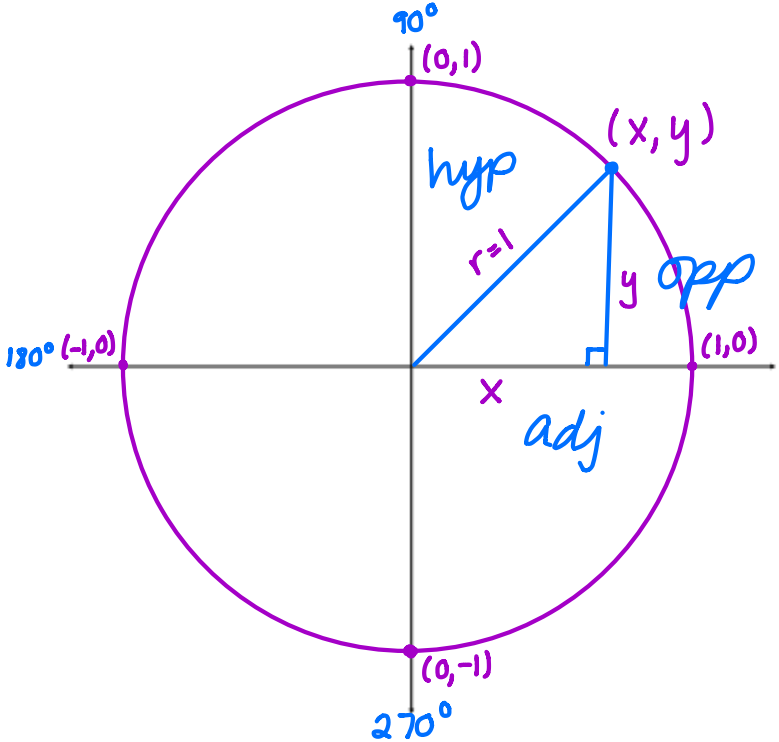
General Definitions of Trigonometric Functions

1. Draw a circle with the equation $x^2 + y^2 = r^2$
2. Draw θ in standard position.
3. Write the point (x, y) where the terminal side intersects the circle.
4. Label the terminal line segment "r" for the radius of the circle.



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

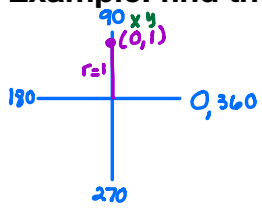
$$\cos\theta = \frac{x}{r} \qquad \sec\theta = \frac{r}{x}$$

$$\tan\theta = \frac{y}{x} \qquad \cot\theta = \frac{x}{y}$$

Syr cxr tyx

If we remember what we learned about the unit circle in chapter 10.2, we can fairly quickly determine what the sine/cosine/tangent values are for the axis. (0°, 90°, 180°, 270°, 360° are also known as the quadrantal angles)

Example: find the six trigonometric functions for 90°



Syr cxr tyx

$\sin 90^\circ = \frac{y}{r} = \frac{1}{1} = 1$ $\quad \csc 90^\circ = \frac{r}{y} = \frac{1}{1} = 1$

$\cos 90^\circ = \frac{x}{r} = \frac{0}{1} = 0$ $\quad \sec 90^\circ = \frac{r}{x} = \frac{1}{0} = \text{Undefined}$

$\tan 90^\circ = \frac{y}{x} = \frac{1}{0} = \text{Undefined}$ $\quad \cot 90^\circ = \frac{x}{y} = \frac{0}{1} = 0$

This method, is how we populate the rest of the table for the axes.

Degrees	Radians	sin Θ	cos Θ	tan Θ	csc Θ	sec Θ	cot Θ
0	0	0	1	0	undefined	1	undefined
30°	$\frac{\pi}{6}$	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{3}}{3}$	2	$\frac{2\sqrt{3}}{3}$	$\sqrt{3}$
45°	$\frac{\pi}{4}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$	1	$\sqrt{2}$	$\sqrt{2}$	1
60°	$\frac{\pi}{3}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$	$\frac{2\sqrt{3}}{3}$	2	$\frac{\sqrt{3}}{3}$
90°	$\frac{\pi}{2}$	1	0	undefined	1	undefined	0
180°	π	0	-1	0	U	-1	U
270°	$3\pi/2$	-1	0	U	-1	U	0

(U = undefined)