

WARMUP Download Desmos on your phone

Then look at graphs of

$$y = \sin x$$

$$y = \sin(3x)$$

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

Section 5.6 Sinusoidal Curves

Graph using period, phase shift, and amplitude
horizontal shift

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

↑ greek letter "omega"
↙ greek letter "phi"

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

$$\text{Amplitude} = |a|$$

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

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

$$y = 3 \sin\left(\frac{\pi}{4}x\right)$$

$$y = 3 \sin\left(\frac{\pi}{4}x - 0\right)$$

$$a = 3$$

$$\text{Amp} = |3| = 3$$

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

$$\text{Period} = \frac{2\pi}{\frac{\pi}{4}}$$

$$\phi = 0$$

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

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

For sine

$$(0, 0), (2, 3), (4, 0), (6, -3), (8, 0)$$

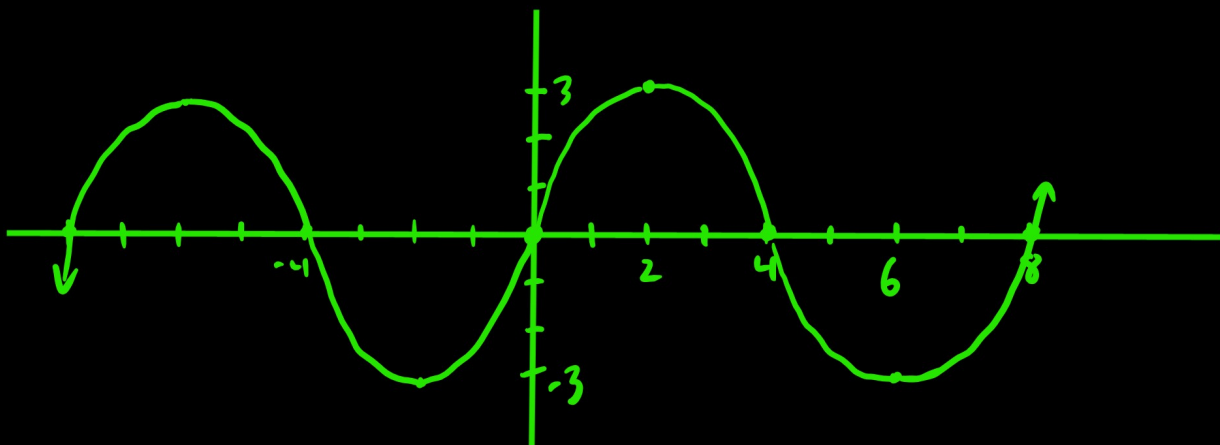
P.S.

midpoint
of 1st
and 3rd
values

midpoint
of 1st and
5th
x-values

midpoint
of 3rd
and 5th
x-values

P.S. + period



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

$$a = -2$$

$$a = -2$$

$$\omega = 4$$

$$\text{period} = \frac{2\pi}{4} = \frac{\pi}{2}$$

$$\phi = -\frac{\pi}{2}$$

$$\text{P.S.} = \frac{-\frac{\pi}{2}}{4} = -\frac{\pi}{8}$$

For cosine: a

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

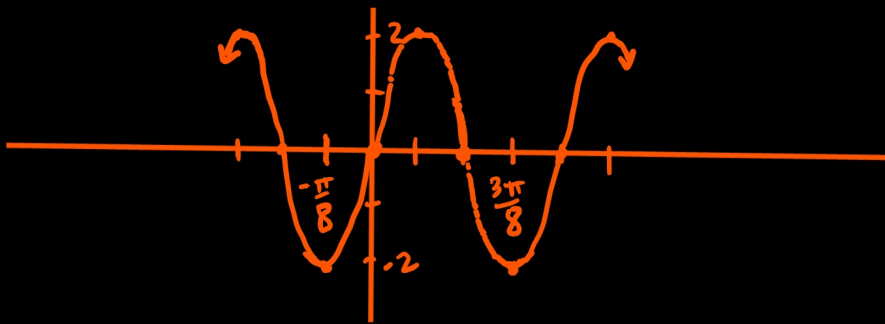
P.S.

$$\begin{aligned} & \left(-\frac{\pi}{8} + \frac{3\pi}{8}\right) \frac{1}{2} \\ & \left(\frac{2\pi}{8}\right) \cdot \frac{1}{2} \\ & \frac{\pi}{8} \end{aligned}$$

$$\begin{aligned} & \left(\frac{\pi}{8} + \frac{3\pi}{8}\right) \frac{1}{2} \\ & \frac{4\pi}{8} \cdot \frac{1}{2} \\ & \frac{2\pi}{8} = \frac{\pi}{4} \end{aligned}$$

P.S. + period

$$\begin{aligned} & -\frac{\pi}{8} + \frac{\pi}{2} \\ & -\frac{1}{8} + \frac{1}{2} = -\frac{1}{8} + \frac{4}{8} = \frac{3}{8} \end{aligned}$$



$$y = -4 \cos(\pi x + 3\pi)$$

$$a = -4$$

$$\omega = \pi$$

$$\phi = -3\pi$$

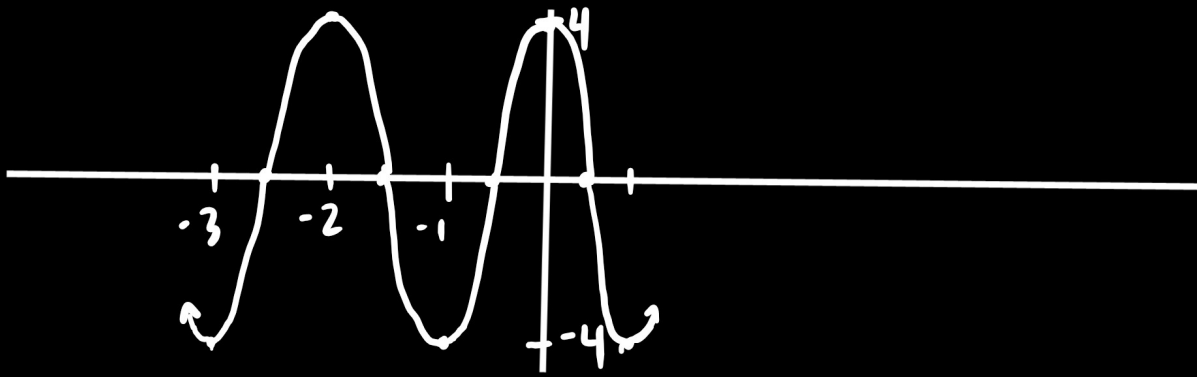
$$\text{Amp} = 4$$

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

$$\text{P.S.} = \frac{-3\pi}{\pi} = -3 \quad \frac{\phi}{\omega}$$

$$(-3, -4), (-2.5, 0), (-2, 4), (-1.5, 0), (-1, -4)$$

$$\begin{aligned} & \uparrow \\ & -3 + 2 \end{aligned}$$



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