AA8-3 Investigation Name: ____ Per: _____

The Circle of Terror – Graphing Sine and Cosine

It's January 1, 2100, and Great Galaxy Amusement Park has a new ride for the new century: The Circle of Terror. It is a huge Ferris Wheel, half above ground and half below. It rises to a height of 1 kilometer and descends to a depth of 1 kilometer. Steve boards the ride at ground level and notices a display that reads **ALTITUDE 0 km**. As the ride begins, Steve pays attention to the relationship between the **distance he's traveled along the track** and the **altitude above or below ground** level.

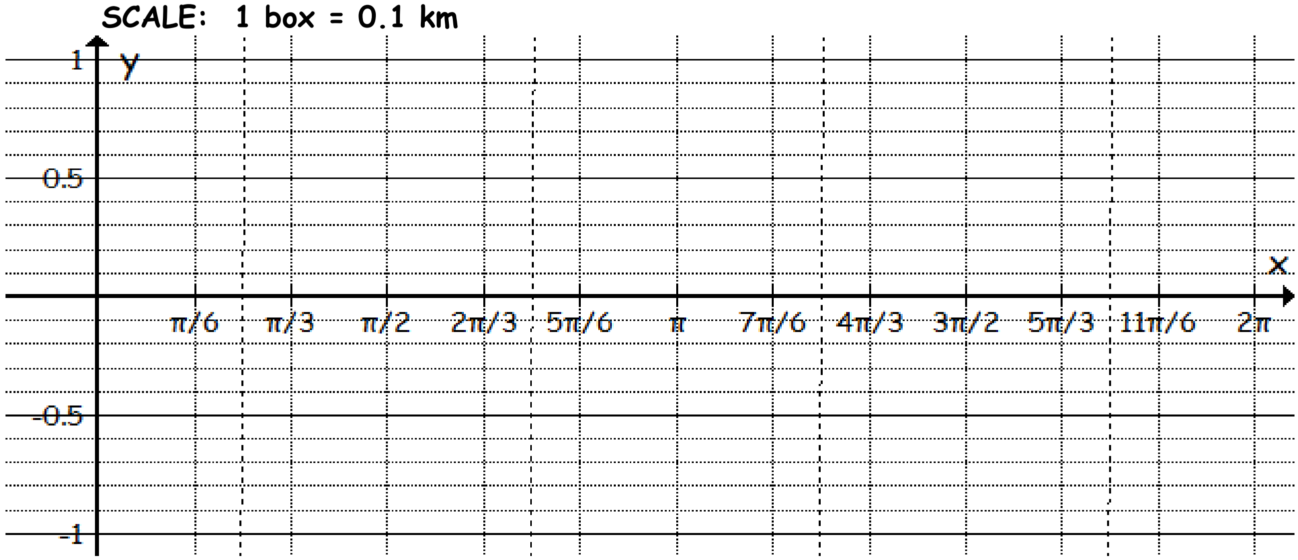
1) Using your unit circle, complete the table below. Use negative numbers to indicate altitude below ground level.

Distance Travelled Around Circle (km)	Exact Altitude (km)	Altitude as a decimal
0	0	
$\frac{\pi}{6}$		
$\frac{\pi}{4}$		
$\frac{\pi}{3}$		
	1	
$\frac{2\pi}{3}$		
$\frac{3\pi}{4}$		
$\frac{5\pi}{6}$		

Distance Travelled Around Circle (km)	Exact Altitude (km)	Altitude as a decimal
π	**0**	
$\frac{7\pi}{6}$		
$\frac{5\pi}{4}$		
$\frac{4\pi}{3}$		
	-1	
$\frac{5\pi}{3}$		
$\frac{7\pi}{4}$		
$\frac{11\pi}{6}$		

2) Graph your table of values below by plotting the points. The location of the $\frac{\pi}{4}$ family on the graph below is marked but not labled.

SCALE: 1 box = 0.1 km

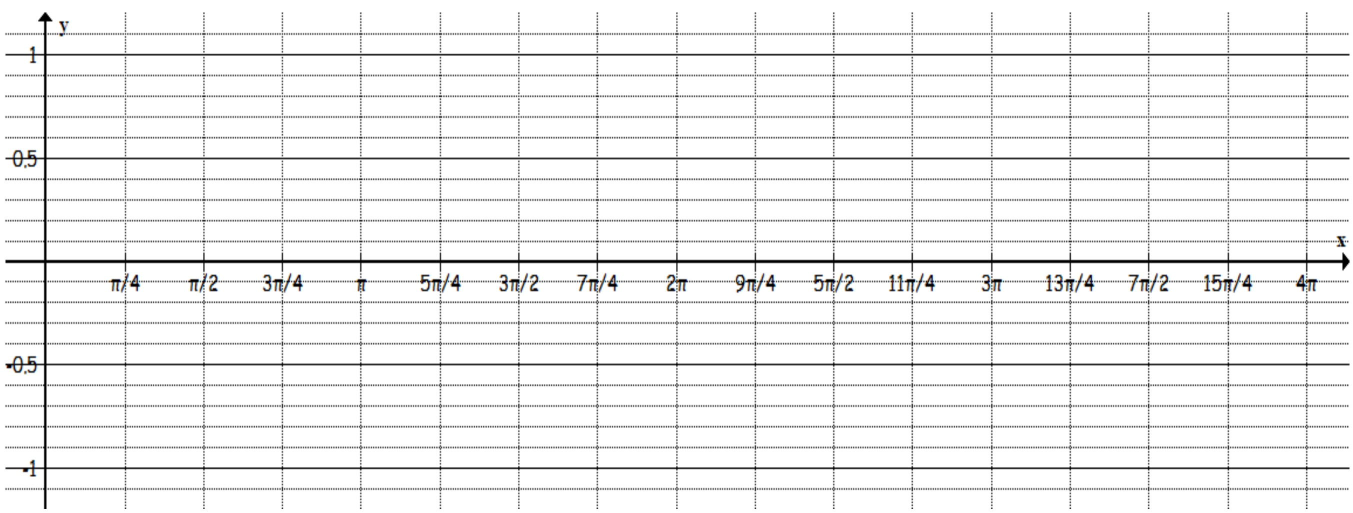


3) Steve was now more curious than ever about his Circle of Terror. He decided that his data was incomplete. Steve decided to head for the park and ride the Circle again to gather more information. He paid the ride operator double to allow him to make **two** complete circles instead of the usual one. Steve boarded the ride for the second time. Fortunately, the data he collected for the first rotation had not changed.

Complete the table of values at right.

Distance Travelled Around Circle (km)	Exact Altitude (km)	Altitude as a decimal
$\frac{9\pi}{4}$		
$\frac{5\pi}{2}$		
$\frac{11\pi}{4}$		
3π		
$\frac{13\pi}{4}$		
$\frac{7\pi}{2}$		
$\frac{15\pi}{4}$		
4π		

4) What would this graph look like if Steve travelled around the circle one more time? Graph the values for the first and second rotation carefully.

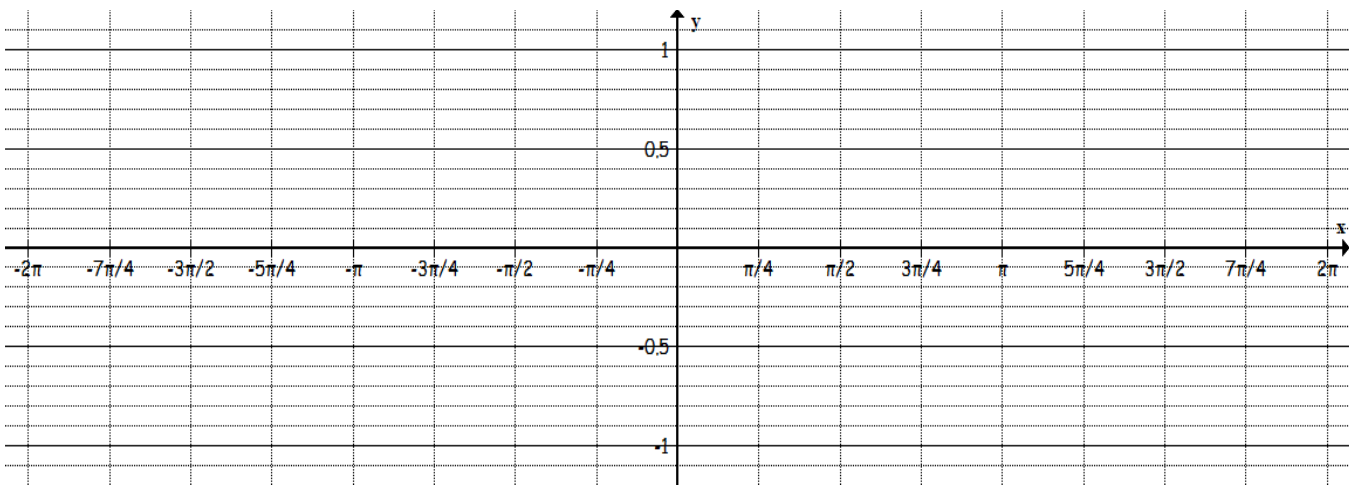


5) How does this graph compare to the graph you did in Part I of this problem?

6) Sally is even more daring than Steve. She climbed into the seat and made one complete revolution going in reverse! To tell which points were collected when the ride was going forwards, and which were taken when the ride was going backwards Sally used negative numbers to represent distance traveled in the opposite direction."

Distance Travelled Around Circle (km)	Exact Altitude (km)	Altitude as a decimal
0	0	
$-\frac{\pi}{6}$		
$-\frac{\pi}{4}$		
$-\frac{\pi}{3}$		
	1	
$-\frac{2\pi}{3}$		
$-\frac{3\pi}{4}$		
$-\frac{5\pi}{6}$		
$-\pi$		

4) Add Sally's data to the graph below.



These are graphs of the function **y = sin (x).**

A function that repeats the same pattern endlessly in both directions, is called a **PERIODIC, CYCLICAL** or **CIRCULAR FUNCTION.** The length of one cycle is called the **PERIOD,** which is how long it takes for it to start to repeat itself. What is the period of y = sin(x)? ___________

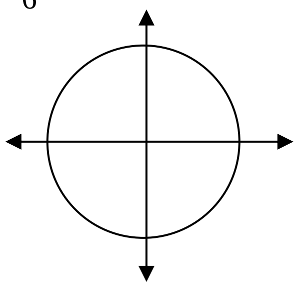
One-half of the distance between the highest and lowest values in the graph is called the **AMPLITUDE**. Since y = sin (x) is symmetrical, you can also define amplitude as the distance from the midline to the high point. What is the amplitude of y = sin (x)? ________________

5) Sketch a graph of a sine function with an amplitude of 2. Be sure to include a scale for the axes.

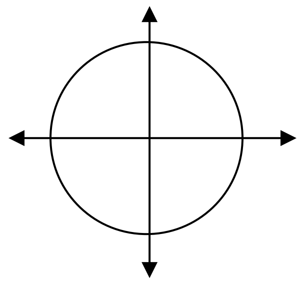
Practice:

Using the sine graph and the unit circle, mark the angle on each unit circle below and state the value of the sine of that angle.

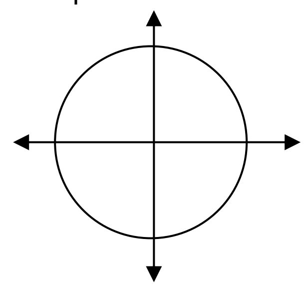
a) $\frac{\pi}{6}$ radians



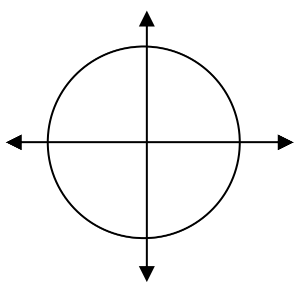
b) 0 radians



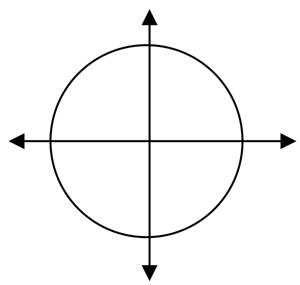
c) $\frac{\pi}{4}$ radians



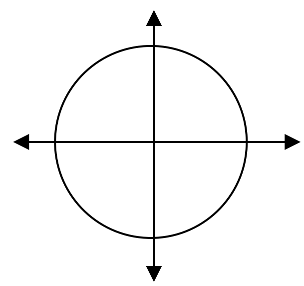
d) $\frac{\pi}{2}$ radians



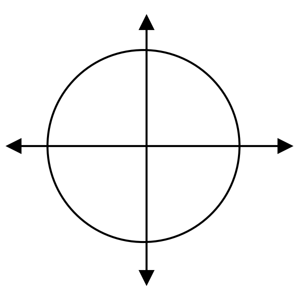
e) $\frac{\pi}{3}$ radians



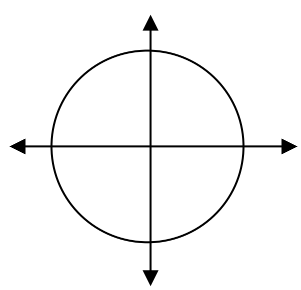
f) $\frac{2\pi}{3}$ radians



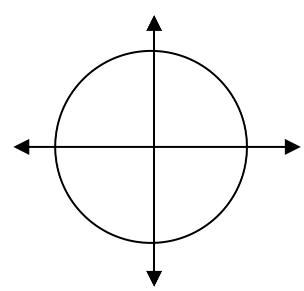
g) $-\frac{\pi}{3}$



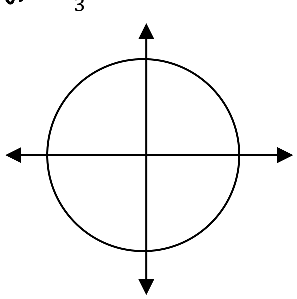
h) $-\frac{\pi}{4}$



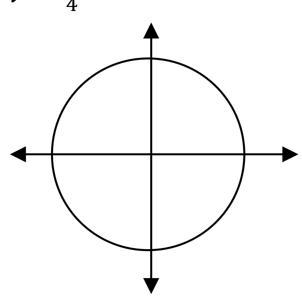
i) $-\frac{\pi}{6}$



j) $-\frac{2\pi}{3}$



k) $-\frac{3\pi}{4}$



l) $-\pi$