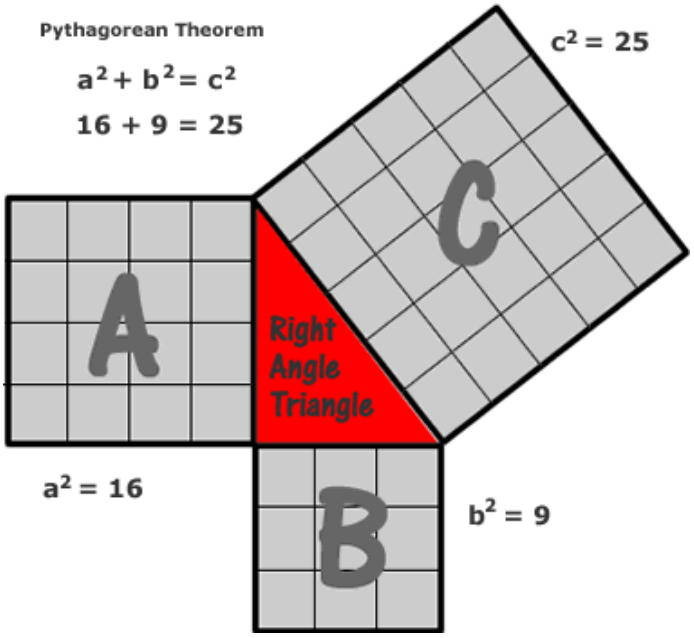
Pythagorean Theorem

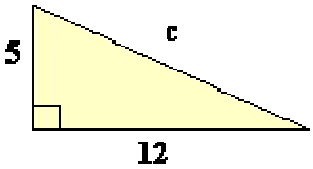
The **hypotenuse** is the side opposite the right angle and is the longest side in a right angled triangle.

Pythagoras determined many years ago that the square of the hypotenuse is equal to the sum of the squares of the other two sides.



If we know the lengths of ***two sides*** of a right angled triangle, we can find the length of the ***third side***.

Example: Solve this triangle.



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

$5^2 + 12^2 = c^2$

$25 + 144 = c^2$

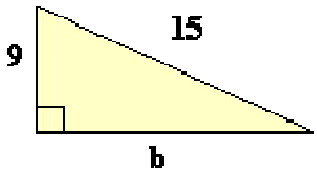
$169 = c^2$

$c^2 = 169$

$c = \sqrt{169}$

c = 13

Example: Solve this triangle.



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

$9^2 + b^2 = 15^2$

$81 + b^2 = 225$

Take 81 from both sides:

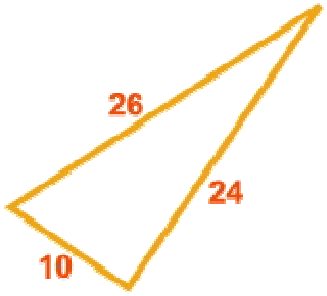
$b^2 = 144$

$b = \sqrt{144}$

b = 12

It works the other way around, too: when the three sides of a triangle make $a^2 + b^2 = c^2$, then the triangle is right angled.

Example: Does this triangle have a right angle?



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

$a^2 + b^2 = 10^2 + 24^2 = 100 + 576 =$ **676**

$c^2 = 26^2 =$ **676**

They are **equal** so **YES,** it does have a right angle.

Example: Does an 8, 15, 16 triangle have a right angle?

Does $8^2 + 15^2 = 16^2$?

$8^2 + 15^2 = 64 + 225 =$ **289**

$c^2 = 16^2 =$ **256**

They are **not equal** so **NO,** it does not have a right angle.