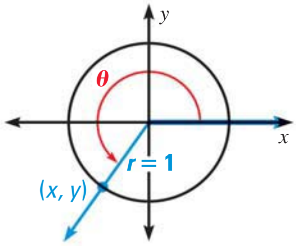
KEY CONCEPT — *For Your Notebook*

The Unit Circle

The circle $x^2 + y^2 = 1$, which has center (0, 0) and radius 1, is called the **unit circle**. The values of $\sin\theta$ and $\cos\theta$ are simply the y-coordinate and x-coordinate, respectively, of the point where the terminal side of θ intersects the unit circle.



$$\sin\theta = \frac{y}{r} = \frac{y}{1} = y \qquad \cos\theta = \frac{x}{r} = \frac{x}{1} = x$$

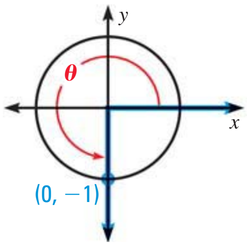
It is convenient to use the unit circle to find trigonometric functions of *quadrantal angles*. A **quadrantal angle** is an angle in standard position whose terminal side lies on an axis. The measure of a quadrantal angle is always a multiple of 90°, or $\frac{\pi}{2}$ radians.

EXAMPLE 2 Use the unit circle

Use the unit circle to evaluate the six trigonometric functions of $\theta = 270°$.

Solution

Draw the unit circle, then draw the angle $\theta = 270°$ in standard position. The terminal side of θ intersects the unit circle at $(0, -1)$, so use $x = 0$ and $y = -1$ to evaluate the trigonometric functions.



$\sin\theta = \frac{y}{r} = \frac{-1}{1} = -1$ $\qquad$ $\csc\theta = \frac{r}{y} = \frac{1}{-1} = -1$

$\cos\theta = \frac{x}{r} = \frac{0}{1} = 0$ $\qquad$ $\sec\theta = \frac{r}{x} = \frac{1}{0}$ **undefined**

$\tan\theta = \frac{y}{x} = \frac{-1}{0}$ **undefined** $\qquad$ $\cot\theta = \frac{x}{y} = \frac{0}{-1} = 0$

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ANOTHER WAY

The general circle $x^2 + y^2 = r^2$ can also be used to find the trigonometric functions of $\theta = 270°$. The terminal side of θ intersects the circle at $(0, -r)$. Therefore:

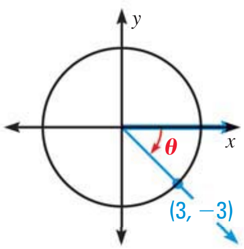
$$\sin\theta = \frac{y}{r} = \frac{-r}{r} = -1$$

The other functions can be evaluated similarly.

✓ GUIDED PRACTICE for Examples 1 and 2

Evaluate the six trigonometric functions of θ.

1.



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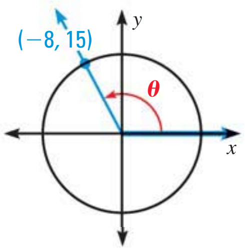
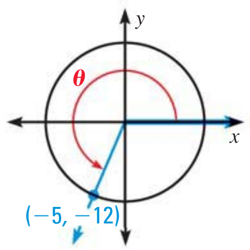


3.



4. Use the unit circle to evaluate the six trigonometric functions of $\theta = 180°$.