

Objective: To understand how trig functions and the unit circle are related.

Vocabulary:

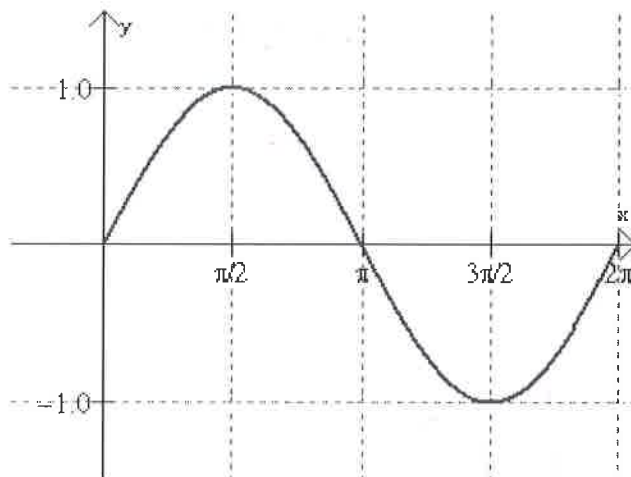
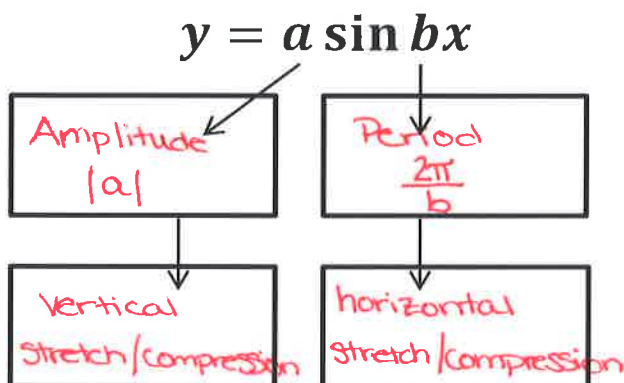
Periodic Functions: A function that has a repeating pattern that continues indefinitely

Cycle: The shortest repeating portion of the graph

Period: The horizontal length of each cycle $\left(\frac{2\pi}{b}\right)$

Amplitude: The distance from the midline to the maximum value and the distance from the midline to the minimum value of the function (amplitude = a)

Standard "Parent Graph" Functions

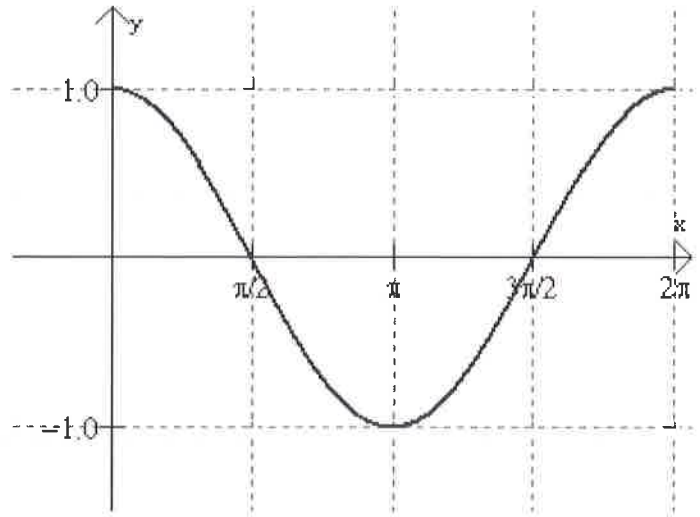
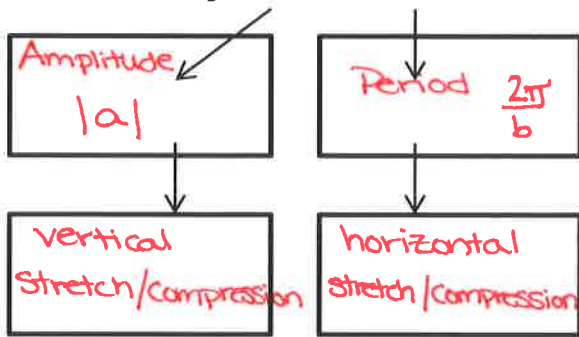


A sine graph without any transformations have the following characteristics:

- Amplitude: 1
- Period: 2π
- Frequency: $\frac{1}{2\pi}$
- Domain: $(-\infty, \infty)$
- Range: $[-1, 1]$

* Frequency: The number of cycles a function completes in a given interval
(Frequency = $\frac{1}{\text{period}}$)

$$y = a \cos bx$$



A cosine graph without any transformations have the following characteristics:

- Amplitude: 1
- Period: 2π
- Frequency: $\frac{1}{2\pi}$
- Domain: $(-\infty, \infty)$
- Range: $[-1, 1]$

Example 1: Identify the amplitude and range of the trigonometric functions below.

A.) $y = 3 \sin x$

Amp: 3

$[-3, 3]$

B.) $y = \cos 4x$

Amp: 1

$[-1, 1]$

C.) $y = \frac{1}{4} \sin 2x$

Amp: $\frac{1}{4}$

$[-\frac{1}{4}, \frac{1}{4}]$

D.) $y = 2 \sin \pi x$

Amp: 2

$[-2, 2]$

E.) $y = 5 \cos \frac{2}{3}x$

Amp: 5

$[-5, 5]$

F.) $y = 3 \cos 2x$

Amp: 3

$[-3, 3]$

Example 2: Write sine and cosine functions that have the following characteristics

A.) A sine function that has an amplitude of 5

$y = 5 \sin x$

$y = -5 \sin x$

$y = 5 \sin 10x$

$y = -5 \sin \pi x$

B.) A cosine function that has an amplitude of 3

$$y = 3 \cos x$$

$$y = -3 \cos 5x$$

$$y = 3 \cos 12x$$

$$y = 3 \cos \frac{4x}{7}$$

C.) A sine function that has a period of π

$$y = \sin 2x$$

$$y = -8 \sin 2x$$

$$\frac{\pi}{1} = \frac{2\pi}{b}$$

$$\frac{b\pi}{\pi} = \frac{2\pi}{\pi}$$

$$b = 2$$

D.) A cosine function that has a period of 4π

$$y = \cos \frac{1}{2}x$$

$$y = 4 \cos \frac{x}{2}$$

$$\frac{4\pi}{1} = \frac{2\pi}{b}$$

$$\frac{4\pi b}{4\pi} = \frac{2\pi}{4\pi}$$

$$b = \frac{1}{2}$$

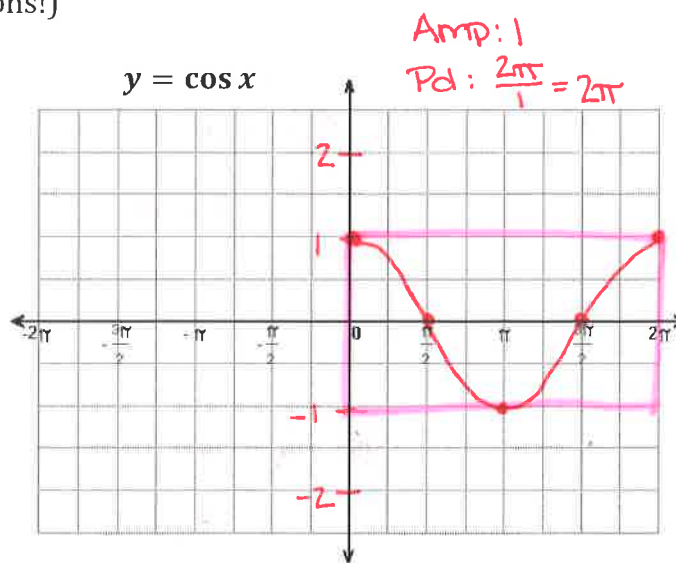
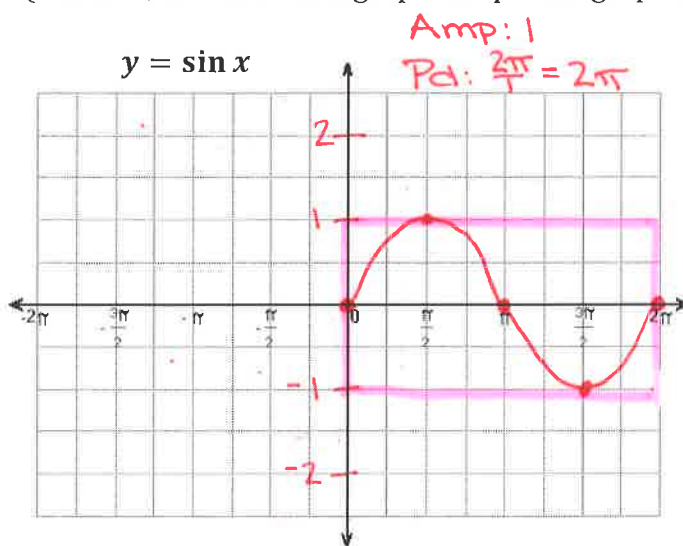
E.) A sine function that has a period of π and an amplitude of 5

$b = 2$
(Work done in C)

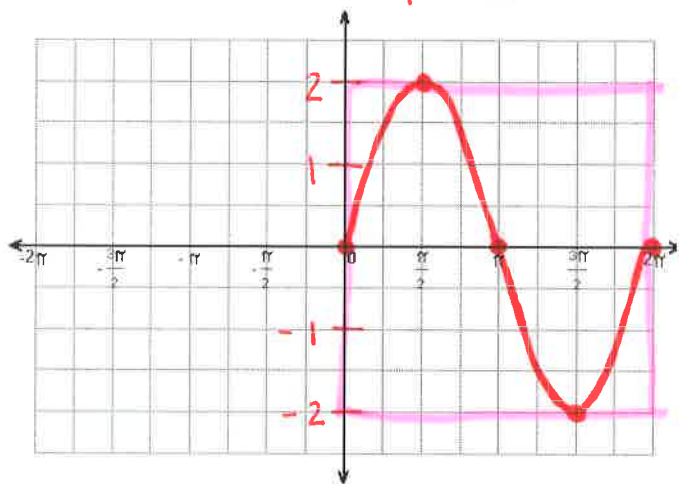
$$y = 5 \sin 2x$$

$$y = -5 \sin 2x$$

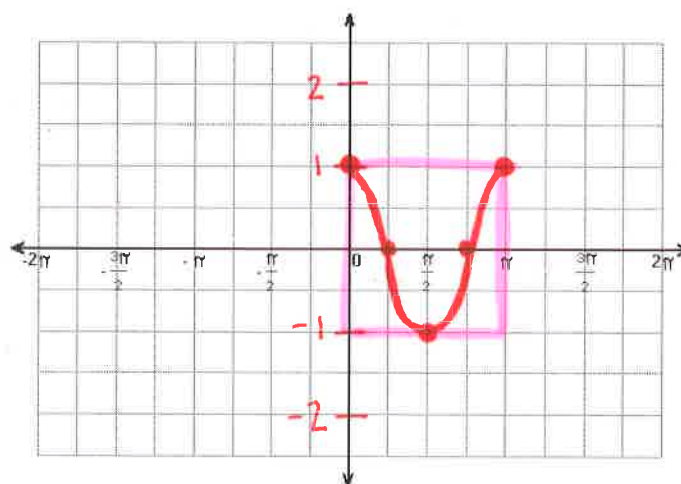
Example 3: Graph the sine and cosine functions with period and amplitude transformations.
(But first, for reference, graph the parent graph functions!)



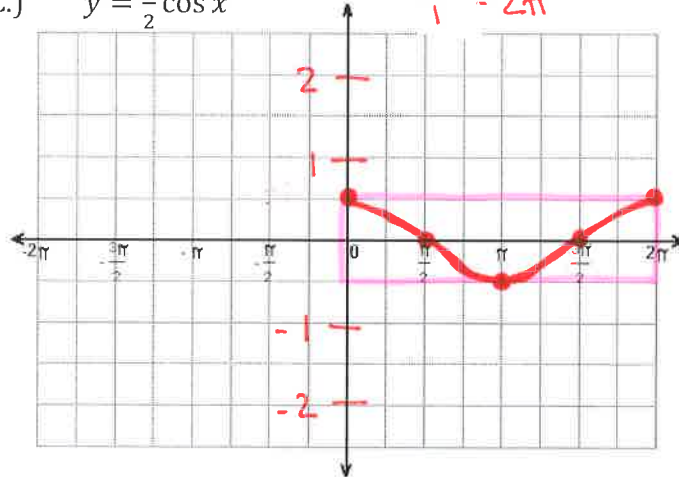
A.) $y = 2 \sin x$ Amp: 2
Pd: $\frac{2\pi}{1} = 2\pi$



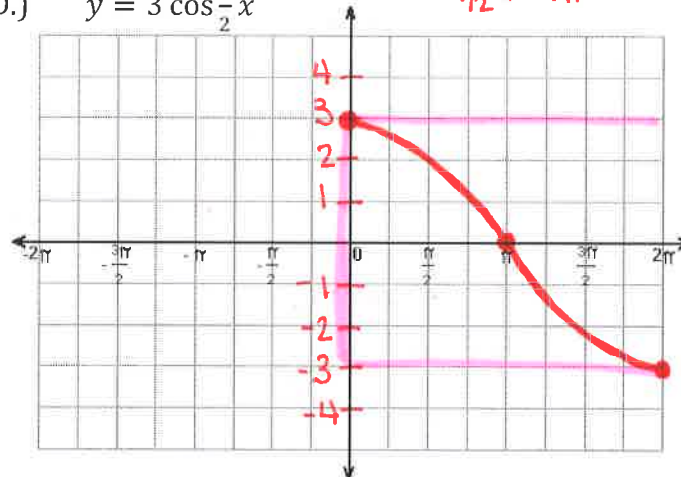
B.) $y = \cos 2x$ Amp: 1
Pd: $\frac{2\pi}{2} = \pi$



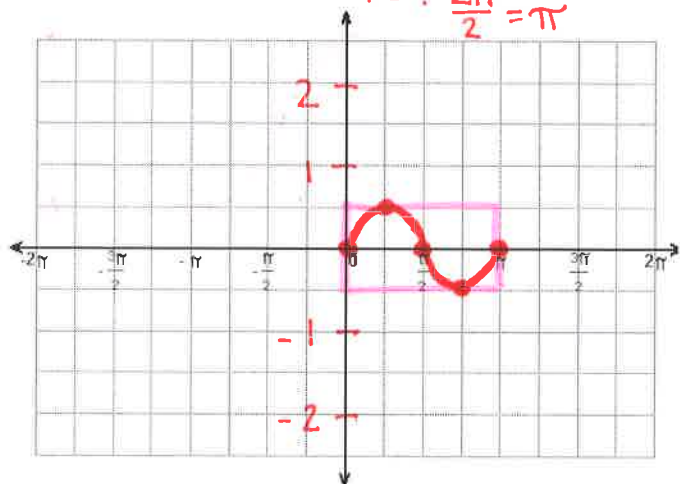
C.) $y = \frac{1}{2} \cos x$ Amp: $\frac{1}{2}$
Pd: $\frac{2\pi}{1} = 2\pi$



D.) $y = 3 \cos \frac{1}{2} x$ Amp: 3
Pd: $\frac{2\pi}{1/2} = 4\pi$



E.) $y = \frac{1}{2} \sin 2x$ Amp: $\frac{1}{2}$
Pd: $\frac{2\pi}{2} = \pi$



F.) $y = -2 \cos 4x$ Amp: 2
Pd: $\frac{2\pi}{4} = \frac{\pi}{2}$
reflected!

