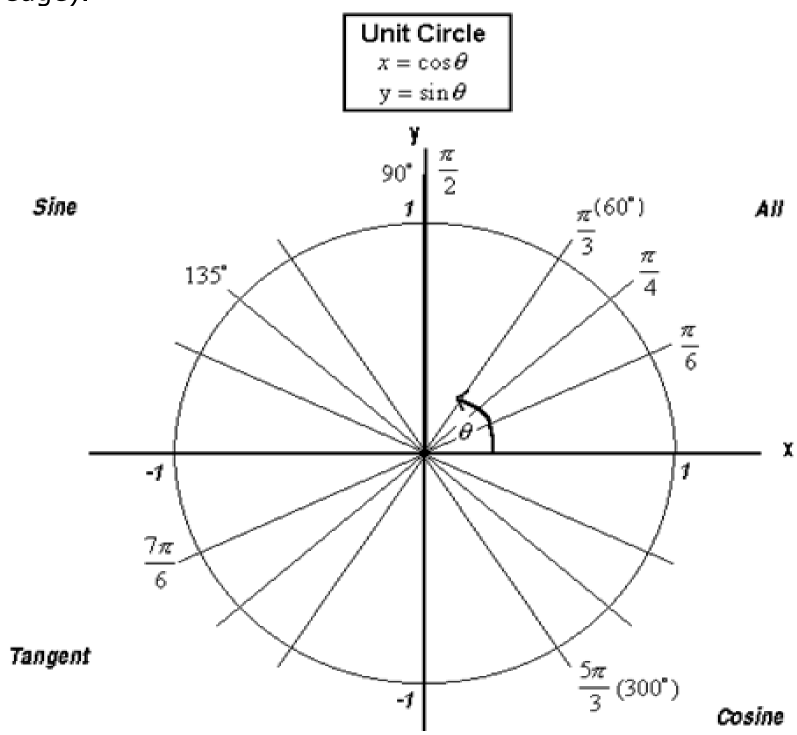
Name: _______________________________________ Date: ________

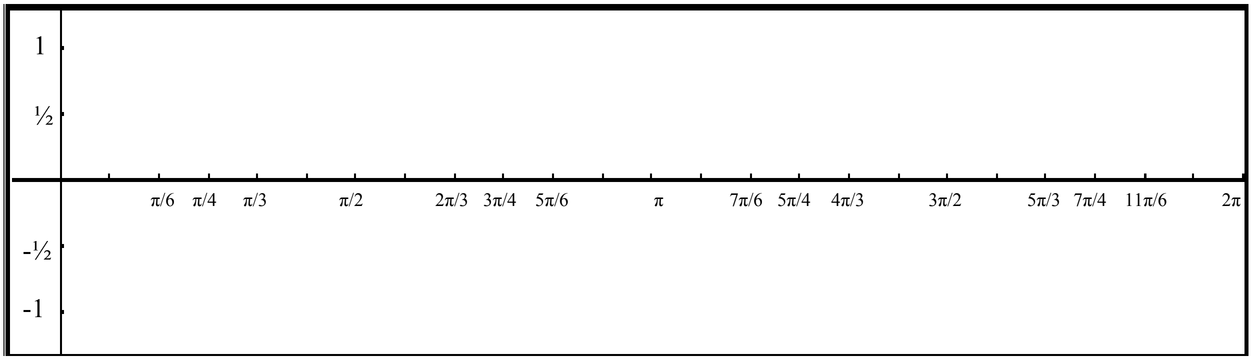
Unit Circle and Basic Trig Function Review

One of the most useful circles to know is the unit circle. Angles are commonly written in radian or degree measures. The idea to split a circle into 360 pieces (degrees) came about in early civilizations due to the many divisors of 360. Also recall that an angle of 1 radian marks off an arc length of 1 unit in a unit circle. The formula that relates θ in radians with the radius and the arc length s is $s = r \cdot \theta$. To find out how many radians are in a circle we solve for $\theta = \frac{s}{r}$. Since the arc length of the entire circle is the circumference ($C = 2 \cdot \pi \cdot r$) we substitute this into our formula. $\theta = \frac{s}{r} = \frac{2 \cdot \pi \cdot r}{r} = 2\pi$. So half a circle is π radians or approximately 3.14 radians; π does not equal 1 radian! π radians is also equal to 180°.

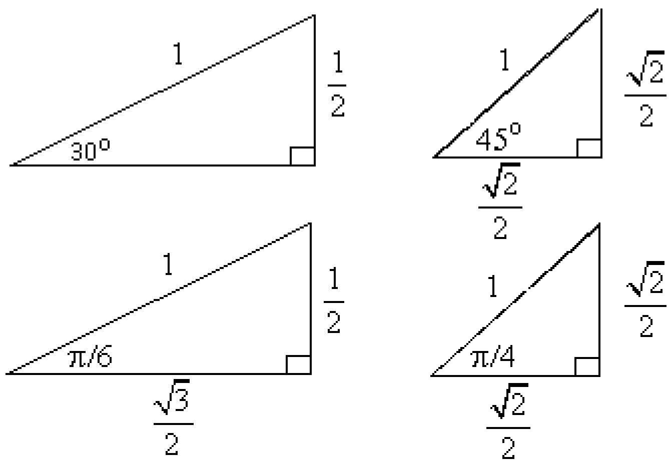
Exercise 1:
Complete the following unit circle by placing the correct degree and radian measure above each line (angle edge).



Note: Each tick mark is $\pi/12$. When graphing, for example $y = \sin(\theta)$, we plot θ on the horizontal axis and height, y, formed by the angle on the vertical axis. Can you envision this? In a way, we are rolling the unit circle along the horizontal axis; plotting (θ, y).



Right triangle reference triangles are very useful to know. Care needs to be taken with which quadrant you are in to make sure you have the correct sign!



Recall, in a <u>right triangle</u>:

$$\sin(\theta) = \frac{\text{opposite side}}{\text{hypotenuse}}; \text{ unit circle, } \sin(\theta) = \boldsymbol{y}$$

$$\cos(\theta) = \frac{\text{adjacent side}}{\text{hypotenuse}}; \text{unit circle, } \cos(\theta) = \boldsymbol{x}$$

$$\tan(\theta) = \frac{\sin(\theta)}{\cos(\theta)} = \frac{\text{opposite side}}{\text{adjacent side}}; \text{unit circle, } \textbf{\textit{slope}}!$$

Exercise 2:

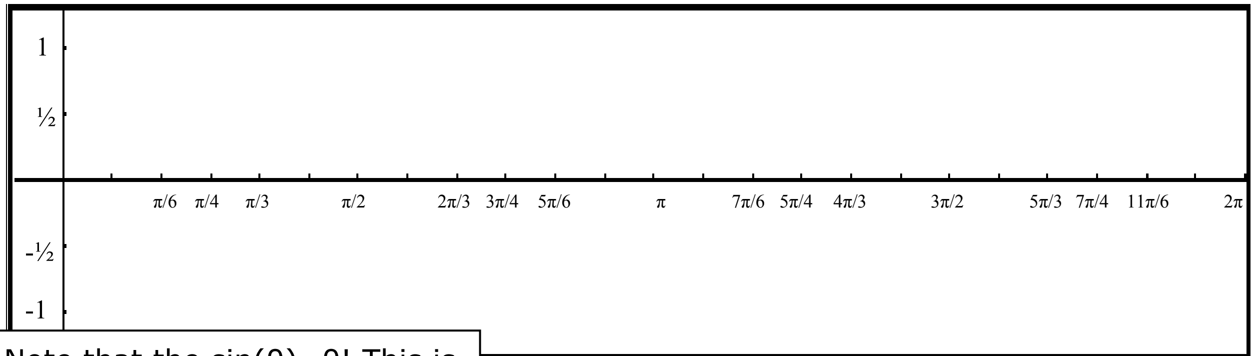
Fill in (a) the degree row of table and (b) the exact values for sine. Hint: You can use the ClassPad to find the exact values. Make sure the status bar shows Deg for degrees and Rad for radians. You also want to be in Standard mode.

θ	0	30°															
θ	0	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2\pi}{3}$	$\frac{3\pi}{4}$	$\frac{5\pi}{6}$	π	$\frac{7\pi}{6}$	$\frac{5\pi}{4}$	$\frac{4\pi}{3}$	$\frac{3\pi}{2}$	$\frac{5\pi}{3}$	$\frac{7\pi}{4}$	$\frac{11\pi}{6}$	2π
$\sin(\theta)$																	

c) Plot the points for $y = \sin(\theta)$ using the table above.

Hint: Use approximations to plot the exact values: $\frac{\sqrt{2}}{2} \approx 0.71$, $\frac{\sqrt{3}}{2} \approx 0.87$.

d) Use the points as a guide to draw the curve $y = \sin(\theta)$.

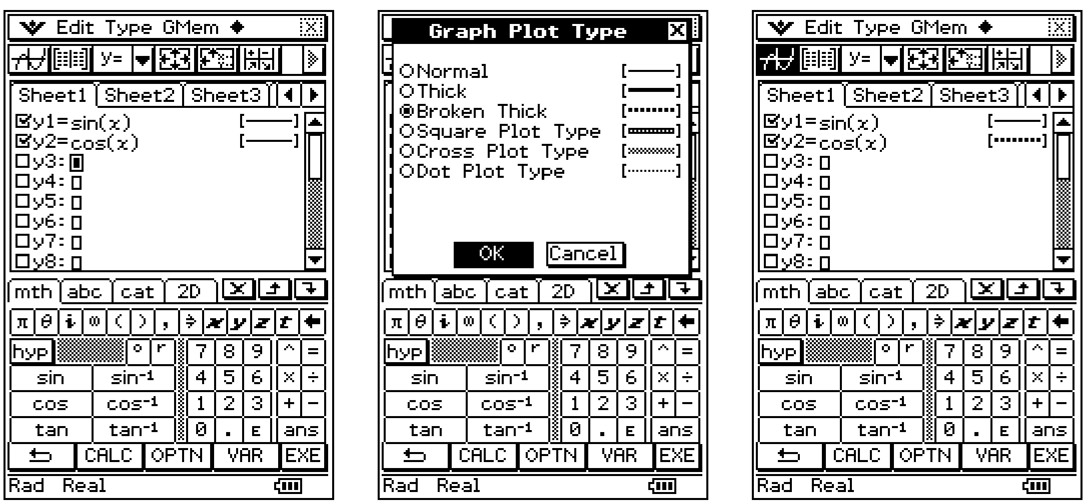


Note that the sin(0)=0! This is very useful to remember ☺

Exercise 3:
Using the ClassPad, sketch with different shadings: y=sin(x) and y=cos(x).

One way to do this is to:

1. Tap m and then W.
2. Open the 9 page of the keyboard and tap **TRIG**.
3. Input following y1, sin(x) and press E.
4. Input following y2, cos(x) and press E.
5. Tap the [---] following y2=cos(x) and select a new line style.
6. Tap the upper left $ button.
7. If needed tap **Zoom** and select **Quick Trig.**



Questions to answer:

What is the relationship between the graph of the sine and cosine? Use a complete sentence or two to describe the relationship.

$f(x) = \sin(x)$ or $y = \sin(x)$ is a **very important function** to know how to graph quickly. Knowing this one function, we can quickly transform it to find the graphs of other trigonometric functions!!!

When graphing, it is also helpful to remember that the $\sin(0) = 0$ and $\cos(0) = 1$. Remembering this will help you remember where to begin the graph.

Next, we will use the Geometry Link in the ClassPad's eActivity application to explore trig functions of the form y=Asin(Bx). To get eActivity ready, please do the following:

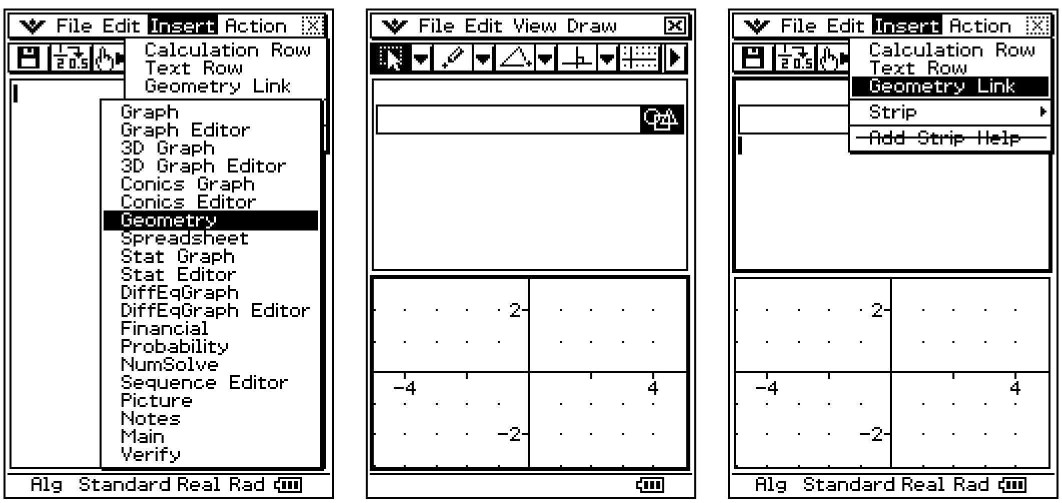
From the start menu (m) select A.

a. Next select **Insert/Strip/Geometry**.

b. Turn the axis and integer grid (dots) on by tapping q three times.

c. **Tap back** in the eActivity window to give it focus.

d. Select **Insert/Geometry Link**.

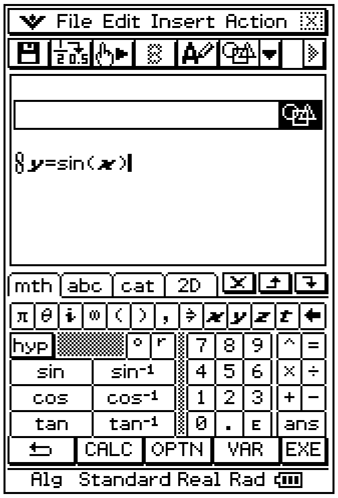


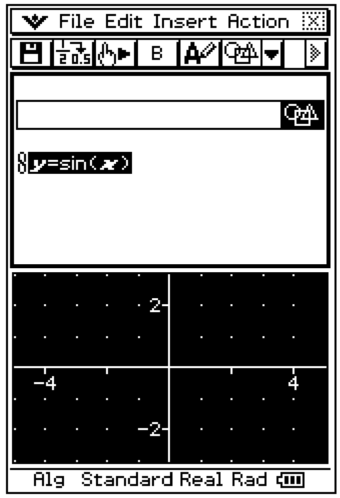
e. In the small box following the link, input **y=sin(x)** and press E. You can type sin(from the 0 page or find it in the 9/ **TRIG** page of the soft keyboard.

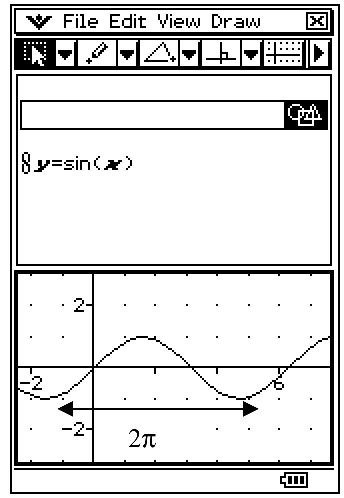
f. Close the keyboard. Select the **y=sin(x),** let go and then drag it to the Geometry window.

g. Your function is now linked to the Geometry window.

h. Tap the right cursor pad arrow to reposition the window to see a full period.





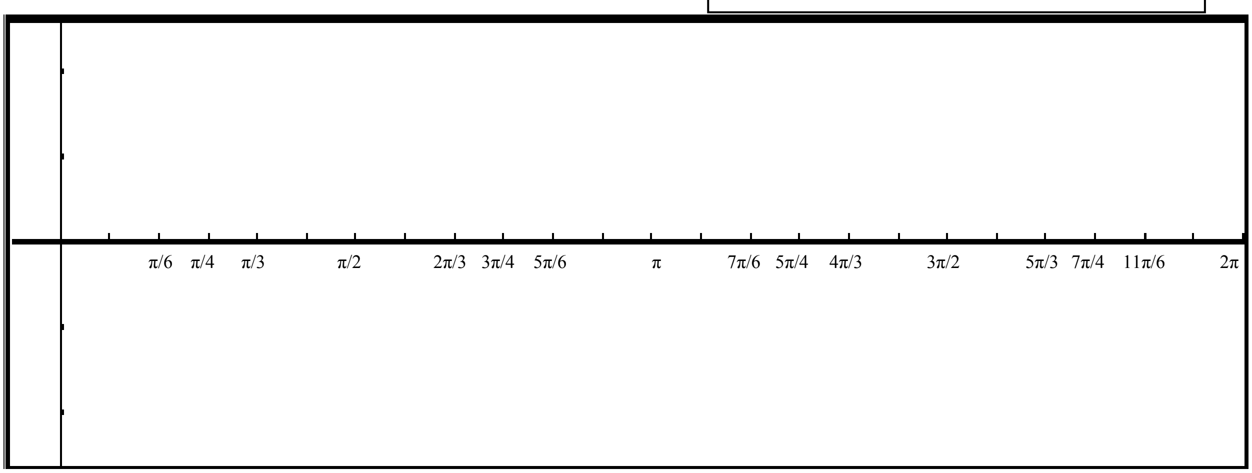


Remember that you can:
- ✓ Press + or – to zoom
- ✓ Pan the window using the cursor pad arrows
- ✓ Tap the O menu, select **View Window** and **Default** to return to normal window setting

Exercise 4:

a) Change the number in front of "sin(x)" from 1 to 2 and press E.
b) Next, change the 2 to .5 and press E.
c) Quickly sketch and label each of the following on the same grid:

$$y = \sin(x),\ y = 2\sin(x),\ y = .5\sin(x)$$



Questions to answer:

What is the range of $y = \sin(x)$?

How does changing the leading coefficient change the graph?

Exercise 5:

a) Change the number in front of "sin($\boldsymbol{x}$)" to a <u>negative value</u> and press E.
b) Try a few other negative values pressing E after each change.

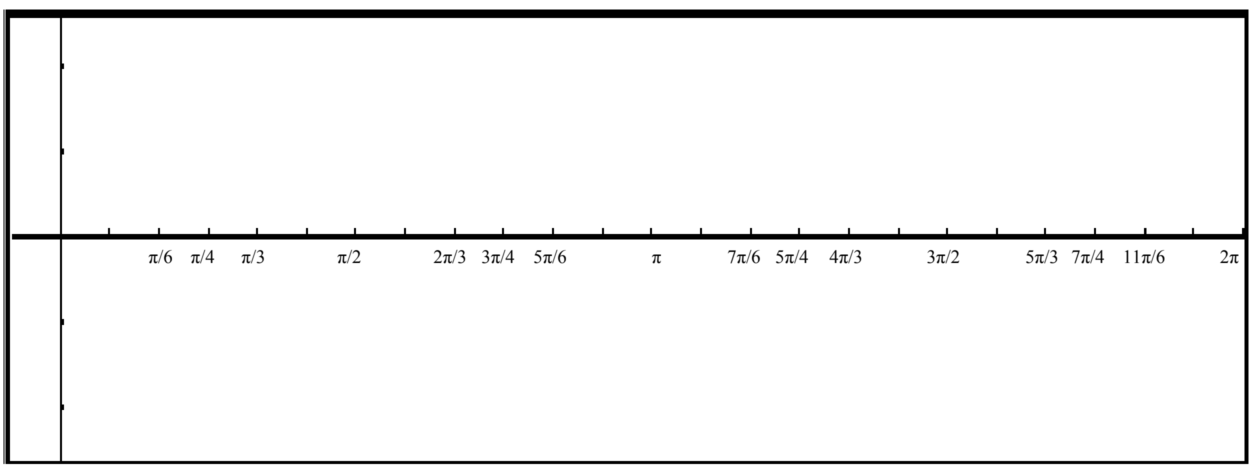
Question to answer:
What happens to the graph when we make the coefficient negative?

Does the range change?

Exercise 6:

a) Change the number in front of "$\boldsymbol{x}$" from 1 to 2 and press E.
(y=sin(x) / y=sin(2x))
b) Next, change the 2 to .5 and press E.
c) Quickly sketch and label each of the following on the same grid:

$$\boldsymbol{y} = \sin(\boldsymbol{x}),\ \boldsymbol{y} = \sin(2\boldsymbol{x}),\ \boldsymbol{y} = \sin(.5\boldsymbol{x})$$



Questions to answer:
Recall that a period of a periodic function is the length of the interval in which a full cycle is completed.
What is the period of $y = \sin(x)$?

What is the period of $y = \sin(2x)$?

What is the period of $y = \sin(.5x)$?

Explain how you could find the period before graphing the function. There is a pattern!!