frac{\text{cookies}}{\text{hour}}$
- B. $\frac{\text{hours}}{\text{cookie}}$
- C. $\frac{\text{cookies}}{\text{pound}}$
- D. $\frac{\text{pounds}}{\text{hour}}$

- 19 A toy train moves along its track at a rate of 132 feet per minute. What is this rate in miles per hour?

- A. 0.025 miles per hour
- B. 1.5 miles per hour
- C. 2.2 miles per hour
- D. 11 miles per hour

Directions: Answer the following question(s).

- 20** Ms. Glick drew two line segments on the chalkboard. The first line segment was 168 cm long and the other was 5 feet 2 inches long. If 1 inch = 2.54 cm, approximately how many inches longer was the first line segment than the second?
- A. 1 inch
B. 4 inches
C. 8 inches
D. 11 inches
- 21** There are 1,000,000 microseconds in a second. If the length of a day on a planet increases by 1,250 microseconds each year, by how much time, in seconds, will the length of a day on this planet increase in 25 centuries?
- A. 5.0 seconds
B. 3.125 seconds
C. 0.500 seconds
D. 0.3125 seconds
- 22** Lian is studying the effects of sugar water on pumpkin growth. She is growing 20 pumpkins, and she gives each pumpkin a different amount of sugar water each day. Lian plans to display her results in a scatter plot. Which is the most appropriate quantity to use on the y-axis of her scatter plot?
- A. weights of the pumpkins
B. number of pumpkins
C. number of days
D. percentage of sugar in the water
- 23** A scientist is conducting an experiment in which two chemicals are mixed together. During the experiment, the two chemicals react and change to form a new compound. The scientist makes a line graph to show the amounts of the original two chemicals present in the mixture during the course of the experiment.
- 10 grams of each substance are combined.
 - The chemical reaction is expected to be complete after 20 minutes.
 - The graph shows two lines, one for each chemical.
- Which quantities are best to use for the x- and y-axes of the graph?
- A. x = the time since the chemicals were mixed
y = the amount of the chemical present in the mixture
- B. x = the amount of the chemical present in the mixture
y = the time since the chemicals were mixed
- C. x = the amount of the first chemical present in the mixture
y = the amount of the second chemical present in the mixture
- D. x = the amount of the chemical present in the mixture
y = the total amount of the mixture

Directions: Answer the following question(s).

24 Two people in different towns drive to meet each other.

- The towns are 300 miles apart.
- The first person travels at a constant rate of 70 miles per hour.
- The second person travels at a constant rate of 50 miles per hour.
- Both people leave at the same time.

What distance has the first person driven when they meet?

- A. 120 miles
- B. 125 miles
- C. 175 miles
- D. 180 miles

25 Trayvon wants to find out if tomato plants produce more tomatoes when they are fertilized. He grows 5 plants with fertilizer and 10 plants without fertilizer, and plans to compare the results. Which is the most appropriate quantity to measure for each group of plants?

- A. the average number of pounds of tomatoes produced per plant
- B. the total number of pounds of tomatoes produced in each group
- C. the number of plants
- D. the total amount of fertilizer used

26 A city manager must predict the population growth of the city between the years 2000 and 2050 to make plans for new business expansions and housing developments. To determine the population growth, the city manager will use the formula $y = a(b)^x$. What do the variables in this formula represent?

- A. y represents the population of the city.
 x represents the year.
 b represents the population in the year 2000.
 a represents the growth rate.
- B. y represents the population of the city.
 x represents the time in years since the year 2000.
 b represents the growth rate.
 a represents the population in the year 2000.
- C. y represents the population of the city.
 x represents the time in years since the year 2050.
 b represents the number of new businesses and houses.
 a represents the population in the year 2050.
- D. y represents the population of the city.
 x represents 50 years.
 b represents the population in the year 2050.
 a represents the growth rate.

Directions: Answer the following question(s).

- 27 Delmond surveyed his classmates to determine the number of siblings each one has. He plans to display the results on a dot plot. What should each dot represent?
- A. one classmate
 - B. one sibling
 - C. the number of classmates
 - D. the number of siblings for each classmate
- 28 **A marine biologist will collect data regarding the length and weight of each of 50 trout caught and released at 5 different locations in a given lake. Which type of visual representation would BEST represent the marine biologist's data?**
- A. a bar graph comparing the largest trout caught at each of the 5 locations
 - B. a scatterplot comparing the length and weight of each trout regardless of location
 - C. a circle graph comparing the number of trout caught at each of the 5 locations
 - D. a scale drawing of all trout caught regardless of location
- 29 A truck tire rotates at 600 revolutions per minute when the truck is traveling at a speed of 110 kilometers per hour. Which equation could be used to determine C , the circumference in meters of the tire?
- A. $36,000C = 110,000$
 - B. $\frac{36,000}{C} = 110,000$
 - C. $110C = 600$
 - D. $\frac{110}{C} = 600$
- 30 Eva measures the mass of her pet lizard each month. She wrote this equation to describe her lizard's growth.

$$y = 0.6x + 4$$

In the equation, x represents the independent variable and y represents the dependent variable. Which of the following can be the quantities that x and y represent?

- A. x = the time in months, and y = the mass in grams
- B. x = the time in months, and y = the type of lizard
- C. x = the mass in grams, and y = the time in months
- D. x = the type of lizard, and y = the mass in grams

Directions: Answer the following question(s).

- 31 Thomas wants to know if his scores on math tests are affected by the amount of sleep he gets the night before. He plans to collect data and plot it on a scatter plot. Which quantities are the best choices for the x - and y -values of the points on his scatter plot?
- A. x = his total sleep time in hours, and y = his test score
 - B. x = his total sleep time in hours, and y = the time in minutes he spent on the test
 - C. x = his morning wake-up time, and y = his test score
 - D. x = his morning wake-up time, and y = the time in minutes he spent on the test

- 32 A university conducted a study of 1,000 of its students. These data were collected for the study:
- Current age of student
 - Number of classes taken in college
 - Current grade-point average in college
 - Entrance exam score

A scatter plot will be created using the data to predict future success in college for incoming students. Which are the best choices for the x - and y -values of the scatter plot?

- A. x = entrance exam score
 y = current grade-point average in college
- B. x = current grade-point average in college
 y = current age of student
- C. x = current age of student
 y = number of classes taken in college
- D. x = number of classes taken in college
 y = entrance exam score

Directions: Answer the following question(s).

- 33 The teacher of a carpentry class offers students extra credit if they can cut the most accurate piece of wood. Each student is only allowed to use a saw, a pencil, and a standard yardstick that includes measurements for inches and feet. The teacher believes that the best students should be accurate to within a fraction of the unit. Use your knowledge of the relationship between inches, feet, and yards to select *all* options that justify the teacher's belief.
- A. The standard yardstick is accurate to $\frac{1}{8}$ of an inch.
 - B. The standard yardstick is accurate to $\frac{1}{3}$ of a foot.
 - C. The standard yardstick is accurate to $\frac{1}{8}$ of a foot.
 - D. The standard yardstick is accurate to $\frac{1}{8}$ of a meter.
 - E. The standard yardstick is accurate to $\frac{1}{3}$ of an inch.
- 34 Which unit of measure provides the **MOST** accuracy when determining the time of a runner in the 100-meter race?
- A. hour
 - B. minute
 - C. second
 - D. hundredth of a second
- 35 To the nearest 0.1 ounce, a package of oatmeal weighs 13.0 ounces. What is the **LEAST** amount the package can actually weigh?
- A. 12.05 oz
 - B. 12.50 oz
 - C. 12.95 oz
 - D. 12.99 oz

Directions: Answer the following question(s).

- 36 This grocery scale is accurate to the nearest 0.1 pound.

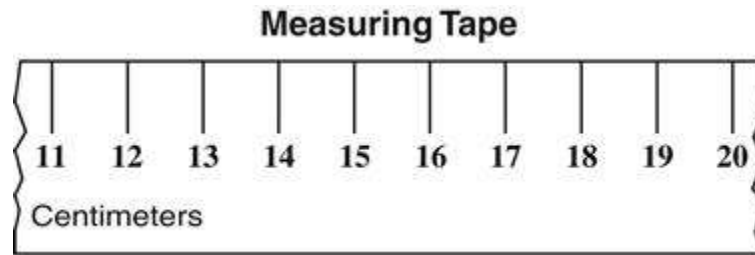


If bananas cost \$1.29 per pound, which best describes the range of possible costs for the bananas on the scale?

- A. \$3.03-\$3.16
- B. \$2.97-\$3.23
- C. \$3.05-\$3.15
- D. \$3.00-\$3.20

Directions: Answer the following question(s).

- 37 Four students in a class measured the length of a piece of cloth needed for a project. They used a measuring tape with scale increments like those shown.



The results of the student measurements are shown in the table.

Student Measurements

Student	Measurement
R	17 cm
S	17.2 cm
T	17.33 cm
U	17.45 cm

Which student's measurement is the MOST accurate to use, based on the measuring tape used?

- A. Student R
- B. Student S
- C. Student T
- D. Student U

- 38 A food manufacturer allows for a relative error of 0.05 in the diameter of its fruit pies. If the mean diameter of a pie is 23 centimeters, what are the maximum and minimum allowable diameters for the pies?

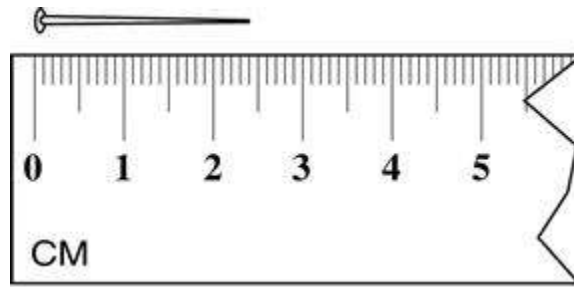
- A. 23.05 centimeters and 22.95 centimeters
- B. 23.115 centimeters and 22.885 centimeters
- C. 23.575 centimeters and 22.425 centimeters
- D. 24.15 centimeters and 21.85 centimeters

Directions: Answer the following question(s).

- 39 According to the manufacturer, the various engine belts on Jon's car should be $\frac{1}{2}$ inch wide with a tolerance of plus or minus $\frac{1}{16}$ inch. Which range describes all the acceptable belt-width measures?
- A. $\frac{1}{18}$ inch to $\frac{1}{14}$ inch
- B. $\frac{7}{16}$ inch to $\frac{1}{2}$ inch
- C. $\frac{7}{16}$ inch to $\frac{9}{16}$ inch
- D. $\frac{1}{2}$ inch to $\frac{9}{16}$ inch
- 40 An environmental committee is checking the relative error of a deforestation report about a rectangular plot of land. The area has reported dimensions of 100 km by 400 km with a relative error of 4% for both measurements. What is the relative error of the calculated area?
- A. 7.54 %
- B. 7.84 %
- C. 8.16 %
- D. 8.51 %
- 41 Eulalia walks 1,230 meters from her house to the post office. After mailing a letter, she turns on her pedometer and goes for a walk around town. When she returns home, her pedometer shows she has walked 5.0 km since leaving the post office. How should she record the total distance of her excursion? (Hint: Keep the precision of the pedometer in mind as you answer this question.)
- A. 6 km
- B. 6.2 km
- C. 6.23 km
- D. 6.230 km

Directions: Answer the following question(s).

- 42 A straight pin is shown next to a ruler below.



Which value is the **GREATEST** possible error for the measurement of the straight pin?

- A. 0.05 cm
- B. 0.10 cm
- C. 0.05 mm
- D. 0.10 mm

- 43 Given: j and l are nonzero rational numbers.
 k and m are irrational numbers.

Which statement is always true?

- A. The result of $j + l$ is an irrational number because the sum of any two rational numbers is irrational.
- B. The result of $k + m$ is a rational number because the sum of any two irrational numbers is rational.
- C. The result of $j + l$ is a rational number because the sum of any two rational numbers is rational.
- D. The result of $k + m$ is an irrational number because the sum of any two irrational numbers is irrational.

- 44 A city park, shaped like a square, has an area of 2 square miles. The city manager wishes to calculate the perimeter of the park. Which is the correct perimeter, and is this value rational or irrational?

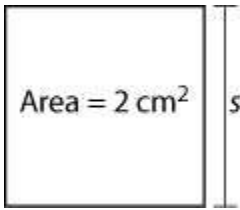
- A. $4\sqrt{2}$ miles, and this value is irrational
- B. $\sqrt{2}\sqrt{2}$ miles, and this value is rational
- C. $4\sqrt{2}$ miles, and this value is rational
- D. $\sqrt{2}\sqrt{2}$ miles, and this value is irrational

- 45 Which statement is **BEST** represented by $\left(\frac{A}{B}\right)\left(\frac{C}{D}\right) = \frac{AC}{BD}$ when A , B , C , and D are non-zero integers?

- A. The product of two rational numbers is rational.
- B. The product of two irrational numbers is rational.
- C. The product of two rational numbers is irrational.
- D. The product of two irrational numbers is irrational.

Directions: Answer the following question(s).

- 46 The area of the square shown is 2 square centimeters.



Which of the following describes $4s$, the perimeter of the square in centimeters?

- A. It is an irrational number, since s is irrational, and 4 times an irrational number is irrational.
- B. It is a rational number, since s is rational, and 4 times a rational number is rational.
- C. It is an irrational number, since s is rational, and 4 times a rational number is irrational.
- D. It is a rational number, since s is irrational, and 4 times an irrational number is rational.

- 47 Let C be a circle with radius $\sqrt{2}$. Which of the following statements is true?

- A. The area of C is a rational number because it is the product of 2, a rational number, and π , an irrational number.
- B. The area of C is an irrational number because it is the product of 2, a rational number, and π , an irrational number.
- C. The circumference of C is a rational number because it is the product of $2\sqrt{2}$, an irrational number, and π , an irrational number.
- D. The circumference of C is an irrational number because it is the product of $2\sqrt{2}$, a rational number, and π , an irrational number.

- 48 When these expressions are evaluated, which results in an irrational number?

- A. $\pi + 2$
- B. $10 - \sqrt{9}$
- C. $\frac{5\pi}{\pi}$
- D. $\frac{\sqrt{20}}{\sqrt{5}}$

Directions: Answer the following question(s).

- 49 Sally makes a rectangular banner for the upcoming baseball game. If its width is $(3 - \sqrt{2})$ feet and its length is $(5 + \sqrt{2})$ feet, which of these correctly describes the perimeter and the area of her banner?

(Note that she measures the perimeter in feet and the area in feet².)

- A. The perimeter of her banner is a rational number and the area is an irrational number.
- B. The perimeter of her banner is an irrational number and the area is a rational number.
- C. The perimeter and the area of her banner are both rational numbers.
- D. The perimeter and the area of her banner are both irrational numbers.

- 50 The area, A , of a trapezoid is given by $A = \frac{1}{2}(b_1 + b_2)h$, where b_1 and b_2 are the lengths of the parallel bases and h is the height, or altitude, of the trapezoid. If the altitude of a trapezoid is 0.1 m, and its upper and lower parallel bases measure 45 mm and 6 cm, respectively, what is the area of the trapezoid in cm²?

- A. 0.00525 cm²
- B. 52.5 cm²
- C. 525 cm²
- D. 5,250 cm²

Directions: Answer the following question(s).

- 51 The graph shows how the amount Amanda earns each day depends on the number of hours she works.



Which unit would be appropriate for the rate of change in the graph?

- A. $\frac{\text{amount earned}}{\text{hour}}$
- B. $\frac{\text{amount earned}}{\text{day}}$
- C. $\frac{\text{hours}}{\text{amount earned}}$
- D. $\frac{\text{days}}{\text{amount earned}}$

- 52 A small printing shop charges 15 cents to print each copy of a poster plus a flat fee of \$4.95 per order. Which equation models the cost in dollars of a printing order for posters?

- A. $y = 0.15x + 4.95$
- B. $y = 0.15 + 4.95x$
- C. $y = 15x + 4.95$
- D. $y = 15 + 4.95x$

- 53 Stephen washes dishes in a restaurant and places the washed dishes in a stack. Which of the following BEST describes the number of dishes that Stephen could stack at the restaurant?

- A. 1, 2, 3, 4, . . .
- B. 1, 2, 3, 4, . . . , 50
- C. all positive real numbers
- D. all real numbers between 1 and 50

Directions: Answer the following question(s).

- 54 An interior designer needs to estimate the volume of a chest of drawers for clothing. Which of these is the most reasonable estimate for the volume?

A. 8 ft^3
B. 30 ft^3
C. 160 ft^3
D. 198 ft^3

- 55 A student is comparing the population and land area of three different states. Complete the table by filling in the population density, in people per square mile. Round each value to the nearest whole.

Population	Land Area (sq. mi.)	Population Density
38,333,000	155,800	
26,488,000	261,200	
19,651,000	47,100	

- 56 An art student wants to make a mural from a small drawing. The student decides to make a grid, place it over the drawing, and then make a larger grid for the mural. Then the student would paint according to what was in the corresponding section of the smaller grid. The student uses a ruler that measures centimeters and inches to measure the length and width of the small grid in centimeters. The student sees that the width of each box extends to the first mark after 13 centimeters. Which is the *most* accurate measurement of the width of each small box in the grid?

A. 13.001 cm
B. 13.01 cm
C. 13.1 cm
D. 13 cm

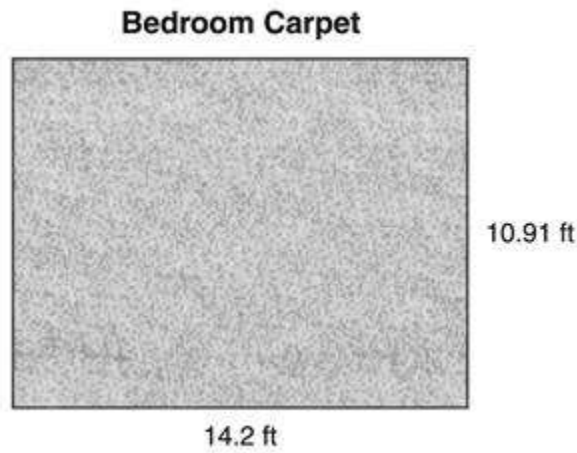
- 57 Melanie measured the length of the leg of a triangle to be 3.6 centimeters. What is the greatest possible error of the measurement?

A. 2.00 centimeters
B. 1.80 centimeters
C. 0.05 centimeter
D. 0.10 centimeter

- 58 Antoine is on vacation with his family. They have a vacation budget of \$ 1,400. Antoine predicts they will spend \$ 110 each night on the hotel, \$ 80 a day on food, and \$ 100 a day on activities. They will also spend \$ 120 on gasoline for the entire trip. Write an inequality to find how many nights, n , they can afford to stay on vacation. What is the longest vacation they can take?

Directions: Answer the following question(s).

- 59 Before ordering new carpet for a bedroom, the length and width of the old bedroom carpet was measured, as shown in the figure below.



What is the area of the carpet, to the highest level of precision possible based on the given measurements?

- A. 154.92 square feet
- B. 154.9 square feet
- C. 154.78 square feet
- D. 154 square feet

- 60 Sienna decides to buy a car. She has enough money saved up for the down payment on the car. The total cost of the car including taxes is \$4800. She pays \$500 down and then agrees to pay the balance over the next two years in 24 equal payments.

Sienna works part time at a bookstore and is paid \$12 for each hour she works. Her employer has agreed to let her work extra hours each month over the next two years to earn the additional money she will need for her car payment each month.

What is the approximate number of additional hours per month Sienna will have to work over the next two years in order to earn enough extra money to cover her monthly car payment?

- A. 180 hours per month
- B. 179.17 hours per month
- C. 15 hours per month
- D. 14.93 hours per month