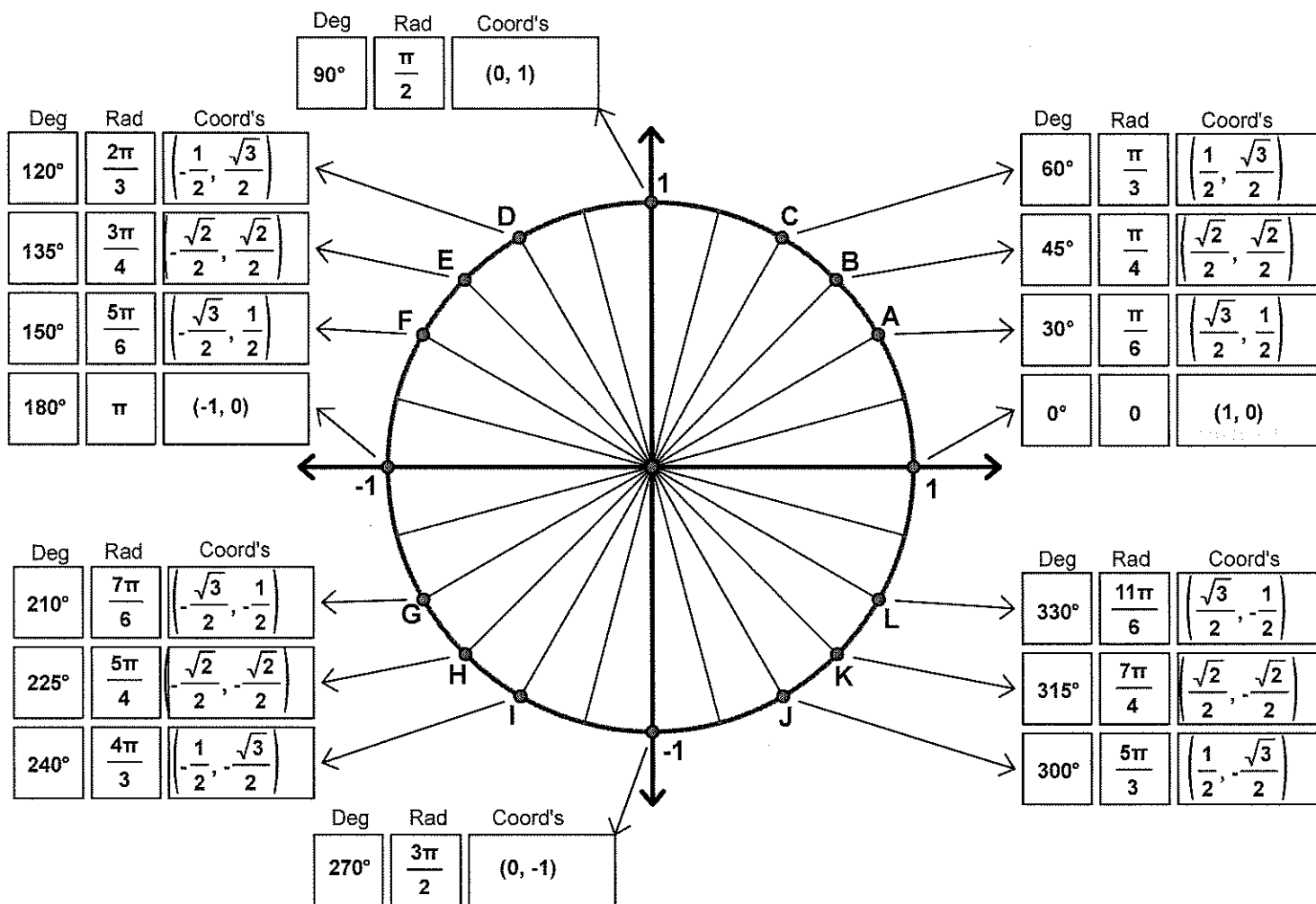


Sections 4.2 & 4.4 – Trig Functions of Any Angle

Using your calculator, find the sine and cosine of the following angles:

θ	0	$\frac{\pi}{2}$	π	$\frac{3\pi}{2}$
$\sin\theta$	0	1	0	-1
$\cos\theta$	1	0	-1	0

Now, fill in the coordinates of these quadrantal angles in the chart below.

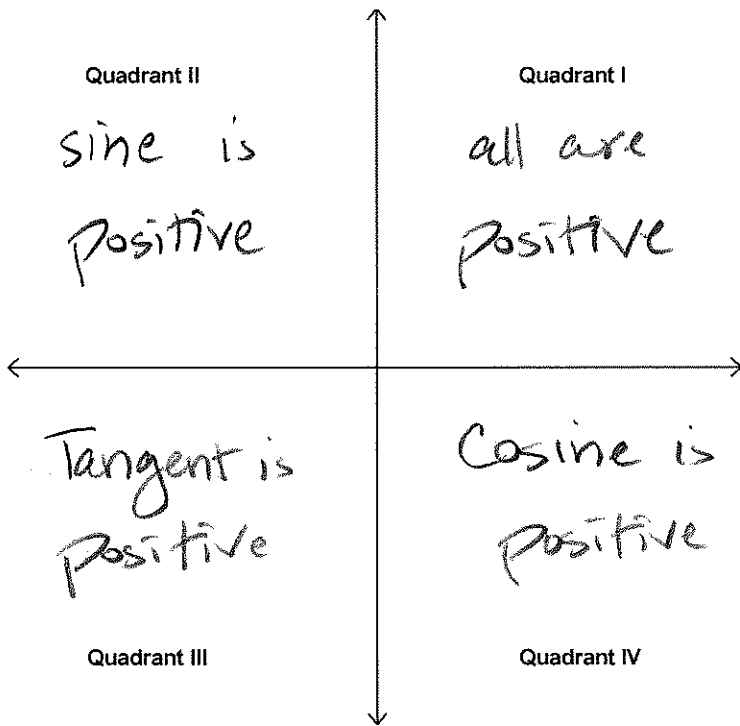


Is there some sort of relationship between sine and cosine and the x and y coordinates of these four angles?

$$(x, y) = (\cos \theta, \sin \theta)$$

Sections 4.2 & 4.4 – Trig Functions of Any Angle

Signs of Trig Functions



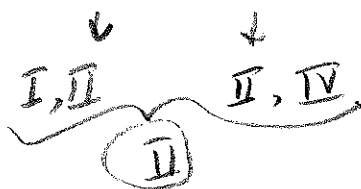
Remember it by.....

<u>S</u> tudents	<u>A</u> ll
<u>T</u> ake	<u>C</u> alculus

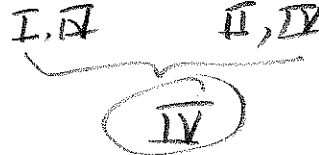
Examples:

1) State the quadrant in which θ lies:

a. $\sin \theta > 0$ and $\tan \theta < 0$



b. $\sec \theta > 0$ and $\cot \theta < 0$



2) If $\sin \theta = 0.5358$, find two values for θ ($0^\circ \leq \theta < 360^\circ$). Round to the nearest tenth of a degree.

$$\theta = \sin^{-1}(0.5358)$$

$$\theta \approx 32.40^\circ \text{ in Q1}$$

sin is also > 0 in QII, so

$$180 - 32.40 \approx 147.6^\circ \text{ in Q2}$$

3) If $\cos \theta = 0.8164$, find two values for θ ($0^\circ \leq \theta < 360^\circ$). Round to the nearest tenth of a degree.

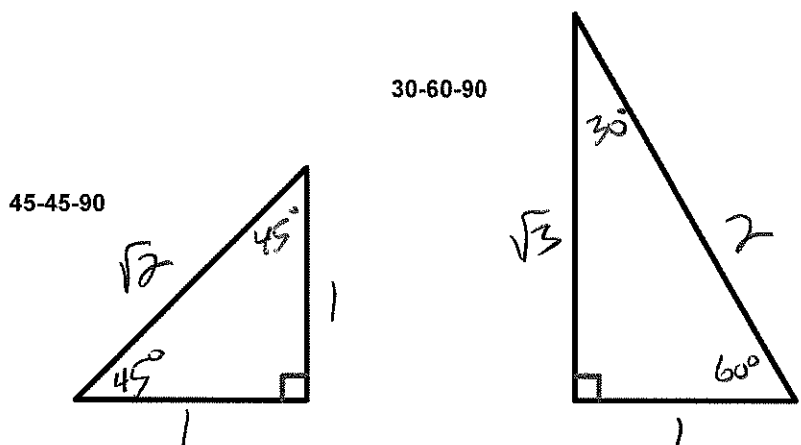
$$\theta = \cos^{-1}(0.8164) \Rightarrow \theta \approx 35.27 \text{ in Q1}$$

$$\approx 324.73^\circ \text{ in Q4 } (360 - 35.27)$$

Sections 4.2 & 4.4 – Trig Functions of Any Angle

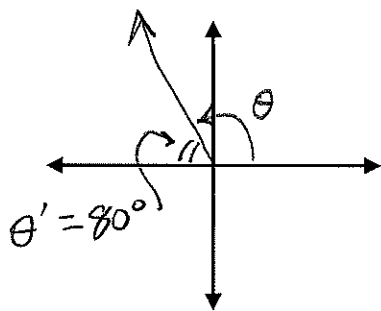
Reference Angles

RECALL: Special Right Triangles:

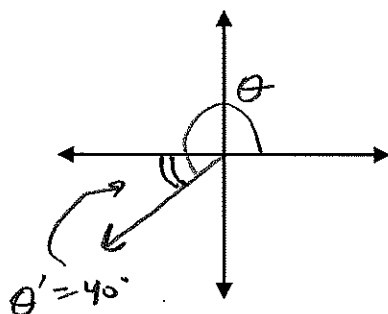


Reference Angle - θ' - an angle made with the x-axis that is used to create an acute right triangle we can use to analyze trig functions

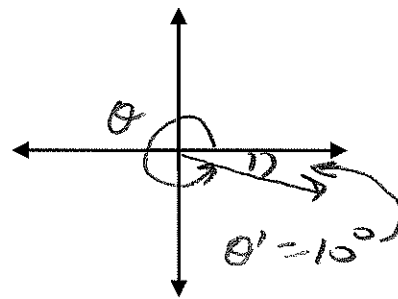
If $\theta = 100^\circ$



If $\theta = 220^\circ$



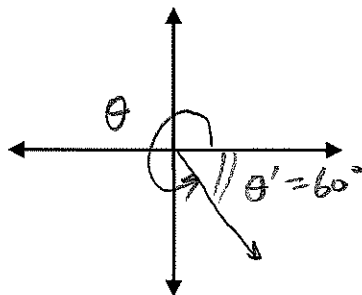
If $\theta = 350^\circ$



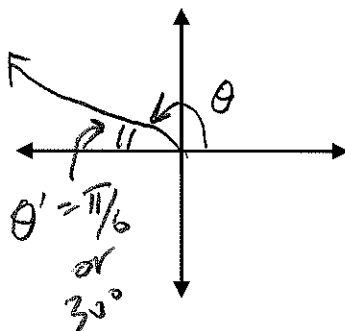
Examples:

Find the reference angle θ' . Draw a diagram to help you.

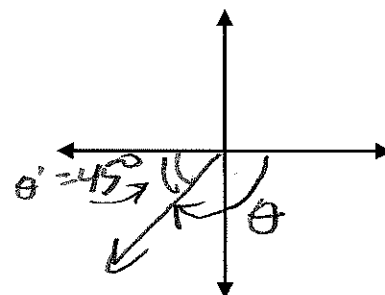
a) $\theta = 300^\circ$



b) $\theta = \frac{5\pi}{6}$



c) $\theta = -135^\circ$



Reference angles are useful because they enable us to evaluate the trig functions of many different "special" angles.

Sections 4.2 & 4.4 – Trig Functions of Any Angle

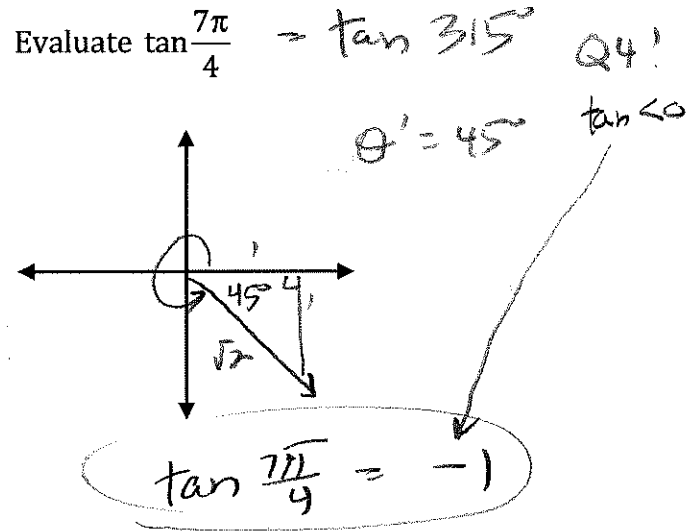
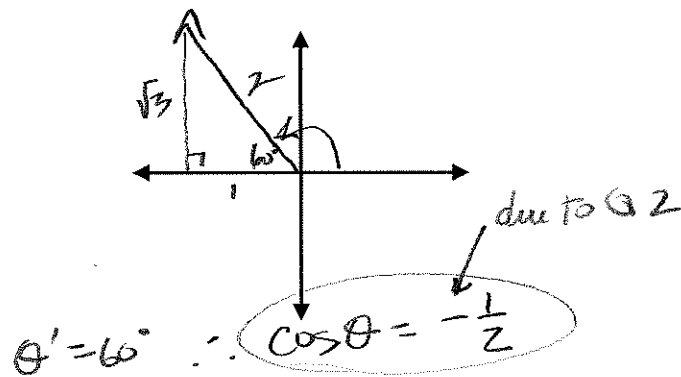
Trig Functions of Real Numbers

To find the value of a trig function of any "special" angle follow the following steps:

1. Draw the angle in standard position
2. Determine the reference angle θ' (always made with the x-axis)
3. Find the function value based on the sides of the appropriate special right triangle
4. Depending on the Quadrant in which θ lies, affix the appropriate sign (positive or negative) to the function value

Examples:

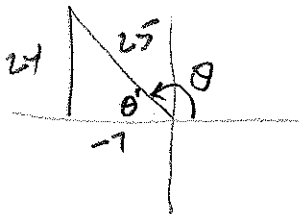
Evaluate $\cos \frac{2\pi}{3} = \cos 120^\circ$



End Day 1

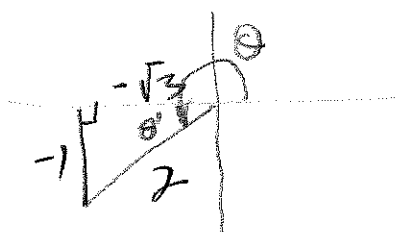
More Examples:

- 1) If θ is in Quadrant II and $\cos \theta = \frac{-7}{25}$, what is $\sin \theta$?



$$\sin \theta = \frac{24}{25}$$

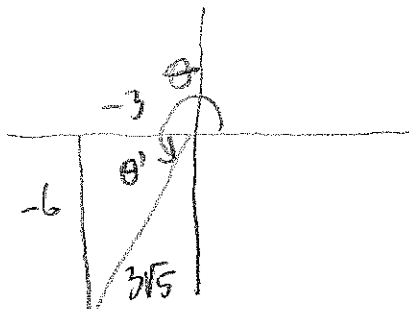
- 2) If $\cos \theta = \frac{-\sqrt{3}}{2}$ and θ is in Quadrant III, what is $\sin \theta$?



$$\sin \theta = -\frac{1}{2}$$

Sections 4.2 & 4.4 – Trig Functions of Any Angle

- 3) If θ is in standard position and the point $(-3, -6)$ is on the terminal side, find the six trigonometric functions of θ .



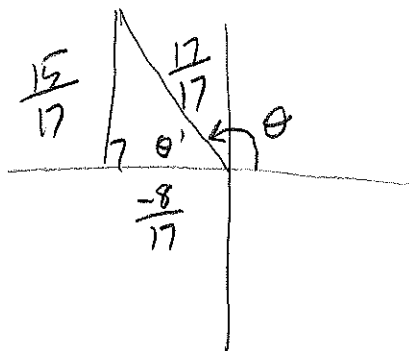
$$(-3)^2 + (-6)^2 = c^2 \Rightarrow c = \sqrt{9+36} = \sqrt{45} = 3\sqrt{5}$$

$$\sin \theta = \frac{-6}{3\sqrt{5}} \left(\frac{\sqrt{5}}{\sqrt{5}} \right) = -\frac{2\sqrt{5}}{5} \quad \csc \theta = -\frac{\sqrt{5}}{2}$$

$$\cos \theta = \frac{-3}{3\sqrt{5}} = -\frac{\sqrt{5}}{5} \quad \sec \theta = -\sqrt{5}$$

$$\tan \theta = \frac{-6}{-3} = 2 \quad \cot \theta = \frac{1}{2}$$

- 4) If θ is in standard position and the point $\left(\frac{-8}{17}, \frac{15}{17}\right)$ is on the terminal side, find the six trigonometric functions of θ .



$$\sin \theta = \frac{15}{17}$$

$$\csc \theta = \frac{17}{15}$$

$$\cos \theta = -\frac{8}{17}$$

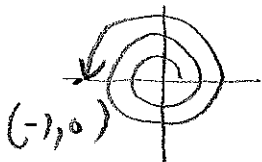
$$\sec \theta = -\frac{17}{8}$$

$$\tan \theta = -\frac{15}{8}$$

$$\cot \theta = -\frac{8}{15}$$

- 5) Evaluate the following trig functions:

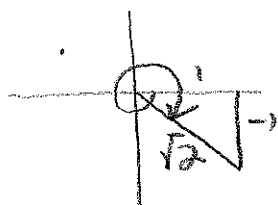
a) $\sin 5\pi$



Quadrantal \angle !!

$$\sin 5\pi = 0$$

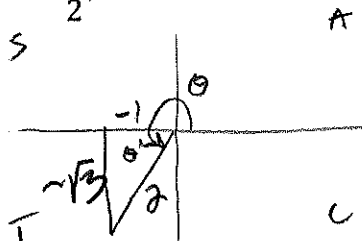
b) $\cos\left(\frac{-9\pi}{4}\right)$



$$\cos\left(\frac{-9\pi}{4}\right) = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$$

Sections 4.2 & 4.4 – Trig Functions of Any Angle

6) If θ is in quadrant III and $\cos\theta = -\frac{1}{2}$, find:



a) $\sin \theta$

$$\sin \theta = -\frac{\sqrt{3}}{2}$$

b) $\tan \theta$

$$\tan \theta = \frac{-\sqrt{3}}{-1} = \sqrt{3}$$

c) $\csc \theta$

$$\csc \theta = \frac{1}{\sin \theta} = \frac{1}{-\frac{\sqrt{3}}{2}} = \frac{2}{-\sqrt{3}} = -\frac{2\sqrt{3}}{3}$$

Homework:

4.4 day 1: p. 318 #11-14, 30, 33, 39, 42, 45, 48, 51, 54

4.4 day 2: p. 318 #1, 6, 7, 17, 21, 59, 61, 81, 83, 92, 93