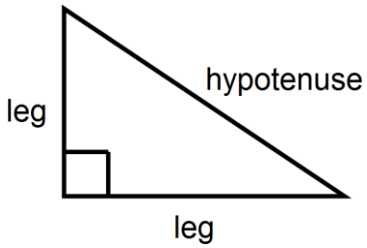
SM 2

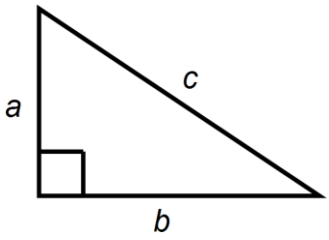
Date: **Section: 11.1**

Objective: Pythagorean Theorem and Distance Notes

The Pythagorean Theorem: In a right triangle, the sum of the squares of the legs equals the square of the hypotenuse.

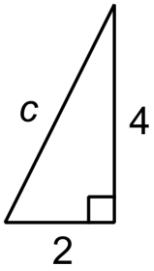
The Pythagorean Theorem: In a right triangle, $a^2 + b^2 = c^2$, or $\text{leg}^2 + \text{leg}^2 = \text{hypotenuse}^2$.





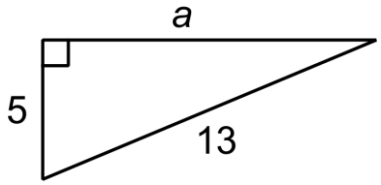
- ★ **The hypotenuse (the longest side – the one across from the right angle) should always be by itself on one side of the equation.**
- ★ *****It does not matter which leg is a or b.**

To find the length of the hypotenuse:



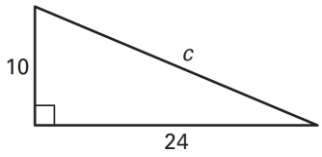
$$2^2 + 4^2 = c^2$$
$$4 + 16 = c^2$$
$$c^2 = 20$$
$$c = \sqrt{20}$$
$$c = 2\sqrt{5} \approx 4.47$$

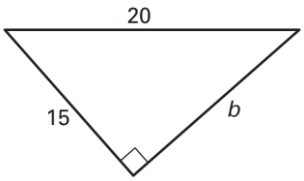
To find the length of a leg:

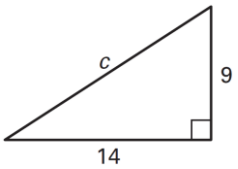


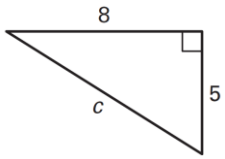
$$a^2 + 5^2 = 13^2$$
$$a^2 + 25 = 169$$
$$a^2 = 169 - 25$$
$$a^2 = 144$$
$$a = \sqrt{144}$$
$$a = 12$$

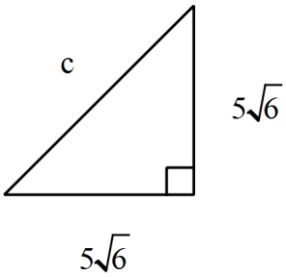
Examples: Find the length of the missing side of each triangle. Write answer as **exact** and **rounded** to the nearest hundredth.

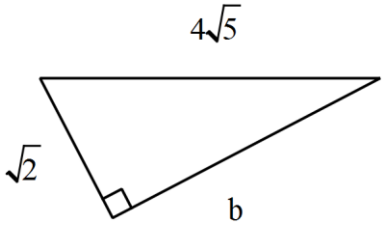
a) 

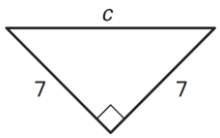
b) 

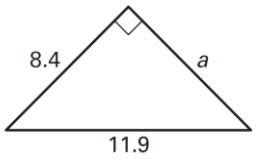
c) 

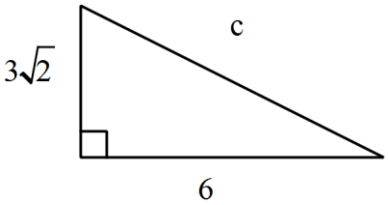
d) 

e) 

f) 

g) 

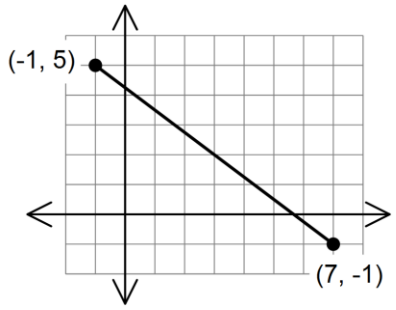
h) 

i) 

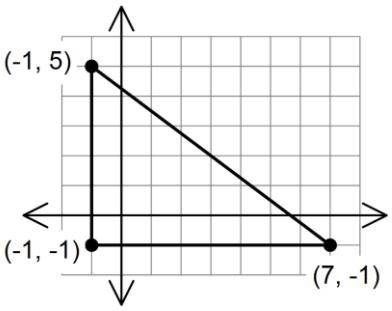
Distance Formula:

Example: Find the distance between $(-1,5)$ and $(7,-1)$.

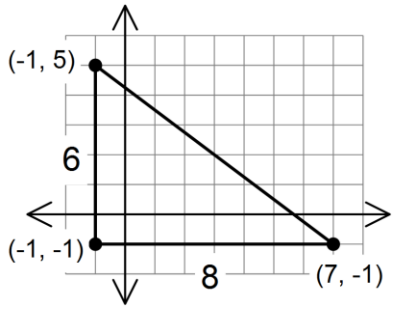
1. Plot the two points on a graph and connect them with a segment.



2. Draw a right triangle with your segment as the hypotenuse.



3. Figure out the lengths of the legs.



4. Plug into the Pythagorean Theorem.

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

-or-

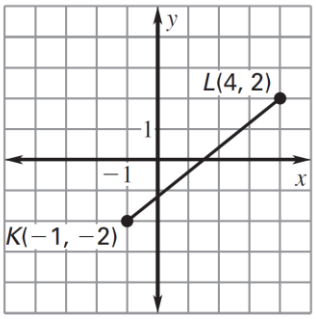
Use the distance formula (but be careful with your negatives!)

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

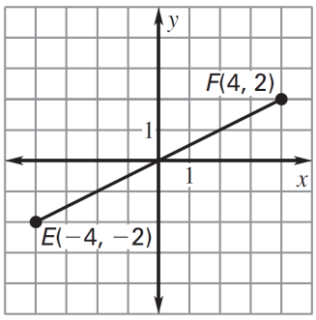
$$= \sqrt{(7-(-1))^2 + ((-1)-5)^2}$$
$$= \sqrt{(8)^2 + (-6)^2}$$
$$= \sqrt{64 + 36}$$
$$= \sqrt{100} = 10$$

Examples: Find the distance between each set of points.

a)



b)



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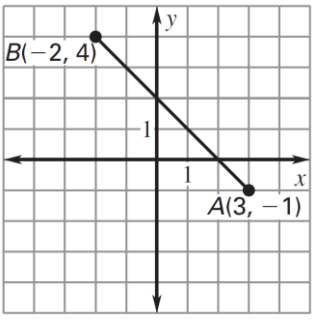

d) $(5,6)$ and $(-1,-2)$

e) $(4,7)$ and $(9,-3)$

f) $(-2,3)$ and $(-5,7)$