Bellwork

1) $x^2 + 9 = 25$

2) $x^2 - 7 = 18$

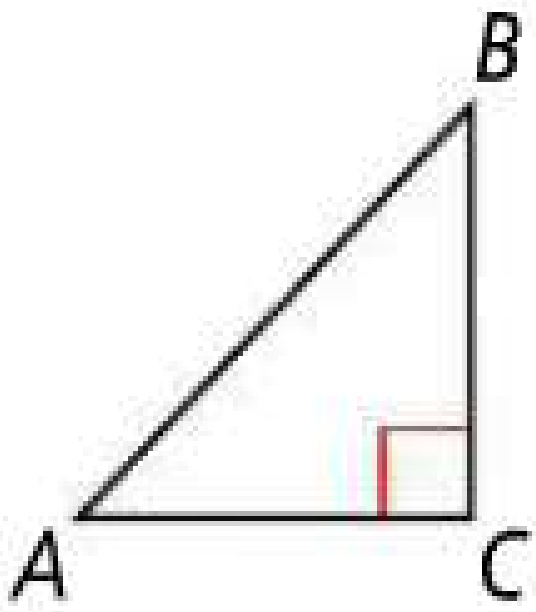
3) $\sqrt{x} - 3 = 4$

5.2 The Pythagorean Theorem and its Converse

- LT: How can the Pythagorean theorem be used to find the lengths of the various sides of a right triangle?

Review: Identifying the sides of a right triangle

- Name the hypotenuse and the legs of the right triangle shown below.



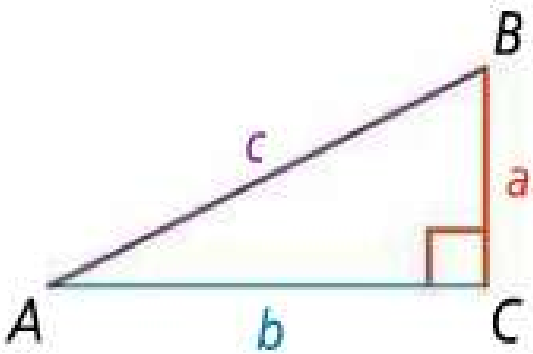
Hypotenuse: $\overline{AB}$
Legs: $\overline{AC}$ and $\overline{BC}$

Theorem 8-1: The Pythagorean Theorem

- If a triangle is a right triangle, then the sum of the squares of the lengths of the legs is equal to the square of the length of the hypotenuse.
- Note: Any three whole numbers that satisfy this equation is a Pythagorean triple.

If . . .

$\triangle ABC$ is a right triangle



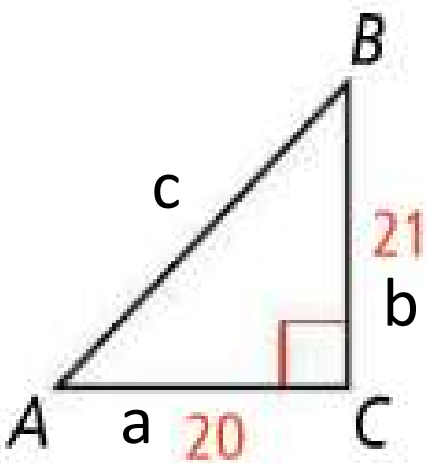
Then . . .

$$(\text{leg}_1)^2 + (\text{leg}_2)^2 = (\text{hypotenuse})^2$$

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

Example: Finding the length of the hypotenuse.

- What is the length of the hypotenuse of ΔABC? Do the side lengths of the triangle form a Pythagorean triple?



1st: Stat by labeling the sides. Which is a, b, and c?

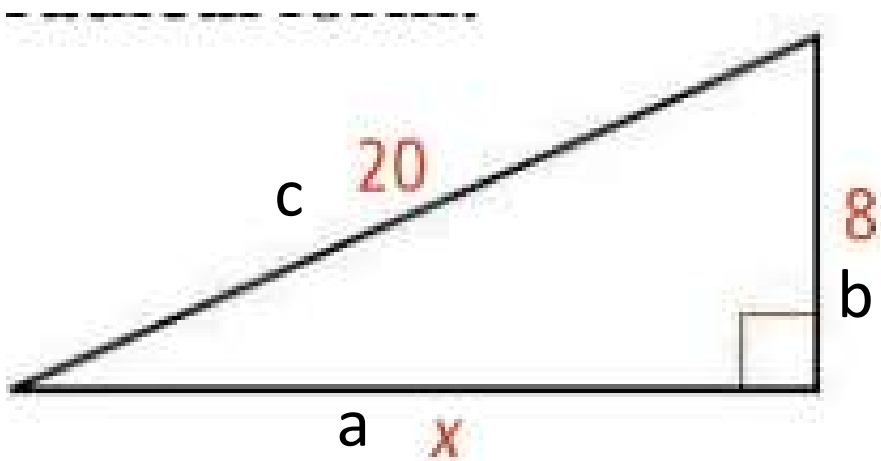
2nd: Plug the numbers into the Pythagorean equation.

$$(20)^2 + (21)^2 = c^2$$

3rd: Solve the equation

Example: Find the length of a leg

- What is the value of *x* in simplest radical form?



Same process as before, except we are solving for a different variable.

The equation would be

$$x^2 + (8)^2 = (20)^2$$

Try it on your own

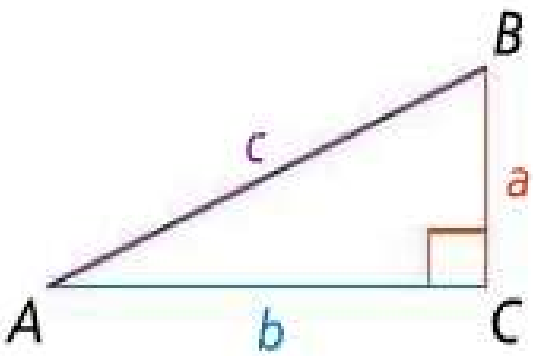
1. The legs of a right triangle have lengths of 10 and 24. what is the length of the hypotenuse?
2. The hypotenuse of a right triangle has a length of 12. One leg has a length of 6. What is the length of the other leg?

Theorem 8-2: Converse of the Pythagorean theorem

- If the sum of the squares of the lengths of two sides of a triangle is equal to the square of the length of the third side, then the triangle is a right triangle.

If . . .

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



Then . . .

$\triangle ABC$ is a right triangle

Example: Determining if a triangle is a right triangle.

- A triangle has side lengths of 85, 84, and 13. Is the triangle a right triangle?

$a^2 + b^2 \stackrel{?}{=} c^2$	Pythagorean Theorem
$13^2 + 84^2 \stackrel{?}{=} 85^2$	Substitute 13 for *a*, 84 for *b*, and 85 for *c*.
$169 + 7056 \stackrel{?}{=} 7225$	Simplify.
$7225 = 7225$ ✓	

Theorem 8-3

- When the side lengths of a triangle are plugged into the Pythagorean equation, if $c^2 > a^2 + b^2$, then the triangle is obtuse.

Theorem 8-4

- When the side lengths of a triangle are plugged into the Pythagorean equation, if $c^2 < a^2 + b^2$, then the triangle is acute.

Examples: Classifying a triangle using the Pythagorean equation

- A triangle has side lengths of 6, 11, and 14. Is the triangle acute, obtuse, or right? (Hint: *c* will always be the longest side.)

$c^2 \blacksquare a^2 + b^2$	Compare c^2 to $a^2 + b^2$.
$14^2 \blacksquare 6^2 + 11^2$	Substitute the greatest value for *c*.
$196 \blacksquare 36 + 121$	Simplify.
$196 > 157$	

Since $c^2 > a^2 + b^2$, the triangle is obtuse.

On your own: Is a triangle with side lengths 7, 8, and 9 acute, obtuse, or right?

Assignment

- Pg. 495 # 7, 10, 14, 17, 20, 21, 28, 30, 55