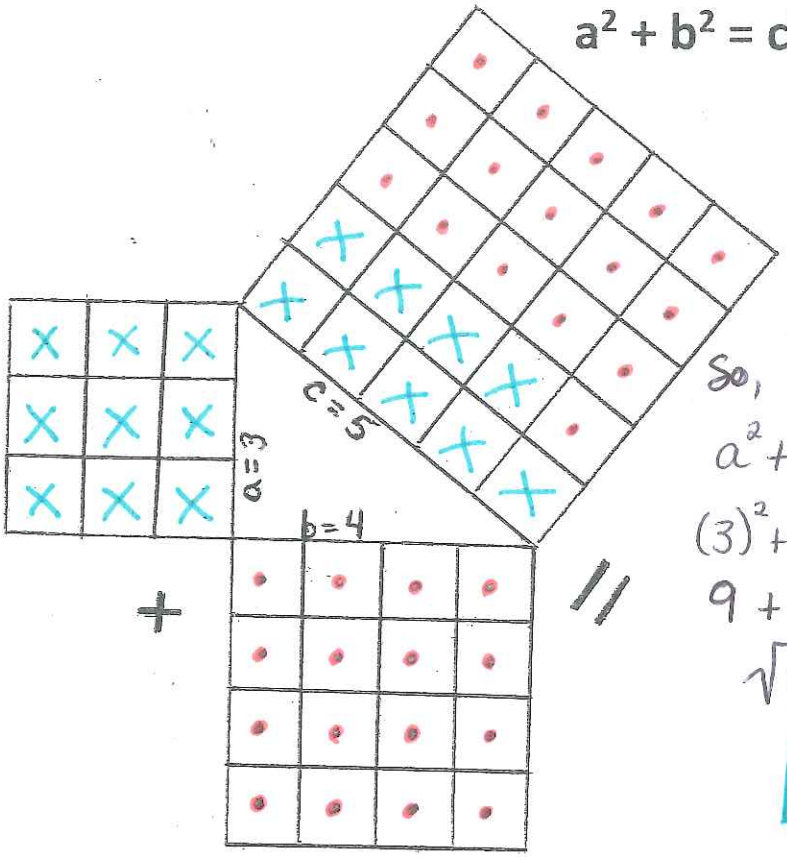
Pythagorean Relationship 2

The Pythagorean Relationship states that for right triangles, the **area** of the square off one **leg** of the triangle, **added** to the **area** of the square off the other **leg** of the triangle is equal to the **area** of the square off the **hypotenuse**. This can also be shown as an equation:

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

Where:

a = length of one leg
b = length of other leg
c = length of hypotenuse



So,

$a^2 + b^2 = c^2$ ← write out equation

$(3)^2 + (4)^2 = c^2$ ← substitute values

$9 + 16 = c^2$ ← evaluate

$\sqrt{25} = \sqrt{c^2}$ ← this tells us what c^2 is but we want to find c, so to undo squaring we use the opposite operation and take the square root.

$5 = c$

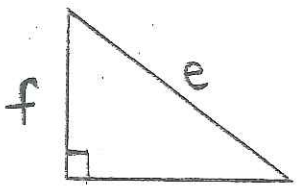
↑ Final answer

This is the length of the hypotenuse.

*Remember from algebra, what you do to one side you have to also do to the other.

Write the Pythagorean Relationship as an equation for the following right triangles:

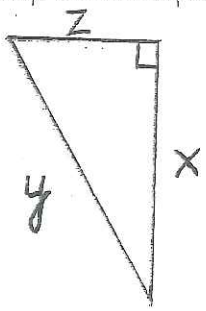
a)



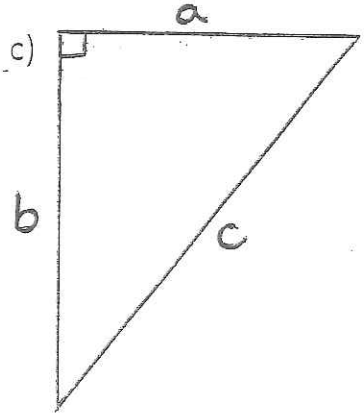
*I have done this one for you!

$f^2 + g^2 = e^2$

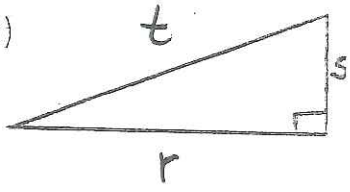
b)

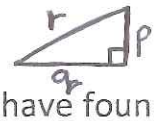


c)



d)



Sometimes students find the letters a, b, and c to be confusing, especially if a triangle is labelled 

or some other variation, as was just shown in the last exercise. For that reason, I have found it easier to use these 2 versions of the equations:

1. $leg^2 + leg^2 = hyp^2$

* Use this version when the hypotenuse is the unknown and the 2 legs are given.

2. $hyp^2 - leg^2 = leg^2$

* Use this version when it is the length of one of the legs that you are trying to find.

So, to summarize, the steps to solve problems involving the Pythagorean Relationship are as follows:

1. Decide if it is a leg or the hypotenuse length that you are trying to find and choose the correct equation to do so.

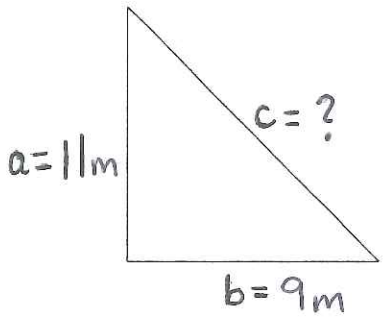
2. Substitute the known values

3. Evaluate to find leg^2 or hyp^2 (i.e. the area of the square on that side)

4. Square root to find the length of the leg or hypotenuse

Now let us try!

Ex1) Find the length of the hypotenuse.



$leg^2 + leg^2 = hyp^2$

$(11m)^2 + (9m)^2 = hyp^2$

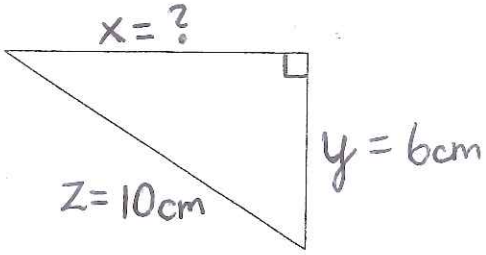
$121 + 81 = hyp^2$

$\sqrt{202} = \sqrt{hyp^2}$

$14.2m = hyp$

↑ I rounded to the nearest tenth.

Ex2) Find the length of side x.



$hyp^2 - leg^2 = leg^2$

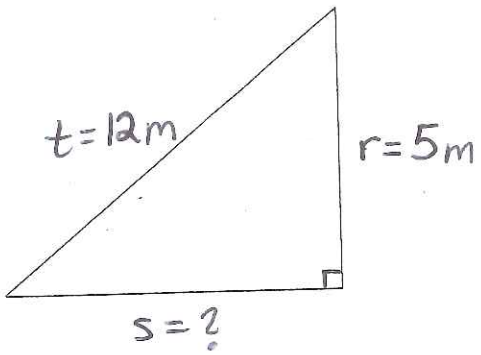
$(10cm)^2 - (6cm)^2 = leg^2$

$100 - 36 = leg^2$

$\sqrt{64} = \sqrt{leg^2}$

$8cm = leg$

Ex 3) Find the length of side s.



$hyp^2 - leg^2 = leg^2$

$(12m)^2 - (5m)^2 = leg^2$

$144m^2 - 25m^2 = leg^2$

$\sqrt{119} = \sqrt{leg^2}$

$10.9m = leg$