WARMUP

Use Desmos or the graphing calculator to graph

$y = \sin x$

$y = \sin(3x)$

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

Section 5.6 Sinusoidal Curves

Graph using period, $\underbrace{\text{phase shift}}_{\text{horizontal shift}}$, and amplitude

$$y = a\sin(\omega x - \phi)$$

"phi"

"omega"

$$y = a\cos(\omega x - \phi)$$

Amplitude $= |a|$

Period $= \frac{2\pi}{\omega}$

Phase Shift $= \frac{\phi}{\omega}$

ex: $y = \sin\left(\frac{\pi}{4}x\right)$

$y = \sin\left(\frac{\pi}{4}x - 0\right)$

$a = 1$

$\omega = \frac{\pi}{4}$

$\phi = 0$

Amp. $= |1| = 1$

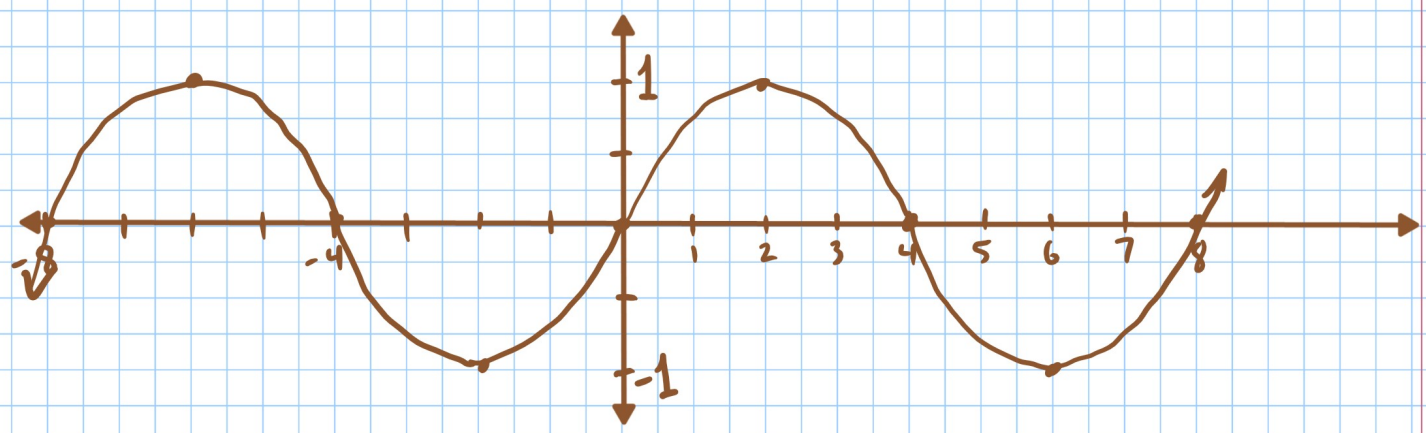
Period $= \frac{2\pi}{\frac{\pi}{4}} = 2\cancel{\pi} \cdot \frac{4}{\cancel{\pi}} = 8$

P.S. $= \frac{0}{\pi/4} = 0$

For sine:

$$\overset{0}{(0,0)},\ \overset{a}{(2,1)},\ \overset{0}{(4,0)},\ \overset{-a}{(6,-1)},\ \overset{0}{(8,0)}$$

P.S. — midpoint of 1st and 3rd x-values — midpoint of 1st and 5th x-values — midpoint of 3rd and 5th x-values — P.S. + Period



ex: $y = -2\cos\left(4x + \frac{\pi}{2}\right)$

$a = -2$ $\qquad$ Amp $= |-2| = 2$

$\omega = 4$ $\qquad$ Period $= \frac{2\pi}{4} = \frac{\pi}{2}$

$\phi = -\frac{\pi}{2}$ $\qquad$ P.S. $= \dfrac{-\frac{\pi}{2}}{\frac{4}{1}} = -\frac{\pi}{2}\cdot\frac{1}{4} = -\frac{\pi}{8}$

For cosine

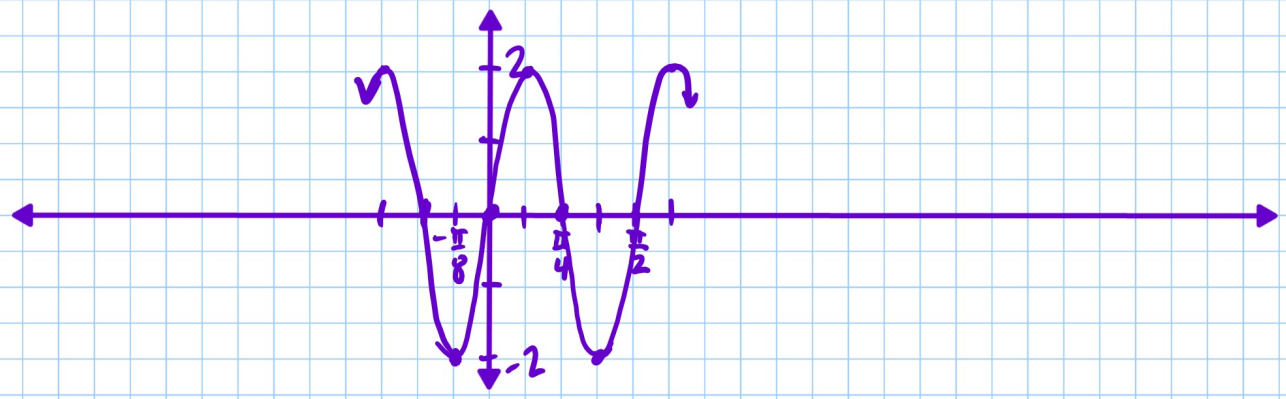
$$\overset{a}{\left(-\tfrac{\pi}{8},-2\right)},\ \overset{0}{(0,0)},\ \overset{-a}{\left(\tfrac{\pi}{8},2\right)},\ \overset{0}{\left(\tfrac{\pi}{4},0\right)},\ \overset{a}{\left(\tfrac{3\pi}{8},-2\right)}$$

P.S. $\qquad$ $\frac{2\pi}{8}$ $\qquad$ P.S. + Period $= -\frac{\pi}{8} + \frac{\pi}{2} = -\frac{\pi}{8} + \frac{4\pi}{8}$

$= \frac{3\pi}{8}$

$\frac{1}{2}\left(-\frac{\pi}{8} + \frac{3\pi}{8}\right) = \frac{1}{\cancel{2}}\cdot\frac{\cancel{2}\pi}{8}$

$= \frac{\pi}{8}$



TRY THIS:

$$y = -4\cos(\overset{\omega}{\pi}x + 3\pi)$$

$a = -4$ Amp $= 4$

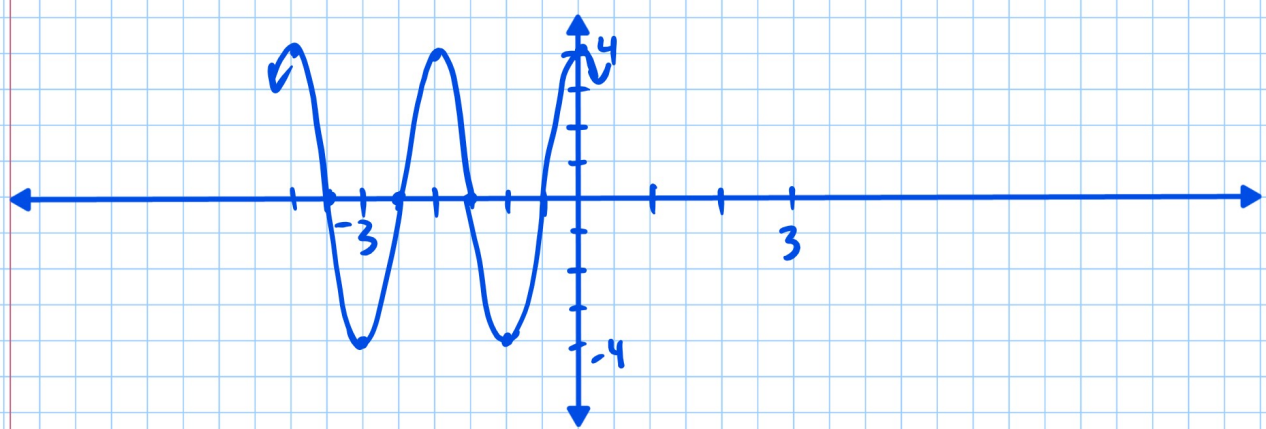
$\omega = \pi$ Period $= \frac{2\cancel{\pi}}{\cancel{\pi}} = 2$ $\frac{2\pi}{\omega}$

$\phi = -3\pi$ P.S. $= \frac{-3\cancel{\pi}}{\cancel{\pi}} = -3$

cosine

$(\underset{\text{P.S.}}{-3}, \overset{a}{-4}), (\underset{\uparrow}{-2.5}, \overset{0}{0}), (\underset{\uparrow}{-2}, \overset{-a}{4}), (-1.5, \overset{0}{0}), (\underset{\uparrow}{-1}, \overset{a}{-4})$

P.S. + period $= -3 + 2$



ex: $y = 3\sin(3x - \pi)$

$a = 3$ Amp $= 3$

$\omega = 3$ Period $= \frac{2\pi}{3}$

$\phi = \pi$ P.S. $= \frac{\pi}{3}$

$\left(\frac{\pi}{3}, 0\right)\left(\frac{\pi}{2}, 3\right)\left(\frac{2\pi}{3}, 0\right)\left(\frac{5\pi}{6}, -3\right)\left(\pi, 0\right)$

$\frac{1}{2}\left(\frac{\pi}{3}+\pi\right) = \frac{1}{2}\left(\frac{\pi}{3}+\frac{3\pi}{3}\right)$

$= \frac{1}{\cancel{2}}\left(\frac{\cancel{4}2\pi}{3}\right) = \frac{2\pi}{3}$

$\frac{\pi}{3}+\frac{2\pi}{3} = \frac{3\pi}{3} = \pi$

$\frac{1}{2}\left(\frac{\pi}{3}+\frac{2\pi}{3}\right) = \frac{1}{2}\cdot\pi = \frac{\pi}{2}$

$\frac{1}{2}\left(\frac{2\pi}{3}+\pi\right) = \frac{1}{2}\left(\frac{5\pi}{3}\right) = \frac{5\pi}{6}$