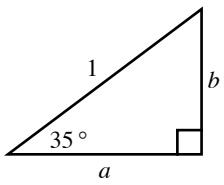
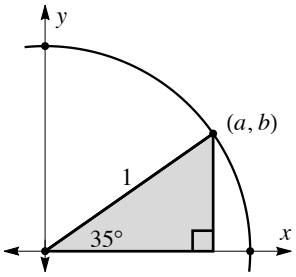
Trigonometry 9: Introduction to Obtaining Missing Side Lengths

One of the very powerful applications of trigonometry is to be able to obtain missing side lengths from right angle triangles (given at least one angle in addition to the right angle).

For example, consider the triangle below, which has a hypotenuse of length 1:



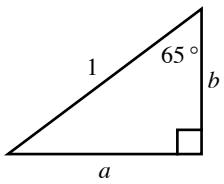
The triangle is in the same orientation of the triangle we draw when using the unit circle:



This means that we can directly find side lengths a and b using the definitions of sine and cosine (using the sine and cosine functions on a calculator):

$$a = \cos 35° \implies a = 0.81915$$
$$b = \sin 35° \implies b = 0.57358$$

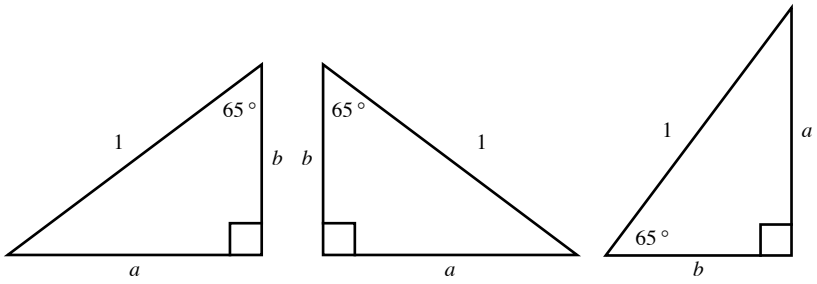
Now let's consider the case where the triangle is not in the same orientation as we would draw it inside the unit circle. For example, consider the following triangle:



We can easily create the necessary triangle by finding the missing angle, which is 25°:

$$a = \cos 25° \implies a = 0.90631$$
$$b = \sin 25° \implies b = 0.42262$$

Another approach is to use Rigid Motion to rotate and reflect the given triangle into the same orientation as the triangle we use in the unit circle. The figure below illustrates the effect of reflecting and then rotating:



$$a = \sin 65° \implies a = 0.90631$$
$$b = \cos 65° \implies b = 0.42262$$