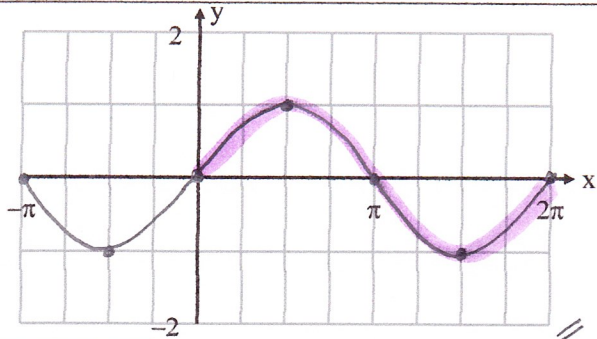
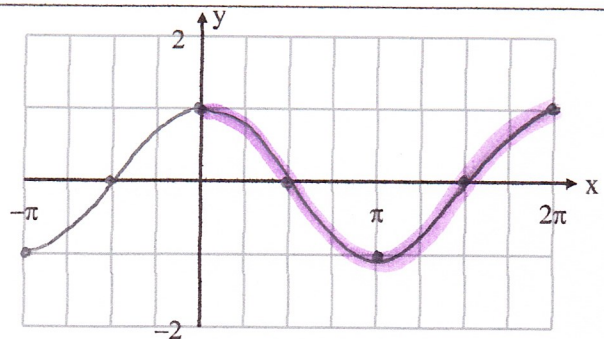


DAY ONE: **MEMORIZE...** THE FOLLOWING "SHORTCUTS".



$y = \sin x$ Amplitude = $\frac{1}{2}$ distance (vertical) from max to min

PERIOD: 2π
 Even or Odd? odd Why? origin symm.
 Domain: \mathbb{R} Range: $[-1, 1]$
 Where are the zeroes? @ mult. of π
 SO THINK... **0-MAX-0-MIN-0**

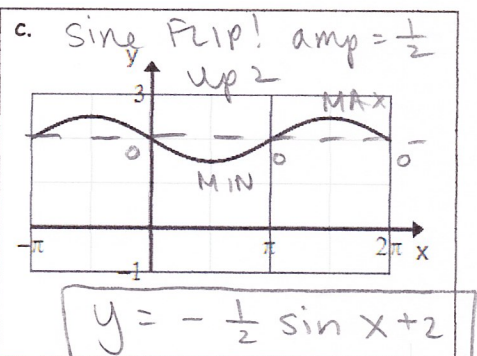
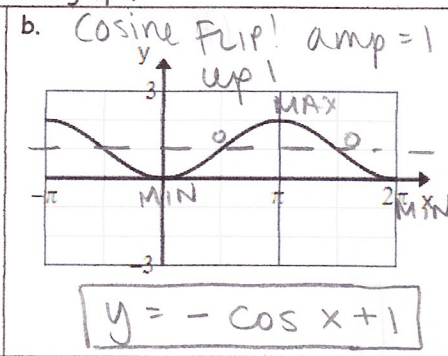
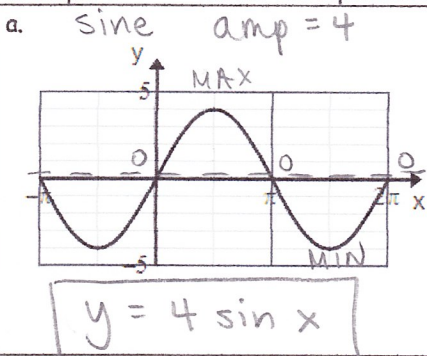


$y = \cos x$ Amplitude = 1

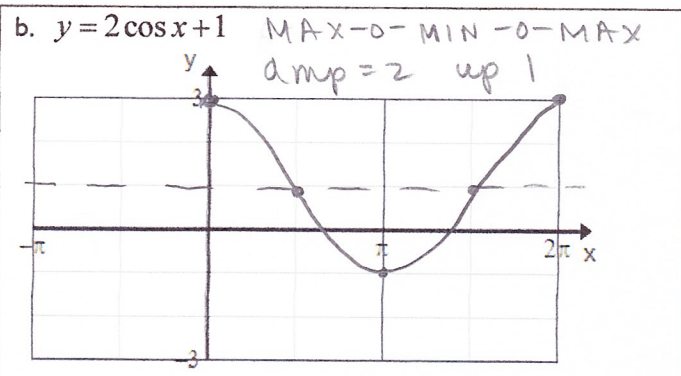
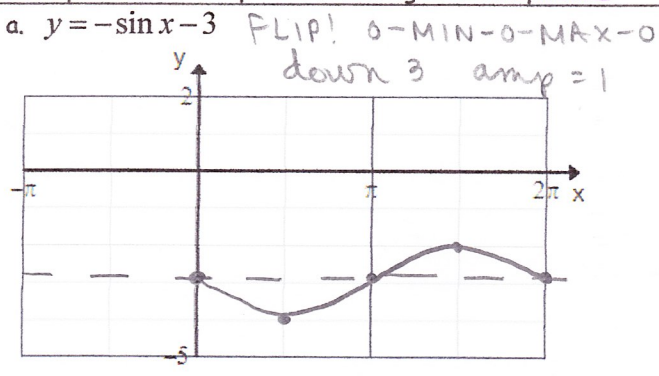
PERIOD: 2π
 Even or Odd? even Why? y-axis symm.
 Domain: \mathbb{R} Range: $[-1, 1]$
 Where are the zeroes? @ odd mult. of $\frac{\pi}{2}$
 SO THINK... **MAX-0-MIN-0-MAX**

* You can think of a change in amplitude in the same manner as a vertical stretch or compression.

Example 1: Write the equation of each graph.



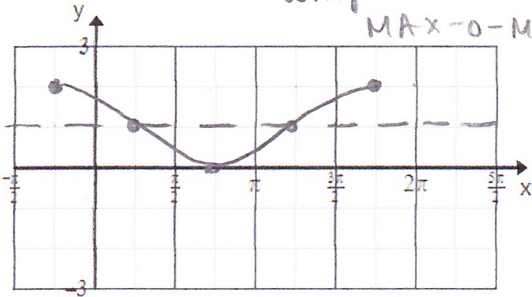
Example 2: Graph the following over one period.



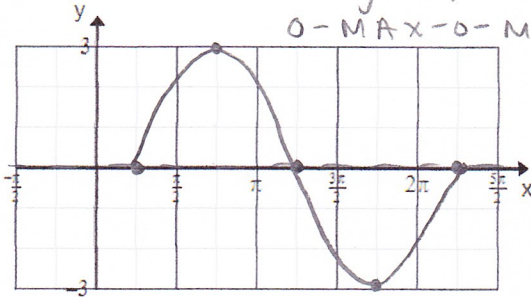
Now it is time to add horizontal shifts, also known as phase shifts.

Example 3: Graph the following over one period.

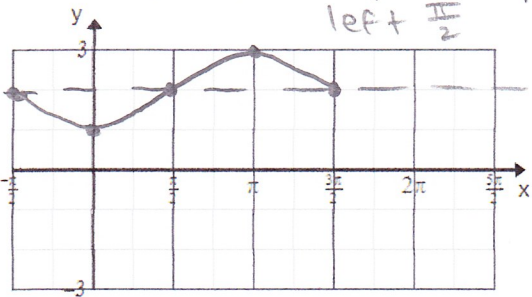
a. $y = \cos\left(x + \frac{\pi}{4}\right) - 1$ left $\frac{\pi}{4}$ down 1
amp = 1
MAX-0-MIN-0-MAX



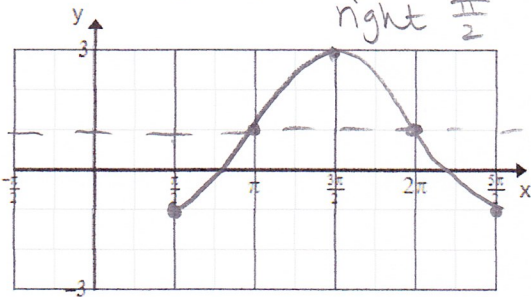
b. $y = 3\sin\left(x - \frac{\pi}{4}\right)$ amp = 3
right $\frac{\pi}{4}$
0-MAX-0-MIN-0



c. $y = -\sin\left(x + \frac{\pi}{2}\right) + 2$ FLIP! 0-MIN-0-MAX
up 2 amp = 1
left $\frac{\pi}{2}$

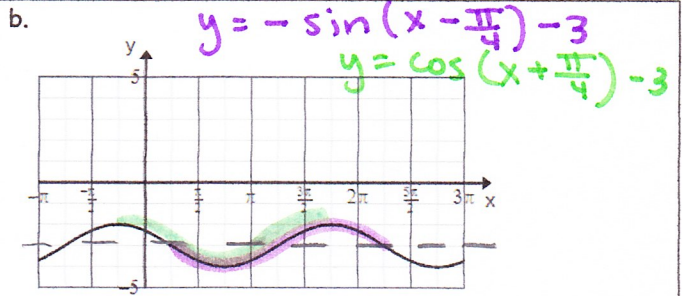
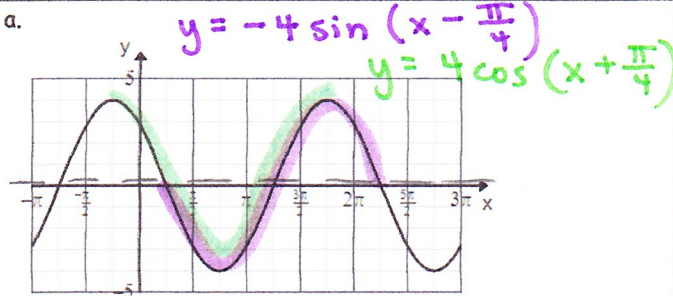


d. $y = -2\cos\left(x - \frac{\pi}{2}\right) + 1$ FLIP! MIN-0-MAX-0-MIN
up 1 amp = 2
right $\frac{\pi}{2}$



Example 4: Write the equation of each graph.

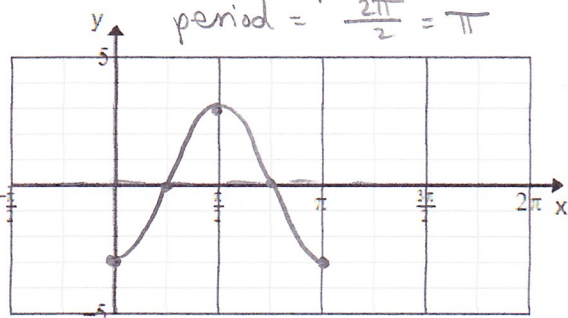
* more than one possible correct answer!



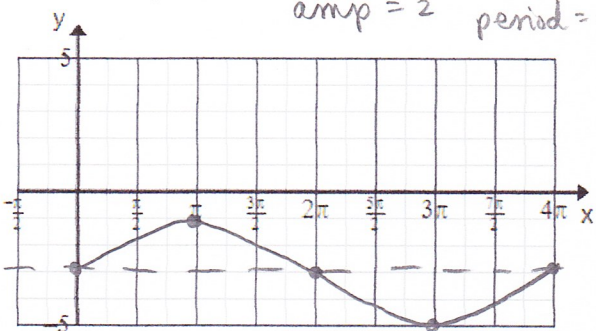
And finally, let's add some horizontal stretches and compressions, also known as period changes.

Example 5: Graph the following over one period.

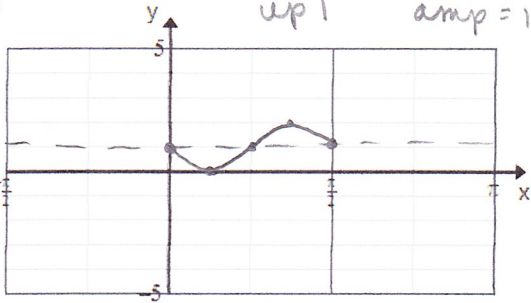
a. $y = -3\cos(2x)$ FLIP! MIN-0-MAX-0-MIN
amp = 3
period = $\frac{2\pi}{2} = \pi$



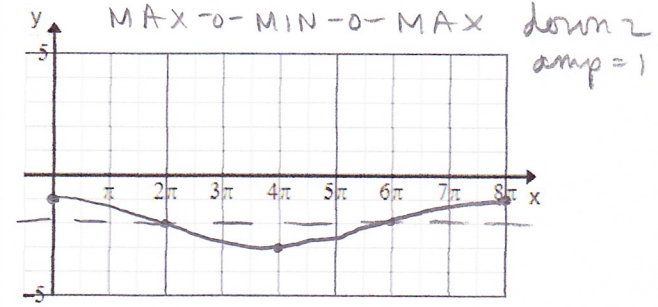
b. $y = 2\sin\left(\frac{1}{2}x\right) - 3$
down 3
0-MAX-0-MIN-0
amp = 2 period = $\frac{2\pi}{\frac{1}{2}} = 4\pi$



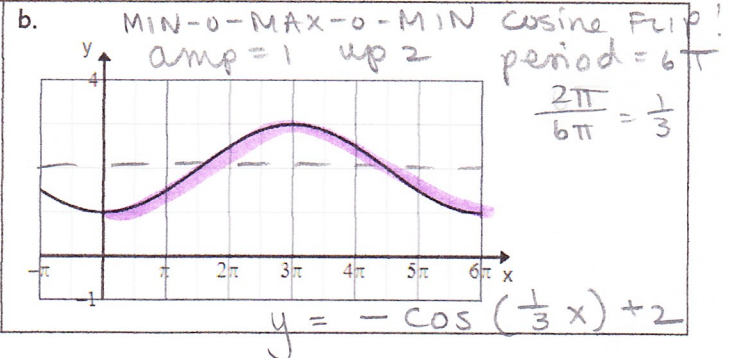
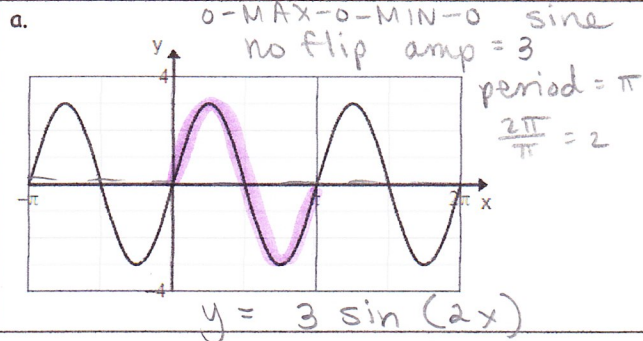
c. $y = -\sin(4x) + 1$ FLIP!
 period = $\frac{2\pi}{4} = \frac{\pi}{2}$ 0-MIN-0-MAX-0
 up 1 amp = 1



d. $y = \cos\left(\frac{1}{4}x\right) - 2$ period = $\frac{2\pi}{\frac{1}{4}} = 8\pi$



Example 6: Write the equation of each graph.

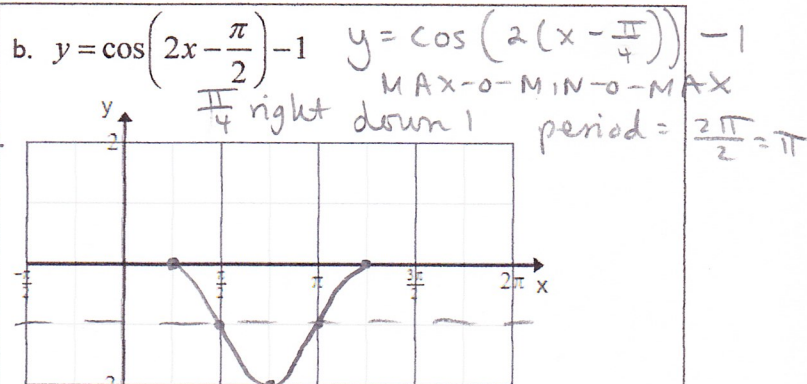
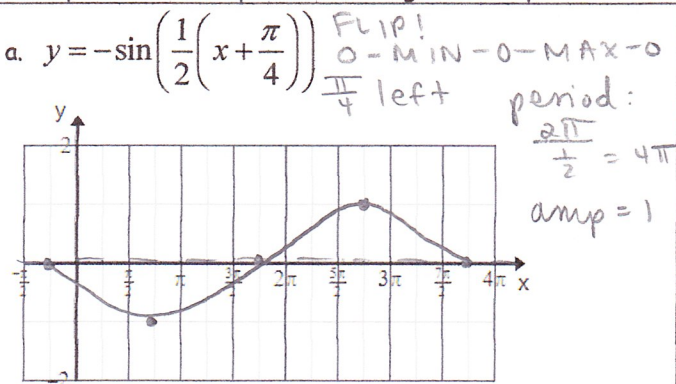


DAY TWO: Today we will do more of the same with transformations of sine and cosine, but make it tougher. ☺

When dealing with a transformation that includes a period change AND a phase shift, be sure to have your function in factored form BEFORE you determine the phase shift. Otherwise, you will run into issues!

Factored form: $y = a \sin(b(x+c)) + d$ or $y = a \cos(b(x+c)) + d$

Example 7: Graph the following over one period.



Example 8: Write the equation of each graph.

