

Trigonometry 4.1 - Day 3

HW p.520:

1,3,5,6,9,10,
12,15,16,17,
18

A **unit circle** is a circle of radius 1, with its center at the origin of a rectangular coordinate system. The equation of this unit circle is $x^2 + y^2 = 1$. **Figure 4.19** shows a unit circle with a central angle measuring t radians.

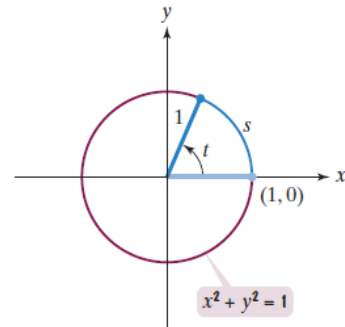


FIGURE 4.19 Unit circle with a central angle measuring t radians

Definitions of the Trigonometric Functions in Terms of a Unit Circle

If t is a real number and $P = (x, y)$ is a point on the unit circle that corresponds to t , then

$$\begin{array}{ll} \sin t = y & \csc t = \frac{1}{y}, y \neq 0 \\ \cos t = x & \sec t = \frac{1}{x}, x \neq 0 \\ \tan t = \frac{y}{x}, x \neq 0 & \cot t = \frac{x}{y}, y \neq 0. \end{array}$$

Because this definition expresses function values in terms of coordinates of a point on a unit circle, the trigonometric functions are sometimes called the **circular functions**. Observe that the function values in the second column in the box are the reciprocals of the corresponding function values in the first column.

✓ **Check Point 1** Use the figure on the right to find the values of the trigonometric functions at t .

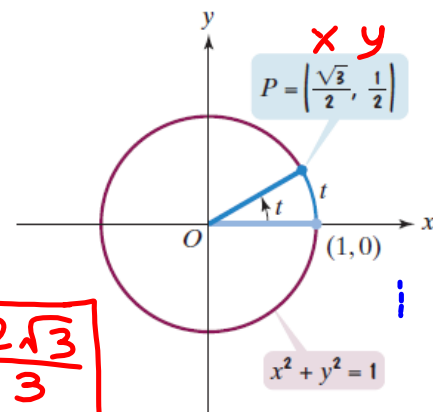
$$t = \frac{\pi}{6}$$

$$\sin t = \frac{1}{2} \quad \csc t = 2$$

$$\cos t = \frac{\sqrt{3}}{2} \quad \sec t = \frac{2}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{3}}{3}$$

$$\tan t = \frac{\frac{1}{2}}{\frac{\sqrt{3}}{2}} \Rightarrow \frac{1}{2} \cdot \frac{2}{\sqrt{3}} = \frac{1}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{3}}{3}$$

$$\cot t = \frac{\frac{\sqrt{3}}{2}}{\frac{1}{2}} \Rightarrow \frac{\sqrt{3}}{2} \cdot \frac{2}{1} = \frac{\sqrt{3}}{1} = \sqrt{3}$$



EXAMPLE 2 Finding Values of the Trigonometric Functions

Use **Figure 4.23** to find the values of the trigonometric functions at $t = \frac{\pi}{2}$.

$$\sin t = \boxed{1} \quad \csc t = \boxed{1}$$

$$\cos t = \boxed{0} \quad \sec t = \frac{1}{0} \rightarrow \boxed{\text{undefined}}$$

$$\tan t = \frac{1}{0} \rightarrow \boxed{\text{undefined}}$$

$$\cot t = \frac{0}{1} = \boxed{0}$$

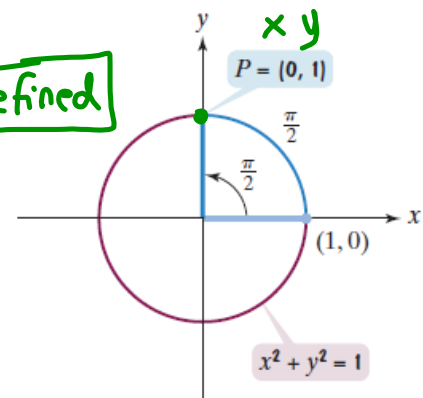


FIGURE 4.23

✓ **Check Point 2** Use the figure on the right to find the values of the trigonometric functions at $t = \pi$.

$$\sin t = \boxed{0} \quad \csc t = \boxed{\text{undef.}}$$

$$\cos t = \boxed{-1} \quad \sec t = \boxed{-1}$$

$$\tan t = \boxed{0} \quad \cot t = \boxed{\text{undef.}}$$

