Pre Calculus

Date:

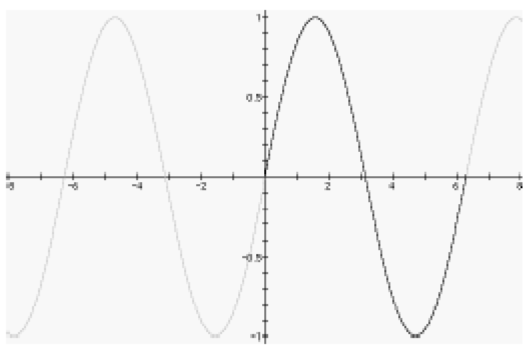
Items Needed: .Book, Go to Unit Circle Sine & Cosine Functions

Objective: The students will be able to sketch the graph of the basic sin and cosine function and any of their translations.

PA Common Core: cc.2.2.hs.c.8

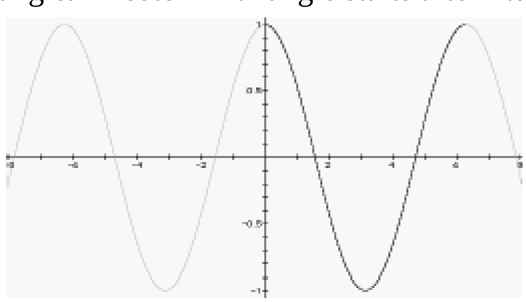
Lesson:

- Have students graph both the sin and cosine function on there calculators looking first at the sine function.
- Make sure the calculator is in degree mode and then do a zoom trig and notice what happens.
- Make sure the calculator is in radian mode and then do a zoom trig and notice what happens.
- The domain of the sine is all real numbers. According to the calculator what would the range be?



- Starting at zero, where would the graph start to repeat itself? This is called the **period** – the interval of *x* in which the function takes to repeat itself.
- The period of the sine function is 2π .

- Look at the cosine function and talk about the domain and range of it.
- What is the period of the cosine function? You should already be used to this idea because of the idea of a coterminal angle. A coterminal angle starts after 2π .



- Look at the library of parent functions – Sine and Cosine, and summarize the properties.
- Go to Unit Circle Sine & Cosine Functions on the favorites to show unit circle compared to the actual graph of the function to help solidify the graph concept.

- Go back to the sine function. What are the key points in this function? $0, \frac{\pi}{2}, \pi, \frac{3\pi}{2}, 2\pi$

  These points represent what, the max, min, or x-intercepts.

- The cosine function follows the same pattern but the max, mins, and x-intercepts would change.

Discuss the **five key points** of both graphs.

	maximums	*minimums*	*intercepts*
$y = \sin x$	(π/2, 1)	(3π/2, -1)	(0, 0) (π, 0) (2π, 0)
$y = \cos x$	(0, 1) (2π, 1)	(π, -1)	(π/2, 0) (3π/2, 0)

- Graph $y = 2\sin x$,
- Graph $y = 4\sin x$
- Graph $y = .5\sin x$
- What is happening? The max and mins are changing.
- Do the same thing with the cosine function.

- The number in front of the function is considered to be half the distance between the max and min values or the amplitude of the function. Amplitude=$|a|$
- Do the x values of your key points change with an amplitude change?
- Only the max and min will reflect an amplitude change.
- Graph $y = 2\sin x$ and $y = -2\sin x$ in the same window.
- Graph $y = 2\cos x$ and $y = -2\cos x$ in the same window.
- Notice how the max and mins stay the same height as the absolute value of the amplitude.
- Do example 2.

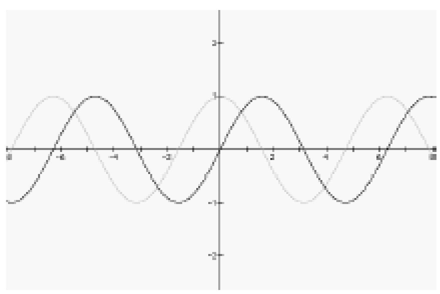
- Graph $y = \cos\frac{1}{2}x$, $y = \cos 2x$, and $y = \cos 3x$
- What happens with these functions? There is a horizontal stretch or shrink.
- What is the period in each one these functions?
- The key to the stretch or shrink is the coefficient *b* in front of the *x* value.
- To determine the period of a function with a coefficient in front of the x term simply take $\frac{2\pi}{b}$. If 0<b<1 – stretch, if b>1 then it shrinks.
- Graph $y = \sin 2x$ and $y = \sin -2x$ in the same window.

- Graph $y = \cos 2x$ and $y = \cos -2x$ in the same window.
- **If b is negative**, the identities sin(-*x*)=-sin *x* and cos(-*x*)=cos *x* are used to rewrite the function. (From section 4-2, p. 269.)

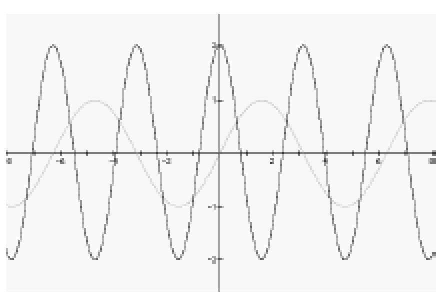
- To find the 5 key *x* value points of the function, simply determine the period and then divide the period by 4 and add that value to the starting value and that will give you the basic outline of the graph.
- Do example 3.

- Graph $y = \sin(x + \frac{\pi}{4})$, $y = \sin(x + 0)$, and $y = \sin(x - \frac{\pi}{4})$ given the general form $y = a\sin(bx - c)$
- How does the value of *c* affect the graph? It creates a phase shift.
- In fact it creates a phase shift specifically *c/b*.
- The left and right endpoints of a one-cycle interval can be determined by solving the equations *bx-c=0* and *bx-c=* 2π .
- Do example a and example 5, to find the coordinates of the 5 key points. If you need an extra example do example b.

a) $y = \cos(x - \pi/2)$
The five key points for this function are (π/2, 1), (π, 0), (3π/2, -1), (2π, 0), and (5π/2, 1).



b) $y = 2\sin(2x + \pi/2)$
The five key points for this function are (-π/4, 0), (0, 2), (π/4, 0), (π/2, -2), and (3π/4, 0).



- Given this equation $y = d + a\sin(bx - c)$ what do you think the *d* would do to the equation?
- Take your five key points and add d to your y value.

- Do example 6.
- Do example 7.
- Do example 8 to just look at avg depth figures.
- Do Number 81, p. 301

Assignment: .Have students do 1-6, 13,14, 43, 47, p. 299.
Have students do 52, 53, 56, 57, 59, 60, 63, 66, 69, p. 300.
Have students do 83, 84, 85 p. 301

Evaluation: (Could be from any one/several of the following)
Responses from classroom questions
Results of classroom sample problems
Homework responses
Check answer with Calculator
End of the section exam

Enrichment: