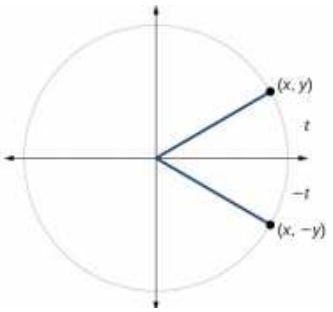
3-3 Notes Trig Functions & the Unit Circle Name _____
Pre-Calculus

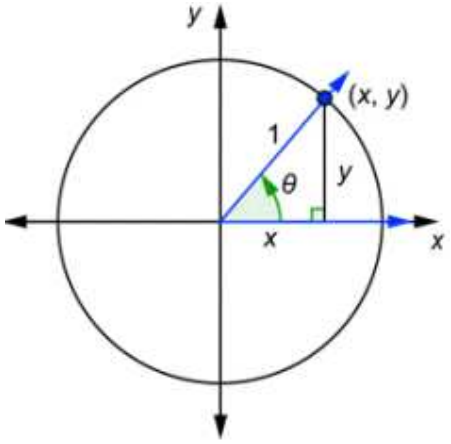
I. Building the Unit Circle

Before we look at the unit circle with respect to the trigonometric functions, we need to get some terminology down for unit circle use. Remember the Unit Circle has a radius of 1.

Terminal Point – For and angle in standard position, let $P = (x, y)$ be the point of the terminal side of θ that is also on the circle $x^2 + y^2 = r^2$



Reference angle - The reference angle is always the smallest angle that you can make from the terminal side of an angle and the x-axis. The reference angle always uses the x-axis as its frame of reference. A reference angle must be < 90° or< $\boldsymbol{\pi}$ **2** $\boldsymbol{rad}$.

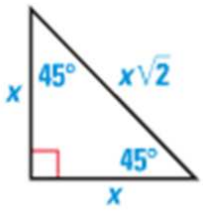


Trig Functions	Reciprocal functions
$\sin\theta = \frac{opp}{hyp} = \frac{y}{r} = y$	$\csc\theta = \frac{hyp}{opp} = \frac{r}{y} = \frac{1}{y}$
$\cos\theta = \frac{adj}{hyp} = \frac{x}{r} = x$	$\sec\theta = \frac{hyp}{adj} = \frac{r}{x} = \frac{1}{x}$
$\tan\theta = \frac{opp}{adj} = \frac{y}{x}$	$\cot\theta = \frac{adj}{opp} = \frac{x}{y}$

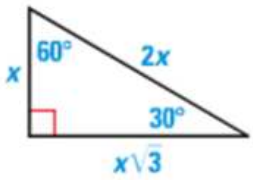
The unit circle can be constructed using the above idea, a basic understanding of geometry, and recognizing the correlation of the arc distance (terminal point, t) and the degree measure of the angle formed with the radius.

Let's review Special Right Triangles…

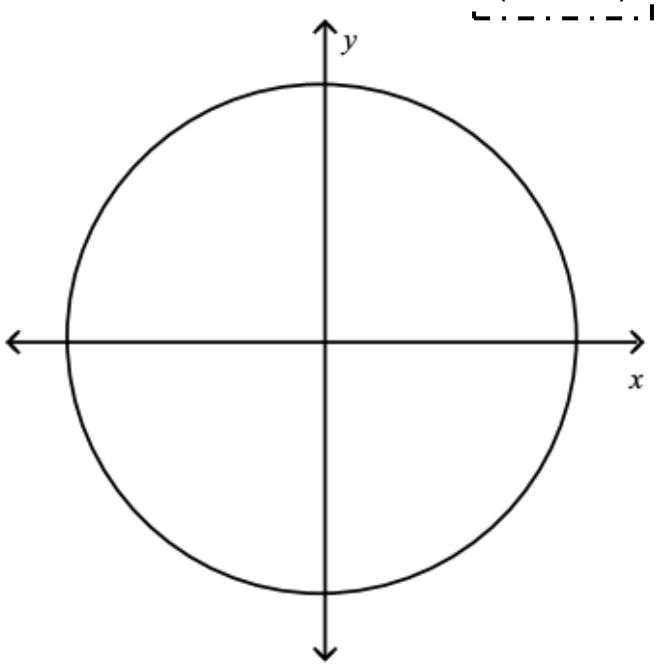
45°-45°-90°



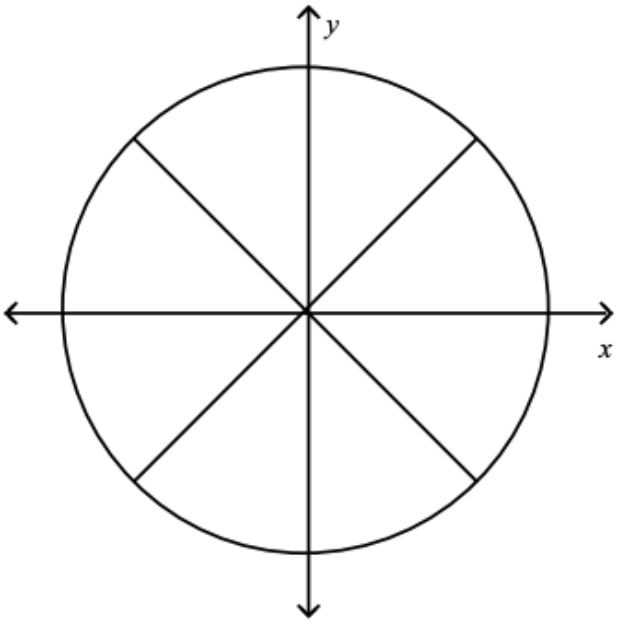
30°-60°-90°



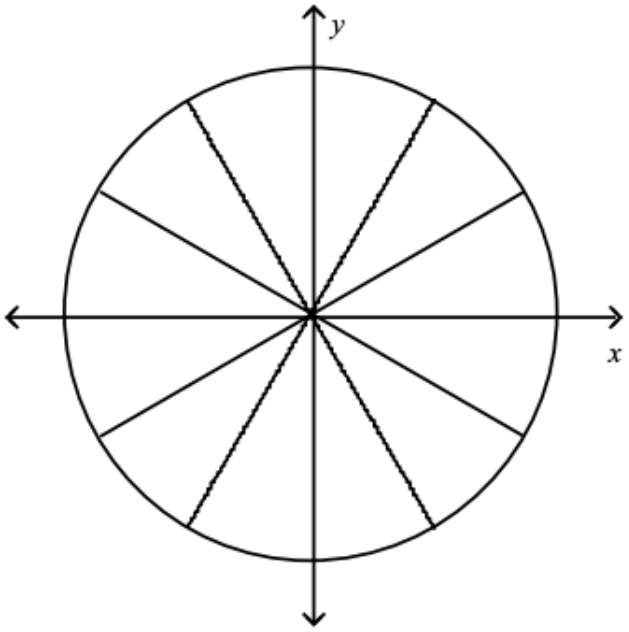
(cos, sin)



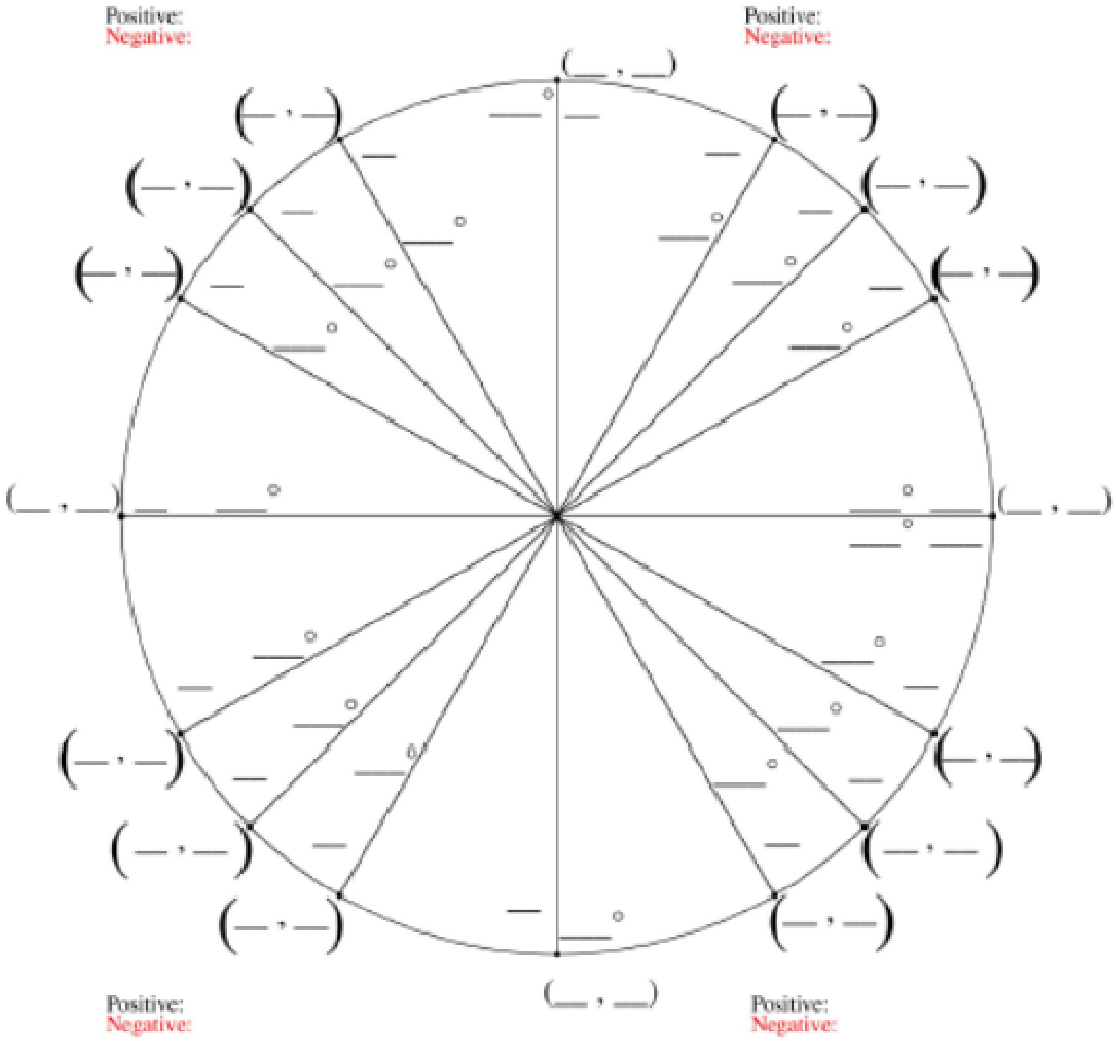
Unit Circle $\frac{\pi}{4}$ reference number



Unit Circle $\frac{\pi}{3}$ and $\frac{\pi}{6}$ reference number



Now we can put all of this together…



Based on our unit circle and reciprocal functions we also know the following…

θ (Radians)	θ (Degrees)	$\sin\theta$	$\cos\theta$	$\tan\theta$	$\csc\theta$	$\sec\theta$	$\cot\theta$
$\frac{\pi}{6}$	30°	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{3}}{3}$	2	$\frac{2\sqrt{3}}{3}$	$\sqrt{3}$
$\frac{\pi}{4}$	45°	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$	1	$\sqrt{2}$	$\sqrt{2}$	1
$\frac{\pi}{3}$	60°	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$	$\frac{2\sqrt{3}}{3}$	2	$\frac{\sqrt{3}}{3}$

II. Finding exact values of the Six Trig Functions

1. Let t be a real number and let $P = (-1/2, \sqrt{3}/2)$ be the point of the unit circle that corresponds to t Find the values of $\sin t, \cos t, \tan t, \csc t, \sec t, \text{and } \cot t.$

A. Find the exact values of the six trig functions for the following:

2. $\cos \frac{5\pi}{4}$

3. $\cos \frac{8\pi}{3}$

4. $\tan 315°$

5. $\csc \frac{\pi}{6}$

6. sin (-60°)

7. sec 45°

B. Find the exact value of each expression.

8. sin45°cos180°

9. tan $\frac{\pi}{4}$ – sin $\frac{3\pi}{2}$

10. (sec $\frac{\pi}{4}$)^2 + csc $\frac{\pi}{2}$

C. Use a calculator to approximate the value of each trig function.

11. cos 48°

12. csc 21°

13. tan $\frac{\pi}{12}$

14. Find the exact values if each of the six trig functions of an angle θ if (4, -3) is a point on its terminal side in standard position.