Converse of the Pythagorean Theorem

I can use the converse of the Pythagorean Theorem to determine if a triangle is a right triangle.

You will need your notebook, a clicker, and access to a calculator that does squares and square roots.

Previously, we learned how to determine if three lengths could be joined together to form any type of a triangle--the Triangle Inequality Theorem. *(The sum of the two smaller lengths must be greater than the third length.)*

Today, we will determine not only if the lengths can form a triangle, but specifically, if they can form a right triangle.

First, a clicker warm-up session focusing our minds back on the Triangle Inequality Theorem.

Is it possible to construct a triangle with the given side lenghts? 6 ft, 10 ft, 20 ft.

A Yes

B No

Is it possible to construct a triangle with side lenghts of 1.5m, 2.5m and 3.5 m?

A Yes

B No

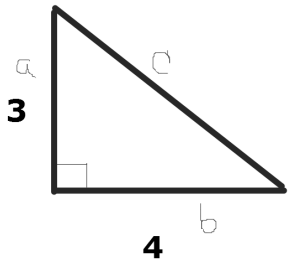
Today, we will look at the converse of the Pythagorean theorem.

I'm considering what I know about the Pythagorean Theorem.
***It is only about right triangles.**
***The two shorter sides of the right triangle are the legs.**
***Legs are always labeled a and b.**
***The longest side of the right triangle is called the hypotenuse, and it is always opposite the right angle.**
***The theorem states $a^2+b^2=c^2$**

The Converse of the Pythagorean Theorem:

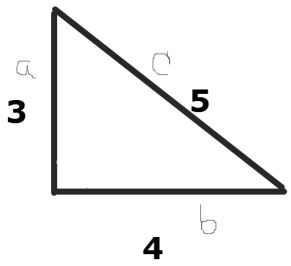
If the square of one side of a triangle is equal to the sum of the squares of the other two sides, then the triangle is a right triangle.

I'm going to start with what I know.



The Pythagorean Theorem states that $a^2+b^2=c^2$ so then I need to add 3^2+4^2 and see what it equals
$3^2=9$
$4^2=16$
$9+16=25$
The square root of 25 is 5, so this theorem proves the side lengths are 3, 4, & 5.

However, what if I am given a triangle without the square corner symbol? How can I prove it is a right triangle? That is what the Converse of the pythagorean Theorem is all about.



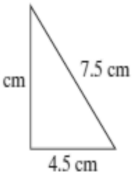
Now I need to prove that lengths of 3, 4, & 5 form a right triangle.
I need to check to see that $3^2+4^2=5^2$
$3^2=9$
$4^2=16$
$5^2=25$
$9+16=25$
Yes, I have proven that this is a right triangle.

If the equation $a^2 + b^2 = c^2$ is true for the lengths of the sides of a triangle, then the triangle is a right triangle. This method is called the Converse of the Pythagorean Theorem. You can use the Converse of the Pythagorean Theorem to determine if a triangle is a right triangle.

Vocabulary Tip
When using the Converse of the Pythagorean Theorem, substitute the greatest side length for *c*.

EXAMPLE 2 **Identifying a Right Triangle**

Determine whether the triangle is a right triangle. Explain.



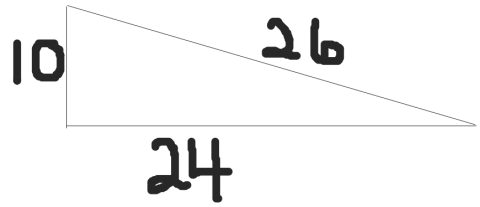
$a^2 + b^2 \stackrel{?}{=} c^2$ ← Use the Pythagorean Theorem.
$6^2 + 4.5^2 \stackrel{?}{=} 7.5^2$ ← Substitute 6 for *a*, 4.5 for *b*, and 7.5 for *c*.
$36 + 20.25 \stackrel{?}{=} 56.25$ ← Simplify. Use a calculator.
$56.25 = 56.25$

The equation is true, so the triangle is a right triangle.

Let's think through a few problems together.

Determine whether the lengths of 10, 24, & 26 can form a right triangle.

First, I want to draw the triangle, and then label the side lengths.



I put the 26 on the longest side. Now, using the Pythagorem Theorem, I want to see if $10^2+24^2=26^2$ $10^2=100$,$24^2=576$ & $26^2=676$, and $100+576=676$. Yes, is a right triangle.

Grab your clicker and get access to a calculator (your ipod, cellphone, computer, etc.)

Let's try a few more as clicker questions.

Feel free to draw out the problems to help visualize the problems.

Determine whether the side lengths of a right triangle could be 11 in, 21 in, and 30 in.

A Yes

B No

Determine whether the side lengths of a right triangle could be 8 cm, 9 cm, and 12 cm.

A Yes

B No

The converse of the Pythagorean Theorem is used to determine if three segments can form an equilateral triangle.

A True

B False

Power down your clickers and put them away.

Grab a piece of scratch paper. Write your name on it, and copy down these three problems.

1. 12, 16, 20
2. 3.4, 16, 20.2
3. 3.8, 5.2, 8.5

Work with your table partners to determine if any one or more of these problems could form a right triangle. Be prepared to prove your answers.

Hand your papers in when directed to do so.

Your assignment (Work time rest of today and tomorrow - due end of class Wednesday)

The front view of a A-frame house is triangle. The lengths of its sides are 39 feet, 39 feet, and 28 feet.

Use geometer's sketchpad to draw the front lines of an A-frame house. Use the text feature to write your response to these questions:
1. Is the front view of the house in the shape of a right triangle? 2. Why or why not? 3. Include your name in your sketch. You will be required to Print off your sketch and hand it in on Wednesday.