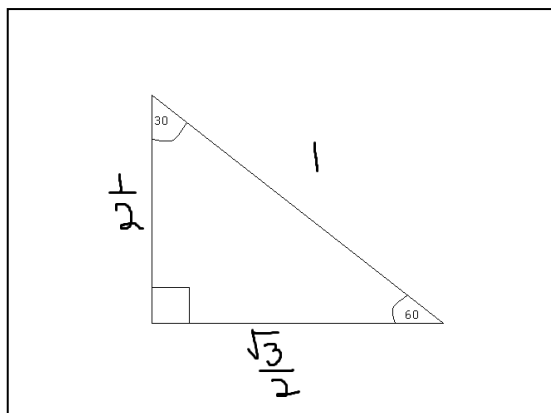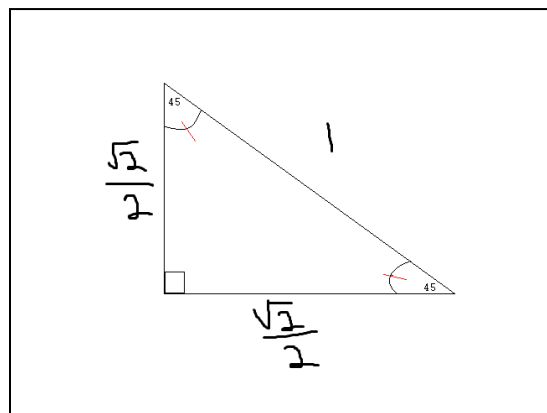# Reference Angles, a Quick Review

Reference angles. What are they, and what is their purpose? Reference angles are basically the trigonometric functions (sine, cosine, tangent, cosecant, secant, and cotangent) of the two special right triangles 30-60-90 and 45-45-90. Why do you need them? Reference angles are heavily prominent in trigonometry, and you will often encounter them when solving or verifying equations, making them very important to learn.
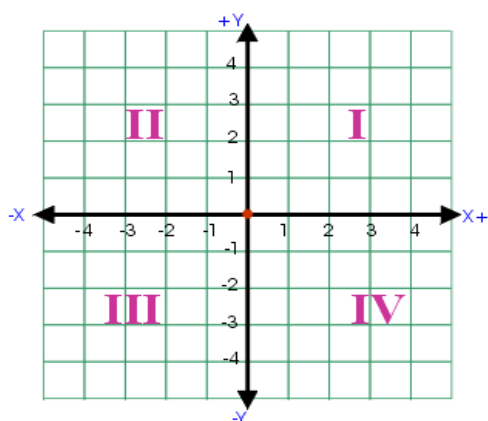
The following are the side values of a 30-60-90 triangle and 45-45-90 triangle respectively.

$$\text{Sin } 30 = \frac{\sqrt{3}}{2} \qquad \csc 30 = \frac{2}{\sqrt{3}}$$
$$\text{Cos } 30 = \tfrac{1}{2} \qquad \sec 30 = 2$$
$$\text{Tan } 30 = \sqrt{3} \qquad \cot 30 = \frac{\sqrt{3}}{3}$$

$$\text{Sin } 60 = \tfrac{1}{2} \qquad \csc 60 = 2$$
$$\cos 60 = \frac{\sqrt{3}}{2} \qquad \sec 60 = \frac{2}{\sqrt{3}}$$
$$\tan 60 = \frac{\sqrt{3}}{3} \qquad \cot 60 = \frac{3}{\sqrt{3}}$$

$$\text{Sin } 45 = \frac{\sqrt{2}}{2} \qquad \csc 45 = \frac{2}{\sqrt{2}}$$
$$\cos 45 = \frac{\sqrt{2}}{2} \qquad \sec 30 = \frac{2}{\sqrt{2}}$$
$$\tan 45 = 1 \qquad \cot 45 = 1$$

The quadrants of a graph are essential to reference angles, as certain quadrants affect the values of certain trig functions. This could be represented in the following:

All – every trig function is positive in 1st quadrant

Students – sin functions are positive only in 2nd quadrant

Take – tan functions are positive only in 3rd quadrant

Calculus – cos functions are positive only in 4th quadrant

If the trig functions were not mentioned, they are negative. These same rules apply to the inverse trig functions (csc, sec, cot).