[Discovering Sine & Cosine Transformations]

(a chris mock lesson)

(INTRO**)**

Today we will be covering section 6.5 out of our book, titled "Graphing Trigonometric Functions". Our goal is to examine how a, b, c, and d in the below function change the graph of sine and cosine.

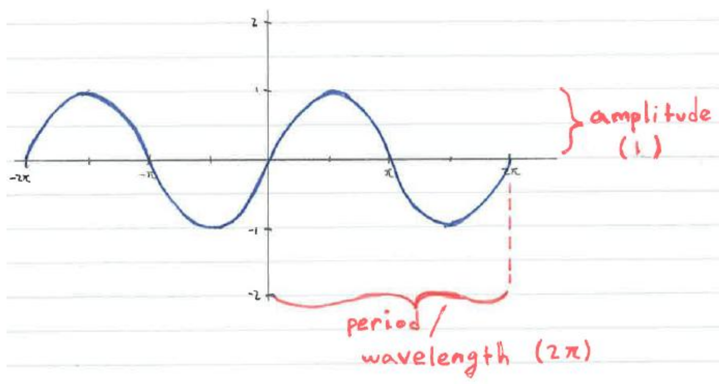
$$y = \text{a}\sin\big(b(x-c)\big) + d \quad \& \quad y = \text{a}\cos\big(b(x-c)\big) + d$$

(SETTING UP**)**

Our primary method of graphing will be the calculator. Make sure your calculator is in radians, and change your window to $[-3\pi, 3\pi, \pi]$ by $[-6, 6, 1]$. Go ahead and plot the function

$$y = 1\sin\big(1(x-0)\big) + 0 = \sin\ x$$

You should get the graph below.



Every sinusoidal graph has an amplitude and a period (wavelength); some are constant, and some vary over the graph's domain - today we focus mainly on the former case.

(DO WORK, SON**)**

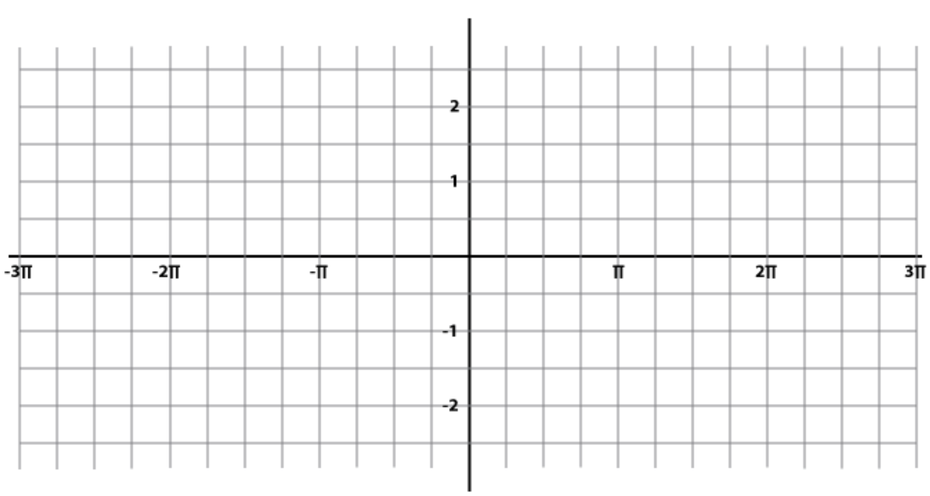
The first thing we'll look at is how changing the value of a changes the graph, so we'll let $b = 1, c = 0$ and $d = 0$. Keeping

$$y = \sin x$$

In your "$y_1 =$" position, graph the following function in your "y_2"

$$y = 2\sin\big(1(x-0)\big) + 0 = 2\sin x$$

Sketch the graph below and record it's amplitude and period.



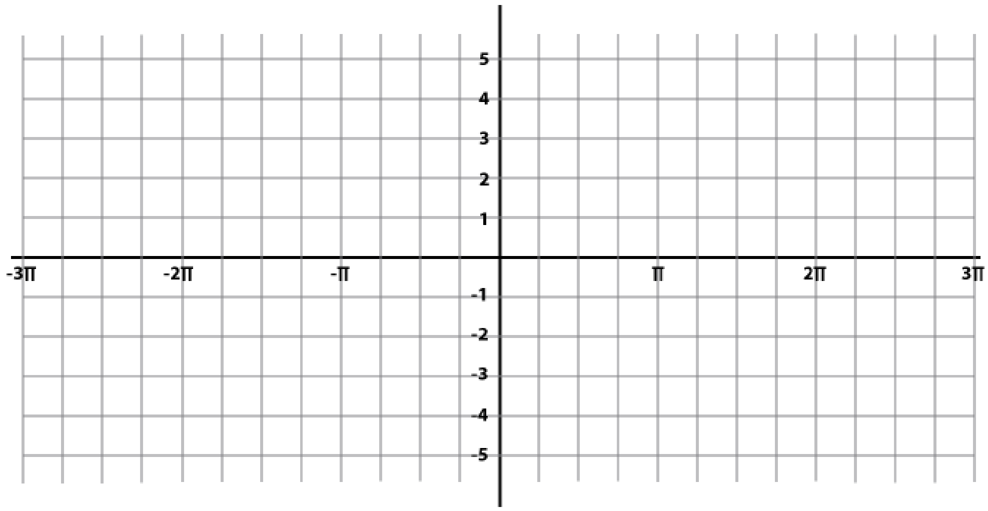
amplitude:

period:

Now, still keeping your "$y_1 = \sin x$" position, graph the following function in your "y_2"

$$y = 5\sin\big(1(x-0)\big) + 0 = 5\sin x$$

Sketch the graph below, record it's amplitude and period.



amplitude:

period:

[question 1] How is the value of **a** changing the graph of $y = \text{a}\sin x$?

The a value also serves a secondary purpose. Still keeping "$y_1 = \sin x$", graph "$y_2 = -\sin x$".
Describe a's secondary purpose below.

Ok cool, so we have an idea of how the a variable changes the original graph – let's move now to the b variable. For the remainder of this lesson, we will keep

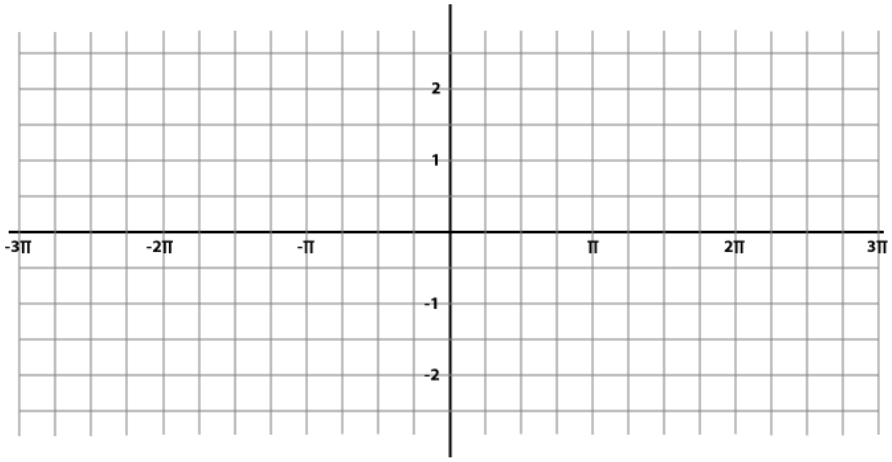
$$y = \sin x$$

in the "$y_1 =$" position on our calculator.

Graph

$$y = 1\sin\big(2(x - 0)\big) + 0 = \sin 2x$$

Record it's amplitude and period.



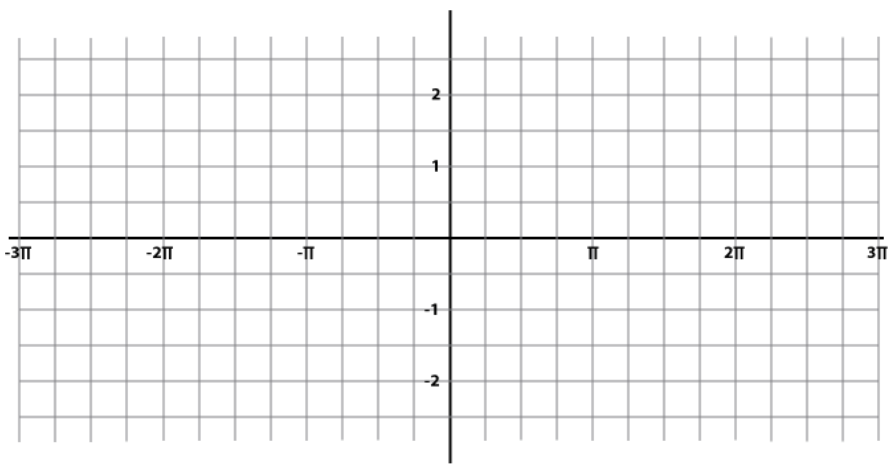
amplitude:

period:

Graph

$$y = 1\sin\big(3(x - 0)\big) + 0 = \sin 3x$$

Record it's amplitude and period.



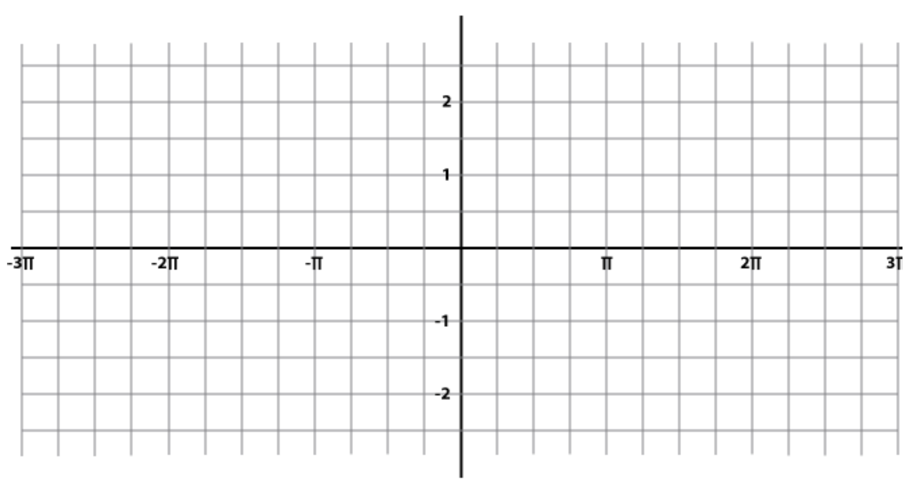
amplitude:

period:

Graph

$$y = 1\sin\left(\frac{1}{2}(x - 0)\right) + 0 = \sin\left(\frac{1}{2}x\right)$$

Record it's amplitude and period.



amplitude:

period:

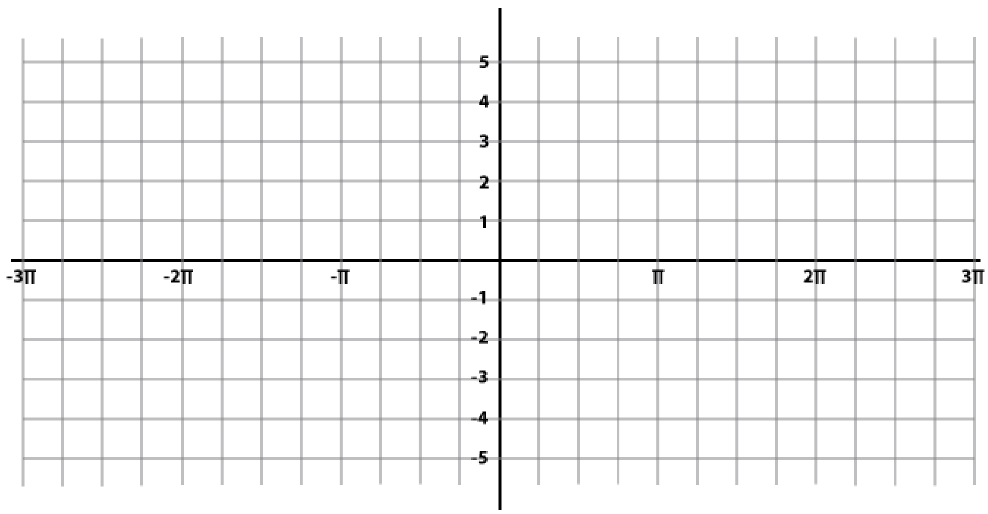
[question 2] How is the value of **b** changing the graph of $y = \mathrm{a}\sin x$?

Now we'll focus on **d**.

Graph

$$y = 1\sin\big(1(x - 0)\big) + 3 = \sin(x) + 3$$

Record it's amplitude and period.



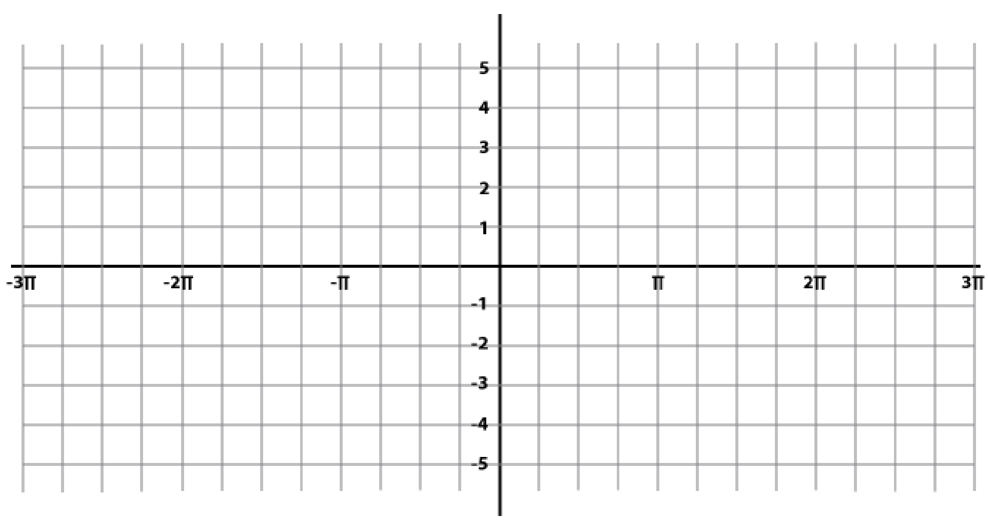
amplitude:

period:

Graph

$$y = 1\sin\big(1(x - 0)\big) - 4 = \sin(x) - 4$$

Record it's amplitude and period.



amplitude:

period:

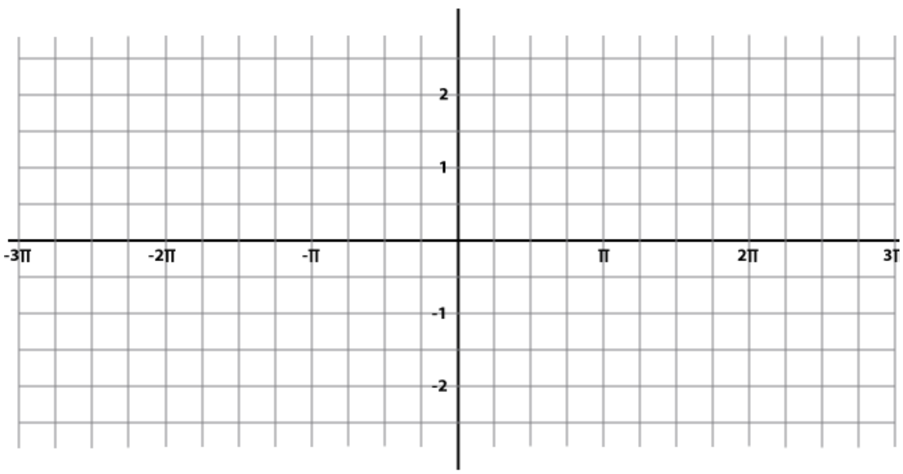
[question 3] How is the value of **d** changing the graph of $y = \mathrm{a}\sin x$?

Finally, let's examine **c**'s influence (keeping in mind how 'd' changed our graph, what do you expect 'c' to do?).

Graph

$$y = 1\sin\left(1\left(x - \frac{\pi}{2}\right)\right) = \sin\left(x - \frac{\pi}{2}\right)$$

Record it's amplitude and period.



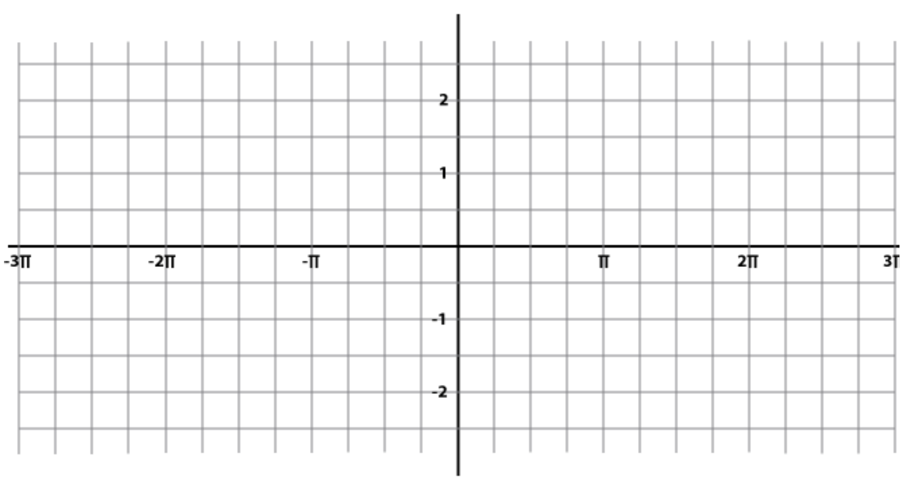
amplitude:

period:

Graph

$$y = 1\sin\left(1\left(x + \frac{\pi}{4}\right)\right) = \sin\left(x + \frac{\pi}{4}\right)$$

Record it's amplitude and period.



amplitude:

period:

[question 4] How is the value of **c** changing the graph of $y = \mathrm{a} \sin x$?

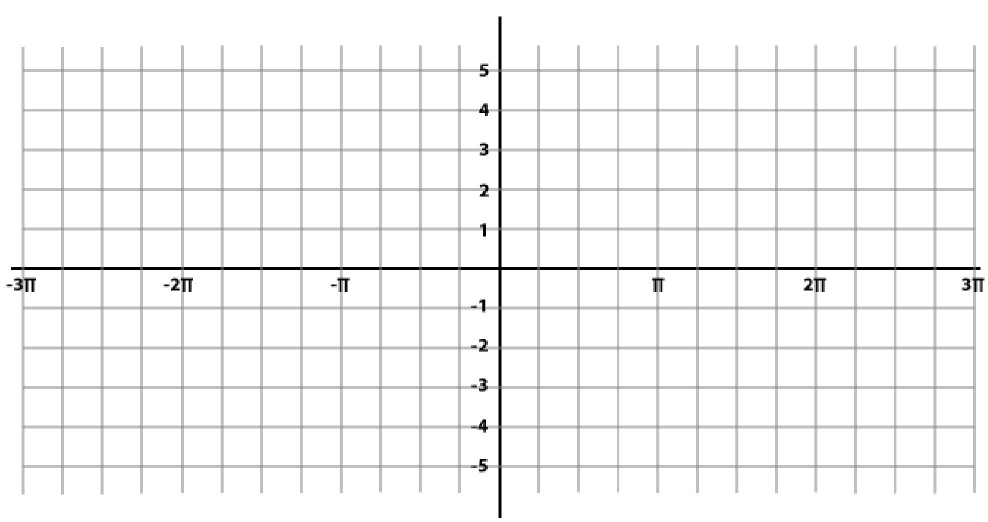
(PIECING EVERYTHING TOGETHER**)**

$$y = \mathrm{a}\sin\big(b(x - c)\big) + d$$

Graph

$$y = 4\sin\left(2\left(x + \frac{\pi}{2}\right)\right) + 1$$

Record it's amplitude and period.



amplitude:

period: