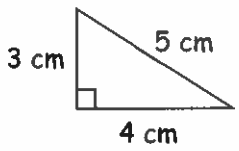
Pythagoras

- For any right-triangle, the length of the longest side (called the hypotenuse) can be related to the length of the other two sides. The hypotenuse is always across from the right (90°) angle.

Pythagorean Theorem: $a^2 + b^2 = c^2$

- The sum of the squares of the legs (a and b) of the triangle is equal to square of the hypotenuse (c).



Ex/ Determine which of the following sets of sides could represent a right triangle.

a) 12, 15, 20

a and b are small sides
c is largest

$12^2+15^2=20^2$?

$144+225=400$

$369 = 400$ No! not right

b) 9, 40, 41

$9^2+40^2=41^2$

$81+1600=1681$

$1681=1681$

Yes!

c) 8, 10, 12

$8^2+10^2=12^2$

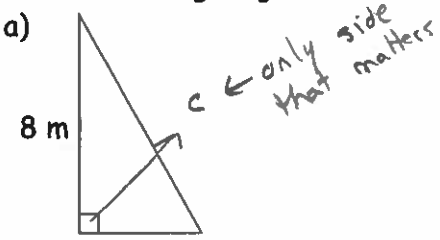
$164 = 144$

No

- Knowing this formula we can solve for an unknown side.

Ex/ Find the missing lengths.

a)



c ← only side that matters

use calculator for exponent before add

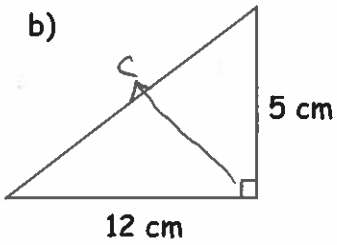
$8^2+6^2=c^2$

$100=c^2$

square root → $\sqrt{100}=c$

$10_{cm}=c$

b)



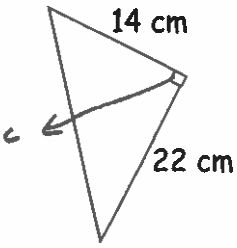
$12^2+5^2=c^2$

$169=c^2$

$\sqrt{169}=c$

$13_{cm}=c$

c)



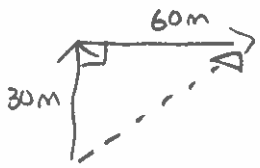
$14^2+22^2=c^2$

$680=c^2$

$\sqrt{680}=c$

$26.08=c$

Ex/ To walk around a school yard, Jill first needs to walk 30 m North, then 60 m East. How much shorter would it be to walk through the yard?



$30^2+60^2=c^2$

$4500=c^2$

$\sqrt{4500}=c$

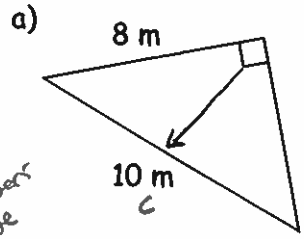
$67.08=c$

Usually walks 90m, short cut is only 67.08m

- We can also solve for either of the legs if we know the hypotenuse.

Ex/ Find the missing lengths.

a)

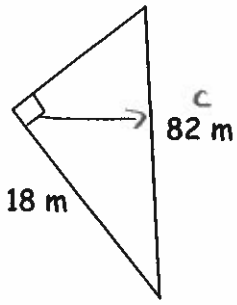


Need numbers on one side and letters on the other

$8^2 + b^2 = 10^2$
$-8^2 \quad -8^2$

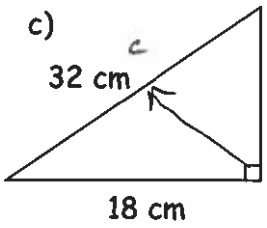
$b^2 = 10^2 - 8^2$
$b^2 = 100 - 64$
$b^2 = 36$
$b = \sqrt{36}$
$b = 6\text{ m}$

b)



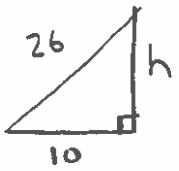
$18^2 + b^2 = 82^2$
$b^2 = 82^2 - 18^2$
$b^2 = 6400$
$b = \sqrt{6400}$
$b = 80\text{m}$

c)



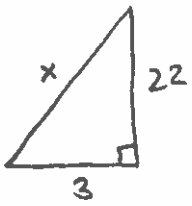
$18^2 + b^2 = 32^2$
$b^2 = 32^2 - 18^2$
$b^2 = 700$
$b = \sqrt{700}$
$b = 26{,}46\text{ cm}$

Ex/ A hydro pole casts a shadow that is 10 m long. A technician measures the wire that runs from the top of the pole to the end of the shadow and finds it to be 26 m. How tall is the pole?



$10^2 + h^2 = 26^2$
$h^2 = 26^2 - 10^2$
$h^2 = 576$
$h = \sqrt{576}$
$h = 24\text{ m}$

Ex/ A ladder is needed to reach a window that is 22 feet above the ground. If the bottom of the ladder is placed 3 feet from the wall, how long does the ladder need to be? Draw a diagram.



$3^2 + 22^2 = x^2$
$493 = x^2$
$\sqrt{493} = x$
$22.2\text{ ft} = x$

Practice: Handout - Pythagoras