Section 4.2 Graphing $y = c + a\sin[b(x-d)]$ or $y = c + a\cos[b(x-d)]$

Vertical shift: Adding or subtracting a value "c" outside of the function shifts the middle of the graph up or down (according to the sign)

Amplitude: Multiplying a value "a" on the outside of the function changes the vertical distance from the middle of the graph to the top and from the middle to the bottom. (Amplitude is always considered to be positive!!)

Phase shift: Adding or subtracting a value "d" inside of the function shifts the graph horizontally (opposite of sign)

Period: Multiplying a value "b" on the inside of the function changes the length of the interval required to complete one full cycle

Period: $\boldsymbol{\frac{2\pi}{b}}$

Basic steps to graph one period of Sine and Cosine.

1) D**etermine the starting x-value.** (Phase shift will determine the starting x-value.)

2) Find the reminder of the x-values used as key points for the graph. (Divide the period by 4. Add that distance to the starting x-value, then continue adding that distance to each x-value until all 5 of the x-values are found.)

2) **Draw a dotted horizontal line for the middle of the graph.** (Vertical shift will determine the middle)

3) **Draw in the basic shape** for sine or cosine **using the amplitude** to determine the vertical distance from the middle of the graph.

Example 1: Graph $\boldsymbol{y = -3 + 2\cos x}$ over a one-period interval.

Vertical shift:

Amplitude:

Phase shift:

Period:

Example 2: Graph $\boldsymbol{y = -3\cos\left(x - \frac{3\pi}{2}\right)}$ over a two-period interval.

Vertical shift:

Amplitude:

Phase shift:

Period:

Example 3: Graph $\boldsymbol{y = \sin\left[2\left(x + \frac{\pi}{4}\right)\right]}$ over a two-period interval.

Vertical shift:

Amplitude:

Phase shift:

Period:

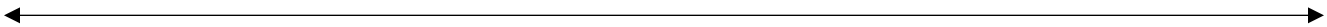
Example 4: Graph $\boldsymbol{y = -3 - 2\sin\left(x + \frac{\pi}{4}\right)}$ over a one-period interval.

Vertical shift:

Amplitude:

Phase shift:

Period:



Example 5: Graph $\boldsymbol{y = 3 + 3\cos\frac{1}{4}x}$ over a one-period interval.

Vertical shift:

Amplitude:

Phase shift:

Period:

Example 6: Graph $\boldsymbol{y = -2\cos(3x + \pi)}$ over a two-period interval.

Vertical shift:

Amplitude:

Phase shift:

Period:

Example 7: Graph $\boldsymbol{y = 1 + \sin\left(\frac{1}{2}x - \frac{\pi}{4}\right)}$ over a one-period interval.

Vertical shift:

Amplitude:

Phase shift:

Period: