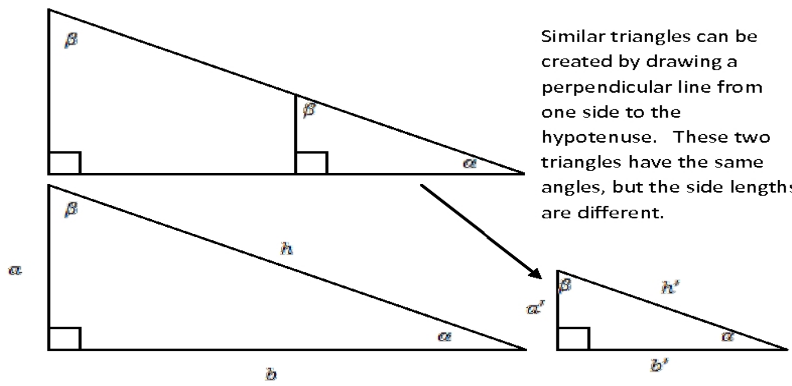
Sine, Cosine, and Tangent: The Right-Angle Trig Functions

Remember similar triangles from Geometry?



Similar triangles can be created by drawing a perpendicular line from one side to the hypotenuse. These two triangles have the same angles, but the side lengths are different.

If I tell you both a and b, and give you a protractor, you should be able to find α (or β) in the triangle to the left. And you'd get the same answer if I gave you a' and b' in the triangle to the right.

The fact that there is a method of going from knowing the lengths of the sides of a right triangle to knowing the angles of those triangles (by using your protractor) means that there is a **relation** between the sides and angles of a triangle. This just means that given the **input** lengths a and b, we can find a unique **output** angle α. Here are examples of this relation:

$$(a, b) \to \alpha$$
$$(1,1) \to 45°$$
$$(a', b') \to \alpha$$

Since for every input we have a unique output, the relation from the lengths to the sides is a **function** (this is all a function means). But what if we wanted to go from the angles to the sides? If we reverse the arrows in the above example, we run into a problem:

$$\alpha \to (a, b)$$
$$45° \to (1,1)$$
$$\alpha \to (a', b')$$