1.

A biologist tracks the number of bacteria living in a water tank. The biologist used a function that represents the amount of a certain chemical solution that is added to the water.

- When the water has no chemicals, the number of bacteria (b) is 1200 per gallon.
- For each tablespoon of the chemical solution (c) added to each gallon of water, the number of bacteria decreases by 75 per gallon.

How much of the chemical, in tablespoons, must be added to a 500-gallon tank to reduce the bacteria count to a safe 300 bacteria per gallon?

2.

29   ☰

Samantha gathered the following information on a given day at the dog park.

- There are 32 dogs playing at the dog park.
- 15 of the dogs are puppies.
- 11 of the dogs are not puppies and have long hair.
- There are 6 more dogs that have long hair than dogs that do not have long hair.

Fill in the table completely to represent Samantha's data.

	Dogs That are Puppies	Dogs That are Not Puppies	Total
Dogs with Long Hair			
Dogs That Do Not Have Long Hair			
Total			

3.

Enter the y coordinate of the solution to this system of equations.

$-2x + 3y = -6$

$5x - 6y = 15$

4.

The ratios $a{:}b$ and $b{:}c$ are equivalent to one another.
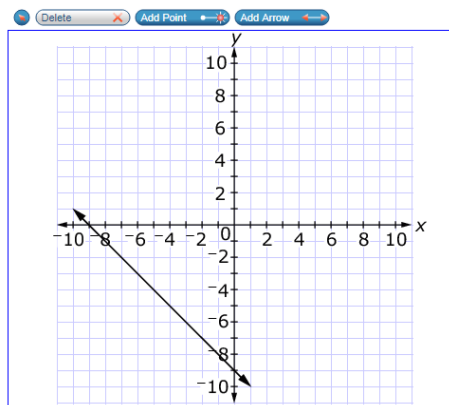
Select **all** the statements that must be true.

☐ $a = c$

☐ $\frac{b}{a} = \frac{c}{b}$

☐ $b - a = c - b$

☐ $a < b$ and $b < c$

☐ if $a = b$, then $b = c$

5.

The graph of $x + y = -9$ is shown.

Use the Add Arrow tool to graph the equation $y = 2x + 3$ on the same coordinate plane. Use the Add Point tool to plot the solution to this system of linear equations.
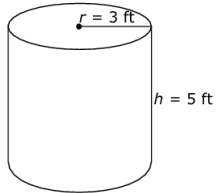
6.

Select **all** the equations that can be represented by a straight line when graphed on the coordinate plane.

☐ $\frac{1}{x}+y=9$

☐ $x=16+3y$

☐ $x=-2y^2+7$

☐ $8x-5y=30$

☐ $y=-6(x+10)$

☐ $y=x(3-x)+1$

7.

A cylinder with radius 3 feet and height 5 feet is shown.

$r = 3$ ft

$h = 5$ ft

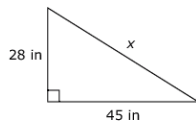Enter the volume of the cylinder, in cubic feet. Round your answer to the nearest hundredth.

8.

Jamal states that $ax + b = a(x + c)$, given a, b, and c are not equal to 0.

What must be the value of c for Jamal's statement to be true?

Ⓐ a

Ⓑ b

Ⓒ ac

Ⓓ $\frac{b}{a}$

9.

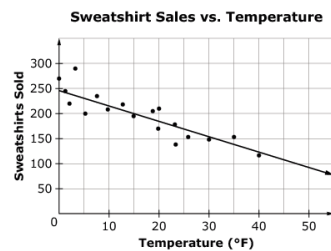A cross section of a ramp is shown.

28 in

x

45 in

The length of the base is 45 inches and the height of the ramp is 28 inches.

Enter the length, x, of the ramp in inches.

10.

This scatter plot shows the relationship between the number of sweatshirts sold and the temperature outside.

Sweatshirt Sales vs. Temperature
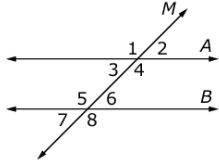
Sweatshirts Sold

Temperature (°F)

The y-intercept of the estimated line of best fit is at $(0, b)$. Enter the approximate value of the b in the first response box.

Enter the approximate slope of the estimated line of best fit in the second response box.

11.

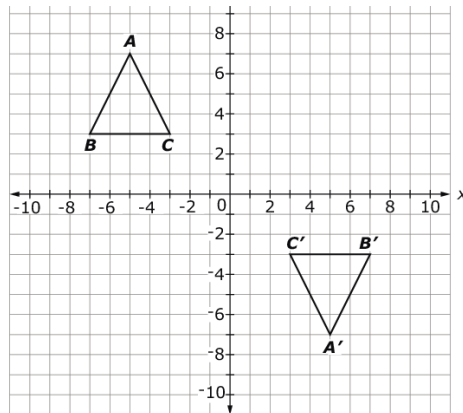Parallel lines A and B are cut by a transversal line M, as shown in the diagram.

The measure of $\angle 2$ is **less than** the measure of $\angle 4$.

For each comparison, select the symbol that makes the relationship between the first quantity and the second quantity true.

First Quantity	Comparison	Second Quantity
$m\angle 1$	< > =	$m\angle 6$
$m\angle 3 + m\angle 5$	< > =	$m\angle 7 + m\angle 8$

12.

Select True or False for each statement about the sequences of transformations that can verify that triangle ABC is congruent to triangle $A'B'C'$.

13.

Simone and Nang read a total of 23 books over the summer. Simone read 5 more books than Nang.

Enter the number of books Nang read.

14.

Marco says that the interior angles of a triangle add up to 180°. He claims that the interior angles of a hexagon must add up to 360° because a hexagon has twice as many vertices as a triangle and can be divided into two triangles. Therefore, its interior angles must sum to twice the value of those of a triangle.

Which statement, if any, explains Marco's error?

Ⓐ A hexagon does not have 6 vertices.

Ⓑ A hexagon can be divided into 4 triangles, not 2.

Ⓒ The interior angles of a triangle do not add up to 180°.

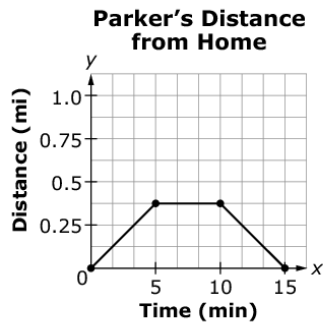Ⓓ Marco's statement is correct and contains no error.

15.

Mary is buying tickets for a movie.

- Each adult ticket costs $9.
- Each child ticket costs $5.
- Mary spends $110 on tickets.
- Mary buys 14 total tickets.

Enter the total number of adult tickets and total number of child tickets she buys.

16.

The graph shows Parker's distance from home over time.

Parker's Distance from Home

Based on the graph, determine whether each statement is true. Select True or False for each statement.

	True	False
Parker's distance from home is increasing between minute 1 and minute 4.	☐	☐
Parker's distance from home is constant between minute 6 and minute 7.	☐	☐
Parker's distance from home is increasing between minute 12 and minute 14.	☐	☐

17.

David and Karen have a goal to read 10,000 pages together by the end of summer.

- David reads 80 pages every day.
- Karen reads 25% more pages every day than David reads.

David and Karen agree that the model $180d = 10,000$ will tell them how many days it will take them to read 10,000 pages, together, by the end of summer.

They invite Rick to read with them to get to their goal faster. Rick reads 35% fewer pages per day than Karen.

Which equation can be used to find how many days it will take David, Karen, and Rick to read 10,000 pages, together, by the end of summer?

Ⓐ $232d = 10,000$

Ⓑ $245d = 10,000$

Ⓒ $288d = 10,000$

Ⓓ $315d = 10,000$

18.

Steven claims that when you multiply two powers with the same base, the new exponent is the product of the original exponents. He uses the example below to support his claim.

$3^2 \cdot 3^2 = 3^{(2 \cdot 2)} = 3^4$

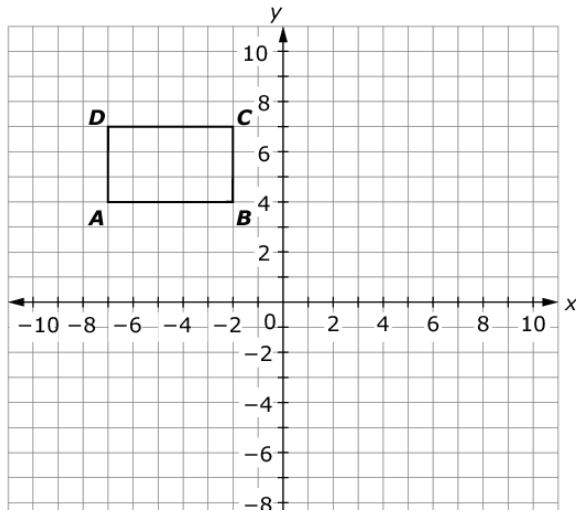Drag a number into each box to create an equation that shows Steven's claim is incorrect.

0
1
2
3
4
5
6
7
8
9

Delete ✕

$3^{\square} \cdot 3^{\square} = 3^{\square}$

19.

Rectangle *ABCD* is rotated by 90 degrees clockwise about the origin and then translated 3 units left and 2 units down to form *A'B'C'D'*.

20.

Which table of values can be defined by the function $y = 4x - 2$?

21.

Sally is solving the linear equation $13 + 4x - 9 = 7x + 7 - 3x$. Her final two steps are:

$4 + 4x = 4x + 7$

$4 = 7$

Select the statement that correctly interprets Sally's solution.

Ⓐ The solution is $x = 0$.

Ⓑ The solution is the ordered pair $(4, 7)$.

Ⓒ There is no solution since $4 = 7$ is a false statement.

Ⓓ There are infinitely many solutions since $4 = 7$ is a false statement.

22.

A leaf falls 18 feet from a branch to the ground at a rate of 5 feet every 2 seconds.

Determine whether each statement about the leaf is true. Select True or False for each statement.

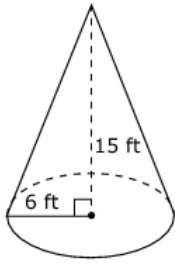|	True	False
The initial height of the leaf is 18 feet.	■	☐
The leaf falls at a rate of $\frac{2}{5}$ foot every 1 second.	☐	☐
The leaf is 3 feet above the ground after 6 seconds.	☐	☐

23.

The ratios *a:b* and *b:c* are equivalent to one another.

Select **all** the statements that must be true.

☐ $a = c$

☐ $\frac{b}{a} = \frac{c}{b}$

☐ $b - a = c - b$

☐ $a < b$ and $b < c$

☐ if $a = b$, then $b = c$

24.

A cone with radius 6 feet and height 15 feet is shown.

Enter the volume, in cubic feet, of the cone. Round your answer to the nearest hundredth.

25.

There are a total of 500 students in grades 1 through 5 in an elementary school.

- 17% of the total number of students are in 1st grade.
- 19% of the total number of students are in 4th grade.
- The number of 3rd-grade students is 9 less than the number of 4th-grade students.
- The number of 2nd-grade students is 10 less than the number of 5th-grade students.

Complete the table to show the number of students in each grade. Enter your answers in the table.

Elementary School Students

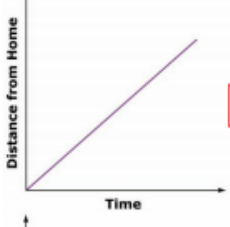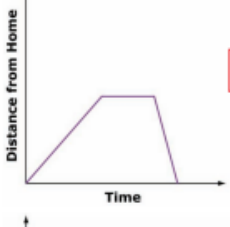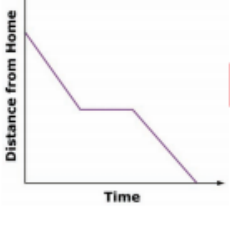| Grade	Number of Students
1st	
2nd	
3rd	
4th	
5th	

26.

Fill in each x-value and y-value in the table below to create a relation that is **not** a function.

x	y

27.

A. Maria walks from school to her friend's house. She visits her friend for a while. Then she walks the rest of the way home.

B. Maria walks from home to school at a constant rate.

C. Maria starts to walk from home to school. She stops to see whether she has her homework. She realizes she forgot her homework and runs back home to get it.

D. Maria walks from school to home at a constant rate.

28.

Right triangle *ABC* and right triangle *ACD* overlap as shown below. Angle *DAC* measures 20º and angle *BCA* measures 30º.
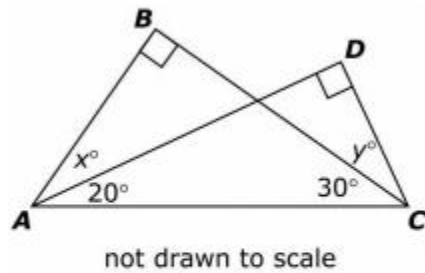
not drawn to scale

What are the values of x and y?

x = [   ] degrees   y = [   ] degrees

29.

In right triangle *ABC*, side *AC* is longer than side *BC*. The boxed numbers represent the possible side lengths of triangle *ABC*.

B

7	8
15	17
18	20
24	25

A   **C**

not drawn to scale

Identify three boxed numbers that could be the side lengths of triangle *ABC*. Enter the number you chose to represent the length of each side.

1a.   *BC* = ☐
1b.   *AC* = ☐
1c.   *AB* = ☐

30.

Juan needs a right cylindrical storage tank that holds between 110 and 115 cubic feet of water.

Using whole numbers only, provide the radius and height for 3 different tanks that hold between 110 and 115 cubic feet of water.

Tank #1   Tank #2   Tank #3

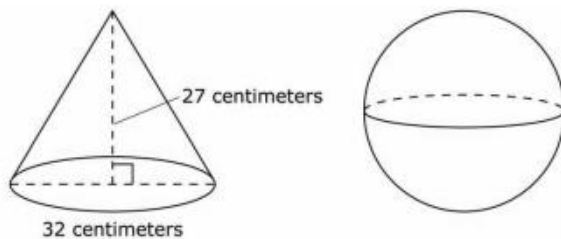radius = ☐ ft.   radius = ☐ ft.   radius = ☐ ft.

height = ☐ ft.   height = ☐ ft.   height = ☐ ft.

31.

This cone and sphere have equal volumes.

27 centimeters

32 centimeters

not drawn to scale

What is the radius of the sphere?   ☐ Centimeters

32.

3908 Nyx is an asteroid between Mars and Jupiter. Let d represent the approximate distance from 3908 Nyx to the Sun.

The average distance from Venus to the Sun is about 7×10^7 miles. The average distance from Jupiter to the Sun is about 5×10^8 miles.

At a certain time of year, the square distance from 3908 Nyx to the Sun is equal to the product of the average distance from Venus to the Sun and the average distance from Jupiter to the Sun. This equation can be used to find the distance from 3908 Nyx to the Sun, d, at this time of year.

$$d^2 = (7\times10^7)(5\times10^8)$$

Solve the equation for d. Round your answer to the nearest million.

$d =$ [   ] miles

33.

Part A

Based on the examples, what is the cost of each shirt, **not** including the one-time design fee?

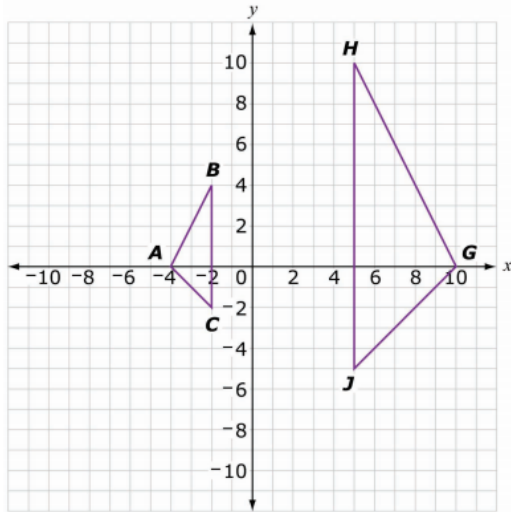$ [   ]

Explain how you found your answer.

Part B

What is the cost of the one-time design fee?

$ [   ]

Explain how you found your answer.

34.

A transformation is applied to △*ABC* to form △*DEF* (not shown).
Then, a transformation is applied to △*DEF* to form △*GHJ*.

Part A

Graph △*DEF* on the *xy*-coordinate plane.

Part B

Describe the transformation applied to △*ABC* to form △*DEF*

Part C

Describe the transformation applied to △*DEF* to form △*GHJ*

Part D

Select one statement that applies to the relationship between △*GHJ* and △*ABC*.

☐ △*GHJ* is congruent to △*ABC*.
☐ △*GHJ* is similar to △*ABC*.
☐ △*GHJ* is neither congruent nor similar to △*ABC*.

Explain your reasoning.

35.

Samir was assigned to write an example of a linear functional relationship. He wrote this example for the assignment.

> The relationship between the year and the population of a county when the population increases by 10% each year

Part A

Complete the table below to create an example of the population of a certain county that is increasing by 10% each year.
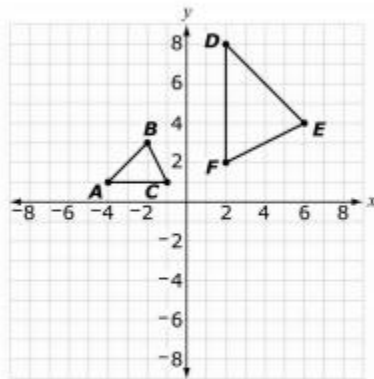
Year	Population of a Certain County
0	
1	
2	
3	
4	

Part B

State whether Samir's example represents a linear functional relationship. Explain your reasoning.

36.

Triangles *ABC* and *DEF* are shown on this coordinate grid.

Describe a sequence of transformations that verify that these triangles are geometrically similar.

37.

A student made this conjecture about reflections on an *xy* coordinate plane.

> When a polygon is reflected over the *y*-axis, the *x*-coordinates of the corresponding vertices of the polygon and its image are opposite, but the *y*-coordinates are the same.

Develop a chain of reasoning to justify or refute the conjecture. You must demonstrate that the conjecture is always true or that there is at least one example in which the conjecture is not true. You may include one or more graphs in your response.

To include a graph to support your reasoning, put your cursor where you want the graph to be, and then click the Graph icon to insert a graph.

38.

Students in a class are using their knowledge of the Pythagorean theorem to make conjectures about triangles. A student makes the conjecture shown below.
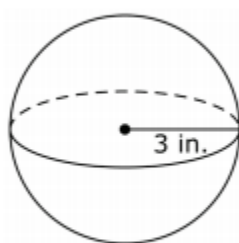
A triangle has side lengths x, y, and z. If $x < y < z$ and $x^2 + y^2 < z^2$, the triangle is an obtuse triangle.

Use the Pythagorean theorem to develop a chain of reasoning to justify or refute the conjecture. You must demonstrate that the conjecture is always true or that there is at least one example in which the conjecture is not true.
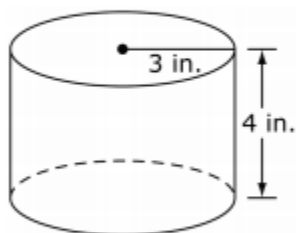
39.

Part A

This sphere has a 3-inch radius.

3 in.

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

Volume = [ ] cubic inches

Part B

This right cylinder has a radius of 3 inches and a height of 4 inches.

3 in.

4 in.

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

Volume = [ ] cubic inches

Part C

Lin claims that the volume of any sphere with a radius of r inches is always **equal** to the volume of a cylinder with a radius of r inches and a height of h inches, when $h = \dfrac{4}{3}r$.

Show all work necessary to justify Lin's claim.

40.

Part A

Triangle *STV* has sides with lengths of 7, 11, and 14 units. Determine whether this triangle is a right triangle.
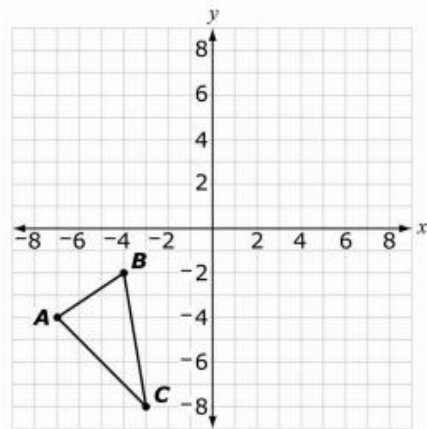
Show all work necessary to justify your answer.

Part B

A right triangle has a hypotenuse with a length of 15. The lengths of the legs are whole numbers. What are the lengths of the legs?

41.

Triangle *ABC* is shown on this coordinate grid.

Part A

△*ABC* is rotated 180 degrees clockwise about the origin to form △*DEF*. What are the coordinates of the vertices of △*DEF* ?

D(☐,☐)   E(☐,☐)   F(☐,☐)

Part B

What conjecture can be made about the relationship between the coordinates of the vertices of an original shape and the coordinates of the vertices of the image of the shape when it is rotated 180 degrees clockwise about the origin?

42.

Mr. Perry's students used pairs of points to find the slopes of lines. Mr. Perry asked Avery how she used the pairs of points listed in this table to find the slope of a line.

x	y
8	18
20	45

Avery said, "The easiest way to find the slope is to divide y by x. The slope of this line is $\frac{18}{8}$, or $\frac{9}{4}$."

Part A

Show another way to find the slope of the line that passes through the points listed in the table. Your way must be different from Avery's way.

Part B

Write an example that shows that Avery's "divide y by x" method will not work to find the slope of **any** line.

43.

Consider the equation $3(2x+5)=ax+b$.

Part A

Find one value for a and one value for b so that there is exactly one value of x that makes the equation true.

$a=\boxed{}$
$b=\boxed{}$

Explain your reasoning.

Part B

Find one value for a and one value for b so that there are infinitely many values of x that make the equation true.

$a=\boxed{}$
$b=\boxed{}$

Explain your reasoning.

44.

Ashley and Brandon have different methods for finding square roots.

Ashley's Method

To find the square root of x, find a number so that the product of the number and itself is x. For example, $2 \cdot 2 = 4$, so the square root of 4 is 2.

Brandon's Method

To find the square root of x, multiply x by $\frac{1}{2}$. For example, $4 \cdot \frac{1}{2} = 2$, so the square root of 4 is 2.

Which student's method is **not** correct?

☐ Ashley's method
☐ Brandon's method

Explain why the method you selected is **not** correct.

45.

A student made this conjecture and found two examples to support the conjecture.

If a rational number is not an integer, then the square root of the rational number is irrational. For example, $\sqrt{3.6}$ is irrational and $\sqrt{\frac{1}{2}}$ is irrational.

Provide two examples of non-integer rational numbers that show that the conjecture is **false**.

Example 1:   Example 2: