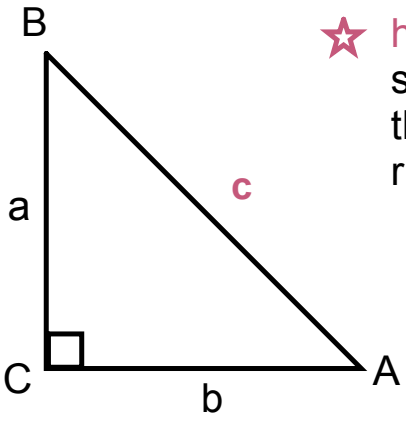
8 - Measurement Relationships

8.1 - Pythagorean Theorem

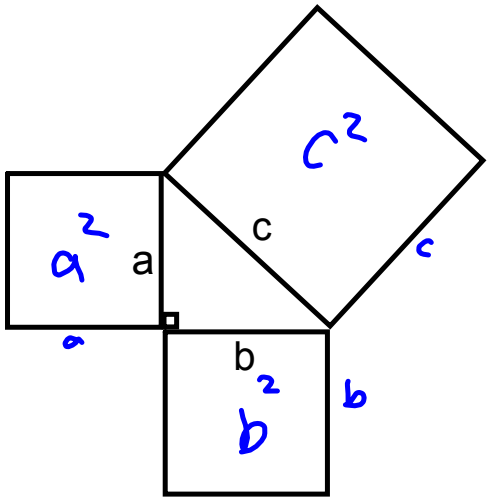
The Pythagorean Theorem

- In a right triangle, the square of the length of the hypotenuse is equal to the sum of the squares of the lengths of the two shorter sides.



☆ hypotenuse: the longest side of a right triangle; the side opposite the right angle

If a right triangle is labelled as shown, then the area of the large square drawn on the hypotenuse is c^2, while the areas of the other two squares are a^2 and b^2.



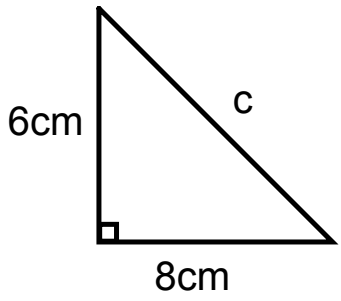
The area of the square drawn on the hypotenuse is equal to the sum of the areas of the squares drawn on the other two sides.

Therefore, the algebraic model for the Pythagorean relationship is

$a^2 + b^2 = c^2$. This is known as the **Pythagorean theorem**.

Ex. Calculate the length of the hypotenuse in the following triangle. Round your answers to the nearest tenth of a unit.

a)



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

$6^2 + 8^2 = c^2$

$36 + 64 = c^2$

$100 = c^2$

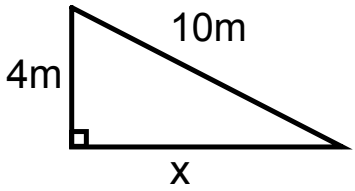
$\sqrt{100} = \sqrt{c^2}$

$\sqrt{100} = c$

$10 = c$

Ex. Calculate the length of the unknown side in each triangle.
Round your answers to the nearest tenth of a unit.

a)



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

$4^2 + x^2 = 10^2$

$16 + x^2 = 100$

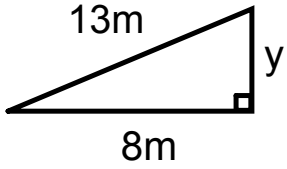
$x^2 = 100 - 16$

$x^2 = 84$

$\sqrt{x^2} = \sqrt{84}$

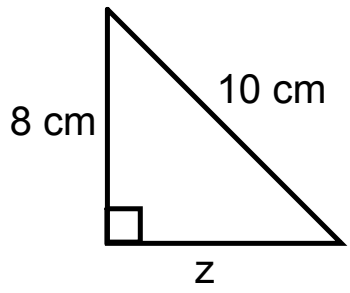
$x = 9.2$ m

b)



Ex. Determine the area of the right triangle. Round your answer to the nearest tenth of a square unit.

a)



Hint: the area formula for a triangle is $A = \frac{1}{2}bh$

$$A = \frac{bh}{2}$$

h = 8cm
b = ?

$a^2 + b^2 = c^2$
$8^2 + z^2 = 10^2$
$64 + z^2 = 100$
$z^2 = 100 - 64$
$z^2 = 36$
$\sqrt{z^2} = \sqrt{36}$
$z = 6$

$A = \frac{bh}{2}$
$= \frac{6(8)}{2}$
$= \frac{48}{2}$
$= 24$

The area is $24\ cm^2$

Practice:

page 423 # 2, 3, 5, 6, 7, 9, 10, 12