

- 1) The letter T has vertical line symmetry. The letter C has horizontal line symmetry. The letter Z has point symmetry. If it is rotated 180 degrees, it still looks the same. **The letter H happens to have both vertical and horizontal line symmetry, as well as point symmetry.** **ANSWER: (4)**

- 2) Solve for x:  
 $6(x-2) = 36 - 10x$  First use the distributive property.  
 $6x - 12 = 36 - 10x$  Add 10x to both sides.  
 $16x - 12 = 36$  Add 12 to both sides.  
 $16x = 48$  Divide both sides by 16.  
 $x = 3$  **ANSWER: (3)**

- 3) The number of games won over 4 years have to add up to 40 so that the average games won will equal 10. (40 divided by 4 is 10). At this point the number of games won are 7, 16, and 4 which total only 27. In the fourth year, if **13 more games are won, (40 - 27 = 13), the average number of games won over the four years will be 10.** **ANSWER: (1)**

- 4) Solve for w:  
 $\frac{1}{2}w + 7 = 2w - 2$  Multiply each term by 2 to get rid of the denominator.  
 $w + 14 = 4w - 4$  Subtract w from both sides.  
 $14 = 3w - 4$  Add 4 to both sides.  
 $18 = 3w$  Divide both sides by 3.  
 $6 = w$  **ANSWER: (1)**

- 5) In order to satisfy the condition that the die lands on a number less than 3, it may land on a 1 or 2. Since there are a total of 6 possibilities, the final answer is 2/6. **ANSWER: (2)**

- 6) When is the following expression positive? You can simply try each of the given choices.

**Choice 1:**  $\sqrt{54 - b}$   $b = -10$   $\sqrt{54 - (-10)} = \sqrt{64} = 8$

Choice 2 will result in 0 which is an integer but it is not positive or negative.

Choice 3 will result in an irrational number, not an integer.

Choice 4 will result in an irrational number as well. **ANSWER: (1)**

- 7) Simplify:  
 $\frac{-32x^8}{4x^2} = -8x^6$   $-32/4 = -8$   $x^8/x^2 = x^{8-2} = x^6$  **ANSWER: (4)**

- 8) The product is the answer to a multiplication problem:  
Multiply  $(c + 8)(c - 5)$  Use FOIL (Firsts Outers Inners Lasts)

Firsts  $(c)(c) = c^2$

Outers  $(c)(-5) = -5c$

Inners  $(8)(c) = 8c$

Lasts  $(8)(-5) = -40$

Now combine these products:

$$c^2 - 5c + 8c - 40$$

$$c^2 + 3c - 40$$

**ANSWER: (1)**

- 9) Set up a proportion. First change 6 feet to inches.  
1 foot = 12 inches 6 feet =  $12(6) = 72$  inches.

$$\frac{\text{inches}}{\text{centimeters}} \quad \frac{1}{2.54} = \frac{72}{x}$$

$$x = 72(2.54)$$

$$x = 182.88$$

$$x = 183$$

Cross multiply.

Multiply

Round to nearest centimeter.

**ANSWER: (3)**

- 10) This is a problem easily solved using the Pythagorean Theorem.

$x$  is the hypotenuse.

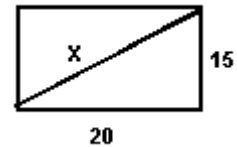
$$x^2 = 20^2 + 15^2$$

$$x^2 = 400 + 225$$

$$x^2 = 625$$

$$x = 25$$

Find the square root of both sides.



**ANSWER: (3)**

- 11) Of the four named transformations, only a **dilation** does not preserve distance. It is the only transformation whose image will not be congruent to the original figure.

**ANSWER: (4)**

- 12) The probability of a fair coin landing tails up will always remain **1/2** regardless of how many times it is tossed, and regardless of how it landed on preceding tosses.

**ANSWER: (2)**

- 13) The area of a triangle can be found by using the following formula:

$$A = \frac{1}{2}bh \quad \text{where } b \text{ and } h \text{ represent the base and height of the triangle.}$$

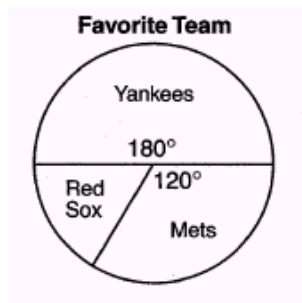
$$\text{In our case the area would be } \frac{1}{2}(x+4)(2x)$$

**ANSWER: (4)**

- 14) The property illustrated is the additive identity property. Any element plus 0 equals that element.

**ANSWER: (4)**

- 15) A complete circle represents  $360^\circ$ . In the accompanying diagram, Yankees and Mets comprise  $180 + 120$  or  $300^\circ$ . This leaves  $60^\circ$  for the Red Sox. You also know that the total circle also represents 3,000 people. As stated earlier, the Red Sox represent  $60^\circ$  or  $1/6$  of the circle. ( $60/360 = 1/6$ ) It will therefore also represent  $1/6$  of the total number of people.  **$1/6$  of 3000 is 500.**



**ANSWER: (2)**

- 16) Solve the given pair of equations:

$$\begin{array}{l} 3x - y = 8 \\ \underline{x + y = 2} \\ 4x = 10 \\ \mathbf{x = 2.5} \end{array} \quad \begin{array}{l} \text{Combine both equations by adding.} \\ \text{Divide both sides by 4.} \end{array}$$

Both choices 2 and 3 have 2.5 as the solution for x, so you now have to solve for y. Pick either of the equations, and solve for y by substituting 2.5 for x.

$$\begin{array}{l} x + y = 2 \\ 2.5 + y = 2 \\ \mathbf{y = -.5} \end{array} \quad \begin{array}{l} \text{Substitute 2.5 for x.} \\ \text{Subtract 2.5 from both sides.} \end{array}$$

**ANSWER: (2)**

- 17) When presented with a conditional statement, its converse is found by switching the position of the hypothesis and conclusion.

For example, the converse of  $p \rightarrow q$  is  $q \rightarrow p$ .

The converse of **If the sun rises in the east, then it sets in the west** becomes **If the sun sets in the west, then it rises in the east.**

**ANSWER: (3)**

- 18) The sum of the exterior angles of any polygon is  $360^\circ$ . Since the polygon in question is regular, its exterior angles will all be equal. The polygon in question is a pentagon. A pentagon has 5 sides and will have 5 exterior angles.  $360$  divided by  $5$  is  $72^\circ$ .

**Angle DEF will equal  $72^\circ$ .**

**ANSWER: (2)**

- 19) Solve for m:

$$\begin{array}{l} c = 2m + d \\ c - d = 2m \\ \underline{c - d} \\ \mathbf{\frac{c-d}{2} = m} \end{array} \quad \begin{array}{l} \text{Subtract d from both sides.} \\ \text{Divide both sides by 2} \end{array}$$

**ANSWER: (1)**

- 20) In scientific notation, 18,900,000 is  **$1.89 \times 10^7$**

**ANSWER: (3)**

- 21) You are told that the graph of the equation  $2x + 6y = 4$  passes through the point  $(x, -2)$ . You are asked to determine the value of  $x$ . Simply substitute the  $-2$  for  $y$  and solve for  $x$ .
- $$2x + 6y = 4 \quad \text{Substitute } -2 \text{ for } y.$$
- $$2x + 6(-2) = 4 \quad \text{Multiply.}$$
- $$2x - 12 = 4 \quad \text{Add 12 to both sides.}$$
- $$2x = 16 \quad \text{Divide both sides by 2.}$$
- $$\mathbf{x = 8}$$
- ANSWER: (2)**
- 22) The first equation is already in the form of  $y = mx + b$ , where  $m$  represents the slope and  $b$  represents the  $y$ -intercept.  $y = \frac{1}{3}x + 12$
- Let's put the second equation into the same form.
- $$6y = 2x + 6 \quad \text{Divide both sides by 6.}$$
- $$\mathbf{y = \frac{1}{3}x + 1}$$
- You can see that both equations have equal slopes, slopes of  $1/3$ . This means that they represent parallel lines.
- ANSWER: (4)**
- 23) There are 8 letters in the word VERTICAL. You are looking for the number of 4 letter arrangements. Since order does make a difference, this is a permutation problem rather than a combination. Your answer is  ${}_8P_4$ .  ${}_8P_4 = (8)(7)(6)(5)$  or **1,680**
- ANSWER: (2)**
- 24) Simplify:
- $$\sqrt{28} + \sqrt{63}$$
- $$\sqrt{4}\sqrt{7} + \sqrt{9}\sqrt{7}$$
- $$2\sqrt{7} + 3\sqrt{7}$$
- $$\mathbf{5\sqrt{7}}$$
- Simplify using greatest perfect square.  
Continue simplifying.  
Add
- ANSWER: (2)**
- 25) Factor the quadratic equation to obtain its solution set.
- $$x^2 - 4x - 12 = 0$$
- $$(x - 6)(x + 2) = 0 \quad \text{Set each factor equal to 0, and solve.}$$
- $$x - 6 = 0 \quad \text{Add 6 to both sides.} \quad x + 2 = 0 \quad \text{Subtract 2 from both sides.}$$
- $$\mathbf{x = 6} \quad \mathbf{x = -2}$$
- ANSWER: (3)**
- 26) Substitute the given values:
- $$ab - b^2 \quad \text{Substitute } a = 3 \quad b = -1$$
- $$(3)(-1) - (-1)^2 \quad \text{Simplify using the order of operations}$$
- $$-3 - (1) \quad \text{Combine}$$
- $$\mathbf{-4}$$
- ANSWER: (3)**

- 27) Find the sum. You have to realize that the common denominator is 21n. To obtain that denominator, you will multiply the first fraction by 3/3 and the second fraction by 7/7.

$$\frac{3}{7n} + \frac{7}{3n}$$

$$\frac{3}{7n} \left(\frac{3}{3}\right) + \frac{7}{3n} \left(\frac{7}{7}\right) \quad \text{Multiply}$$

$$\frac{9}{21n} + \frac{49}{21n} \quad \text{Add}$$

$$\frac{58}{21n}$$

**ANSWER: (4)**

- 28) This is a simple problem involving the counting principle. The counting principle states that if one event can happen in any one of m ways, and another event can happen in any one of n ways, then both events can happen in m(n) ways. In our case the answer would be **(7) (3)**. **ANSWER: (1)**

- 29) When the product of two elements is 1, they are reciprocals. When their product is -1, they are negative reciprocals. In our case, 1/m and m would be reciprocals as their product would equal 1. 1/m and -m would be negative reciprocals as their product equals -1. **x therefore equals -m.** **ANSWER: (2)**

- 30) A biconditional is an "if and only if" statement.  
 Choice 1 is a conditional.  
**Choice 2 is a biconditional.**  
 Choice 3 is a conjunction.  
 Choice 4 is again just a conditional.

**ANSWER: (2)**

- 31) Another problem that can easily be solved using proportions.

$$\frac{\text{US dollar}}{\text{Canadian money}} = \frac{1}{1.41} = \frac{x}{100} \quad \text{Cross multiply}$$

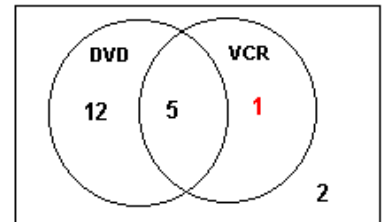
$$1.41x = 100(1)$$

$$1.41x = 100 \quad \text{Divide both sides by 1.41.}$$

$$x = 70.92 \text{ to the nearest cent.}$$

**ANSWER: \$70.92**

- 32) You can set up a Venn diagram based on the given information.  
 12 have only DVD  
 5 have both DVD and VCR  
 2 have none  
**The above accounts for a total of 19.**  
**There were however a total of 20 surveyed.**  
**This means that 1 had only a VCR.**  
**The total number that had VCR's is therefore 5+1 or 6.**



**ANSWER: 6**

- 33) You are told that the perimeter of an isosceles triangle is 71, and that one of its sides is 22. Since we are dealing with an isosceles triangle, we know that 2 sides are congruent. You also know that the sum of the three sides will equal 71. Two triangles are possible based on the given information.

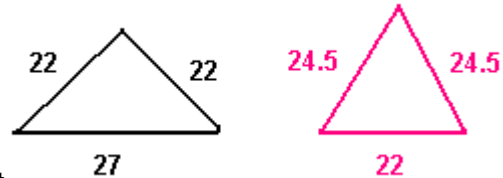
If 22 is the congruent side then the black triangle at the right will be your triangle.

$$22 + 22 + 27 = 71$$

If 22 is not the congruent side then the red triangle at the right will be your triangle.

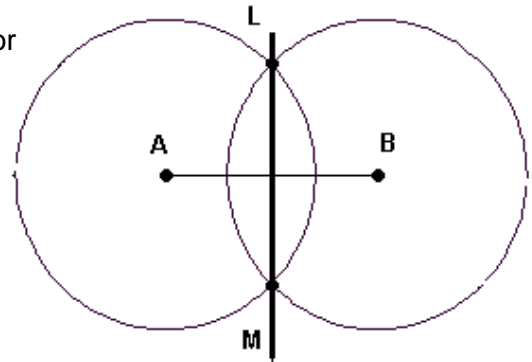
71-22 leaves 49 to be divided for the congruent sides. Those sides will be 24.5 each.

**ANSWER: All possible measures are 22, 27, and 24.5, 24.5.**



- 34) The easiest way to construct a perpendicular bisector is to first draw two circles using A and B as their centers. Keep their radii equal and at least great enough so that the two circles intersect. Connect these two points of intersection with a straight line. This line is the perpendicular bisector of the given line.

At the right, AB is the given line segment. LM would be the perpendicular bisector.

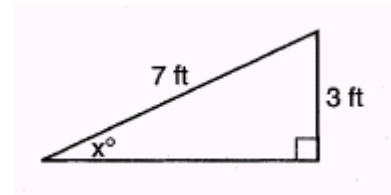


- 35) You are presented with the triangle at the right and asked to determine the measure of angle x to the nearest tenth of a degree.

This problem involves trigonometric ratios. Relative to angle x, the side of 3 ft is the **opposite**. The side of 7 ft. is the **hypotenuse**. The sine ratio is the one that involves the ratio of opposite and hypotenuse. That is therefore the one to use here:

$$\sin x = \frac{3}{7}$$

Now use the  $\sin^{-1}$  key on your calculator to determine the angle measure whose sine will equal  $3/7$ .  $X = 25.3769$  degrees. To the nearest tenth of a degree your **answer** would be **25.4 degrees**. (Make sure your calculator is in degree mode)



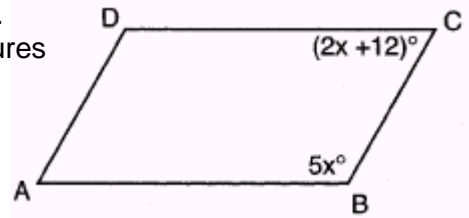
- 36) You are presented with the parallelogram at the right. The given angles, angles B and C, are consecutive angles. Therefore they are supplementary. The sum of their measures equals 180. Set up your equation to solve for x.

$$(2x + 12) + 5x = 180$$

$$7x + 12 = 180 \quad \text{Subtract 12 from both sides.}$$

$$7x = 168 \quad \text{Divide both sides by 7.}$$

$$x = 24$$

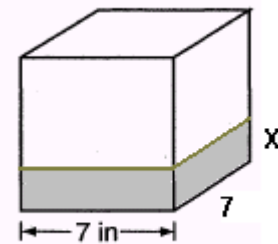


Once you know the value of x, you can determine the measure of the given angles. Remember that in a parallelogram, opposite angle are congruent. In our parallelogram, Angles B and D are opposite angles and will therefore be equal. So now we can solve for angle B. Once we know angle B we will know angle D.  
**Angle B = 5x and we know that x=24**     $5(24) = 120$

**Measure of ANGLE D = 120°**

- 37) Imagine having a cubic container 5 inches on each side and filled completely with water. It is quite easy to figure out how much water is in that container.. You know that the volume can be determined by multiplying the length, width, and height. In the case of a cube it is even easier as these three dimensions are all equal. The amount of water contained in our cube would be 5 (5) (5) or 125 cubic inches of water. Now imagine the container at the right. It is cubic, and 7 inches on each side.

Now if you were empty the original smaller container into this larger one, the water level will only rise part of the way up. Let us call this height or depth X. You do know that the volume contained now in the larger container is still 125 cubic inches. It is all the water that was earlier in the smaller container.



Remember again how to find the volume-- length times width times height. In our case we know the volume but are looking for the height. Set up your equation.

$$7(7)(x) = 125 \quad \text{Multiply}$$

$$49x = 125 \quad \text{Divide both sides by 49.}$$

$$x = 2.5510 \quad \text{Round to nearest tenth.}$$

$$x = 2.6$$

**ANSWER: 2.6 inches deep**

38) Define your variables and set up an equation.

Let  $x$  = Carl's age  
 $2x + 4$  = Angelo's age  
 $x - 5$  = Brandon's age

You are told that the average of their ages is 41.

When finding an average, you add up all the data and divide by how many items there are. In this case you have to add up the 3 ages and divide by 3 to obtain the average. You are told what the average is, so set up your equation.

$$\frac{x + 2x + 4 + x - 5}{3} = 41$$

The sum of the ages divided by 3 equals the average of 41.

Combine the terms in the numerator.

$$\frac{4x - 1}{3} = 41$$

Multiply both sides by 3

$$4x - 1 = 123$$

Add 1 to both sides.

$$4x = 124$$

Divide both sides by 4.

$$x = 31$$

Once you know that  $x$  is 31, go back to the beginning and substitute:

$x$  = **Carl's age = 31**

$2x + 4$  = **Angelo's age =  $2(31)+4= 62+4 = 66$**

$x - 5$  = **Brandon's age =  $31 - 5 = 26$**

39) At the right in black, you see square table ABCD. In red to its left you see square table A'B'C'D', its reflection over the y-axis. That was easy. Now for the more difficult part--finding the area of ABCD.

Imagine DC as being the hypotenuse of a right triangle. I outlined the other two sides of that triangle in green at the right. One side of that triangle = 2, and the other side = 5. We can now use the Pythagorean Theorem to calculate the length of the hypotenuse DC.

$$x^2 = 2^2 + 5^2$$

$$x^2 = 4 + 25$$

$$x^2 = 29$$

$$x = \sqrt{29} \text{ or } DC = \sqrt{29}$$

This means that each side of the square equals  $\sqrt{29}$ .

Let's find the area of this square.

$$A = s^2 = (\sqrt{29})^2 = 29$$

**ANSWER: The area of the square is 29 square units.**

