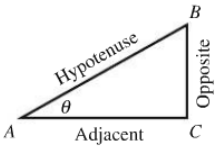
4.2 Trigonometric Functions of Acute Angles



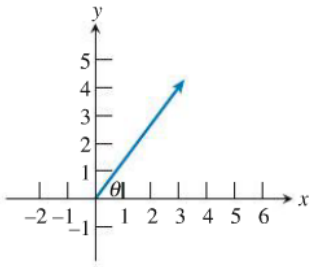


FIGURE 4.7 An acute angle θ in *standard position*, with one ray along the positive x-axis and the other extending into the first quadrant.

Right Triangle Definitions of Trigonometric Functions

Let θ be an acute angle of a right triangle. The six trigonometric functions of the angle θ are defined as follows.

$$\sin\theta = \frac{opp}{hyp} \qquad \cos\theta = \frac{adj}{hyp} \qquad \tan\theta = \frac{opp}{adj}$$

$$\csc\theta = \frac{hyp}{opp} \qquad \sec\theta = \frac{hyp}{adj} \qquad \cot\theta = \frac{adj}{opp}$$

THERE SHOULD BE NO DECIMAL ANSWERS! ALL RADICALS MUST BE SIMPLIFIED! AT TIMES, RATIONALIZING DENOMINATORS WILL BE OPTIONAL

(UNIT CIRCLE VALUES SHOULD BE SIMPLIFIED WITH RATIONALIZED DENOMINATORS)

1) Find the value of all six trigonometric functions for a 45-degree angle

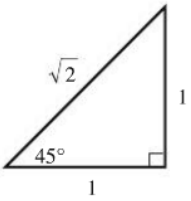


FIGURE 4.9 An isosceles right triangle. (Example 1)

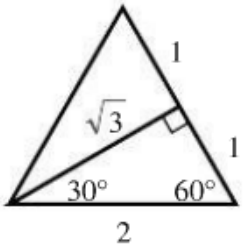
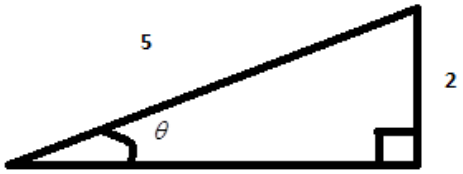


FIGURE 4.10 An altitude to any side of an equilateral triangle creates two congruent 30°–60°–90° triangles. If each side of the equilateral triangle has length 2, then the two 30°–60°–90° triangles have sides of length 2, 1, and $\sqrt{3}$. (Example 2)

2) Find the value of all six trigonometric functions for a 30-degree angle

3) Find the value of all six trigonometric functions for a 60-degree angle

4) Find the six trigonometric functions of θ in the figure.



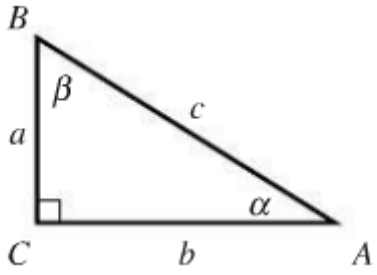
5) Assume that θ is an acute angle in a right triangle satisfying the given conditions. Evaluate the remaining trigonometric functions for the following problems.

a) $\cot\theta = \frac{11}{3}$

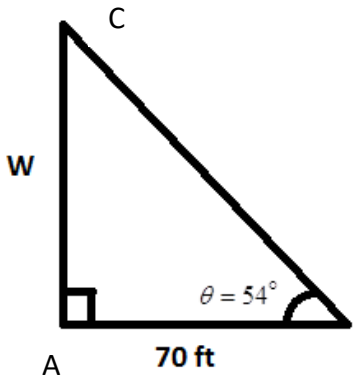
b) $\csc\theta = \frac{23}{9}$

6) Calculator mode is important! If angles are in degrees then calculator should be in degree mode

solve the right ΔABC for all of its unknown parts. $\alpha = 20°; a = 12.3$



7) **A biologist wants to know the width W of a river in order to properly set instruments for studying the pollutants in the water. From point A, the biologist walks downstream 70 feet and sights to point C. From this sighting, it is determined that $\theta = 54°$. How wide is the river?**



8) **A 12-meter flagpole casts a 12-meter shadow. Find θ, the angle of elevation to the sun.**

9) **A ramp 17.5 feet in the length rises to a loading platform that is 3.5 feet off the ground. Find the angle θ that the ramp makes with the ground.**

Fill in the angles in degrees and radians on the blank unit circle. If $x = \cos\theta$ and $y = \sin\theta$, how can we use special right triangles to figure out the coordinate points on the circle?

The Unit Circle