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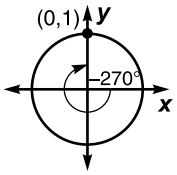
Study Guide

Trigonometric Functions on the Unit Circle

Example 1 **Use the unit circle to find cot (−270°).**



The terminal side of a −270° angle in standard position is the positive y-axis, which intersects the unit circle at (0, 1).

By definition, $\cot(-270°) = \frac{x}{y}$ or $\frac{0}{1}$.

Therefore, $\cot(-270°) = 0$.

Trigonometric Functions of an Angle in Standard Position	$\sin\theta = \frac{y}{r}$	$\cos\theta = \frac{x}{r}$	$\tan\theta = \frac{y}{x}$
	$\csc\theta = \frac{r}{y}$	$\sec\theta = \frac{r}{x}$	$\cot\theta = \frac{x}{y}$

Example 2 **Find the values of the six trigonometric functions for angle θ in standard position if a point with coordinates (−9, 12) lies on its terminal side.**

We know that $x = -9$ and $y = 12$. We need to find r.

$r = \sqrt{x^2 + y^2}$ *Pythagorean Theorem*

$r = \sqrt{(-9)^2 + 12^2}$ *Substitute −9 for x and 12 for y.*

$r = \sqrt{225}$ or 15 *Disregard the negative root.*

$\sin\theta = \frac{12}{15}$ or $\frac{4}{5}$ $\cos\theta = \frac{-9}{15}$ or $-\frac{3}{5}$ $\tan\theta = \frac{12}{-9}$ or $-\frac{4}{3}$

$\csc\theta = \frac{15}{12}$ or $\frac{5}{4}$ $\sec\theta = \frac{15}{-9}$ or $-\frac{5}{3}$ $\cot\theta = \frac{-9}{12}$ or $-\frac{3}{4}$

Example 3 **Suppose θ is an angle in standard position whose terminal side lies in Quadrant I. If $\cos\theta = \frac{3}{5}$, find the values of the remaining five trigonometric functions of θ.**

$r^2 = x^2 + y^2$ *Pythagorean Theorem*

$5^2 = 3^2 + y^2$ *Substitute 5 for r and 3 for x.*

$16 = y^2$

$\pm 4 = y$ *Take the square root of each side.*

Since the terminal side of θ lies in Quadrant I, y must be positive.

$\sin\theta = \frac{4}{5}$ $\tan\theta = \frac{4}{3}$

$\csc\theta = \frac{5}{4}$ $\sec\theta = \frac{5}{3}$ $\cot\theta = \frac{3}{4}$