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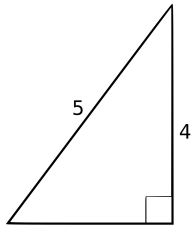
Ms. Pileggi
8th Grade

Pythagorean Theorem

$$a^2 + b^2 = c^2$$

What it is: The pythagorean theorem is an equation used to determine the unknown side lengths of a triangle.

How it is used: A triangle has three sides: a, b, and c. When a side length is missing, this equation would be used by plugging in the side measurements that are given, then use algebra to determine the missing side measurement. When using the pythagorean theorem, sides a and b are the sides with a smaller length and side c is the longest length.



Ex. $a = 3, b = 4, c = 5 \rightarrow 3^2 + 4^2 = 5^2 \rightarrow 9 + 16 = 25 \checkmark$

What we will be doing today: We will be using Geogebra. Geogebra is an online application that is used as a tool to graph and construct 2D and 3D shapes.

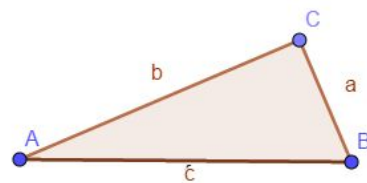
Using Geogebra, we will learn how to construct a triangle and a square on each side of the triangle (3 squares total). Each side of the triangle will have their own length measurement and the squares will represent each side's length-squared (what is used in the Pythagorean Theorem).

The following steps will demonstrate how to construct a triangle:

1. Right click the grid and deselect the grid and axes to make the screen white.
2. These boxes will be where all the tools that are used will be:



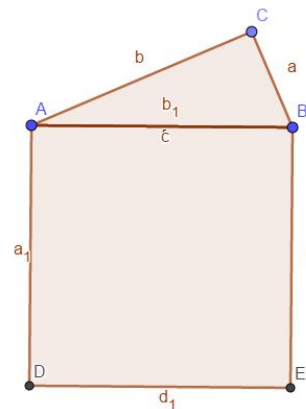
3. Construct a triangle:
 - A. Click the third box and scroll down to click "line segment", then click a point (A) on the screen and drag the line to create another point (B).
 - B. Click the sixth box and select "semicircle", then click on point A and drag the semi circle to point B.
 - C. Click the second box and select "point", then place the point on the curve to create point C.
 - D. Click the fifth box and select "polygon", then click point A, then drag the line and click point B, then drag the line and click point C, then drag the line back to point A to create a triangle
 - E. On the list on the left of the screen, deselect the semicircle to only show the triangle. *This



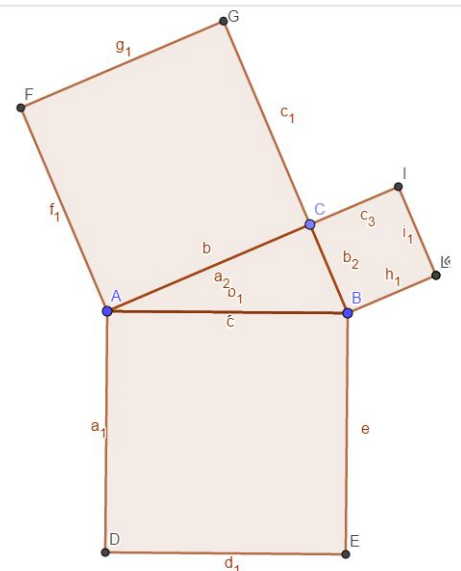
does not delete the semicircle it just makes it easier to visualize the triangle*

4. Construct a square on each side of the triangle:

- A. Click on the fourth box and select “perpendicular line”, then press side c of the triangle, then click point A, to create a perpendicular line to side c. Repeat with side c and point B. There will now be two perpendicular lines to side c through points A and B.
- B. Click on the sixth box and select “circle with center through point”, then press point A and drag the circle to point B, to create a circle with a radius from Point A to B.
- C. Click the second box and select “intersect”, then click the intersection of the circle and the perpendicular line through point A, to create point D.
- D. Click the fourth box and select “parallel line”, then click on side c and drag the parallel line to point D, to create a parallel line to side c.
- E. Click on the second box and select “intersect”, then click on the intersection of the parallel line and the perpendicular line that is through point B to create point E.
- F. Click the fifth box and select “polygon”, then click point A, then drag the line and click point B, then drag the line and click point E, then drag the line and click point D, then drag the line back to point A to create a square.
- G. On the list on the left of the screen, deselect the two perpendicular lines, the circle, and the parallel line to only show the square.



5. Now repeat step 4 to create a square on side b of the triangle (between points A and C) and on side a of the triangle (between points C and B).



6. Labeling:

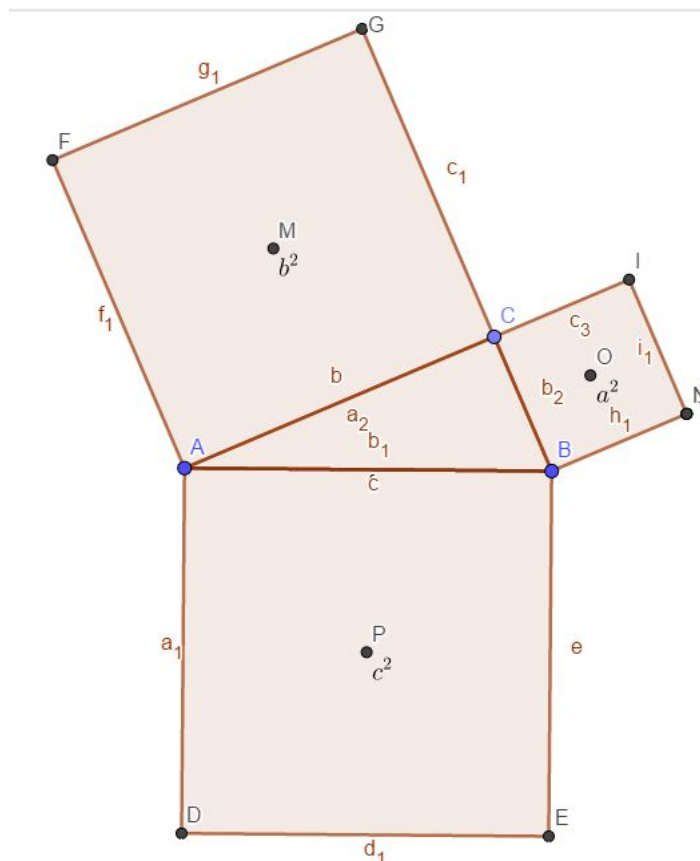
- Each square represents each of the side's length squared.
- Press the second box and click "midpoint or center", then click points F and C that are in the square on side b. This will create the point M in the middle of the box.
- Repeat this with the square on side c (points A and E) and the square on side a (points C and H).
- Press the tenth box and click "text", then click a blank spot on the screen, a text box will pop up, select LaTeX formula and type " a^2 " and it will create a^2 .



Repeat this to create b^2 and c^2 .

- Right click a^2 and select "settings", then in the top right of the screen a settings area will pop up, select "position", and click the drop down menu of the starting point and select point O. This will move the part of equation (a^2) to the center of the square on side a. Repeat this with b^2 and c^2 , this will move b^2 to the center of

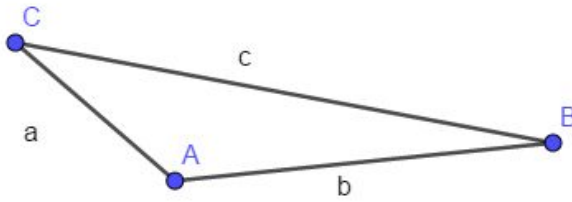
the circle on side b and c^2 to the center of the circle on side c.



The Pythagorean Theorem is $a^2 + b^2 = c^2$. a , b , and c represent the sides of the triangles and a^2 , b^2 , c^2 represent the squares on each side of the triangle.

Practice problems:

Use the equation $a^2 + b^2 = c^2$ to find the missing side length measurement.

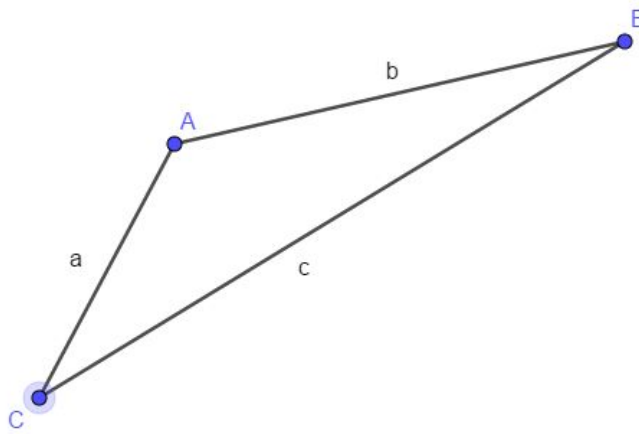


1.

$$a = 5$$

$$b = 12$$

$$c = ?$$

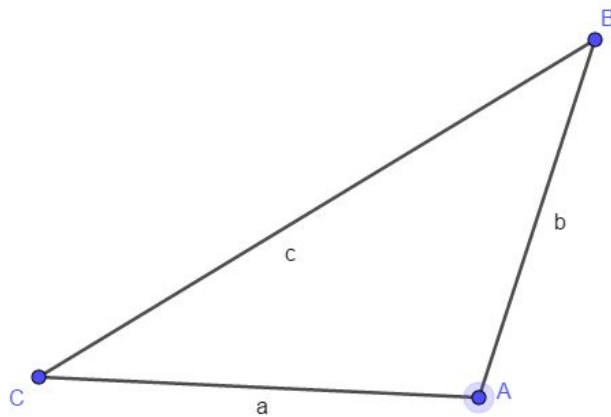


2.

$$a = 6$$

$$b = ?$$

$$c = 10$$



3.

$$a = ?$$

$$b = 21$$

$$c = 29$$