Phase Shifts

$$y = A\sin(\omega x - \phi) + B$$

$$y = A\sin\left[\omega\left(x - \frac{\phi}{\omega}\right)\right] + B$$

phase shift

$y = \sin(x)$

$y = A\sin(\omega x)$

$y = A\sin(\omega x) + B$

First, factor out the frequency. The term being added or subtracted is the phase shift left or right. Remember: Insiders lie.

What happens when we shift sin(x) to the left by $\frac{\pi}{2}$?

$$y = \sin(x + \frac{\pi}{2})$$

What do you think the graph will look like?
Use your calculator to check and see.

$y = \sin(x + \frac{\pi}{2})$
$y = \cos(x)$
Same → 1 graph

State the amplitude, period, and phase shift. Then graph.

$y = \sin(\overset{\omega}{x} - \pi)$

$A = 1$

$T = \frac{2\pi}{\omega} = \frac{2\pi}{1} = 2\pi$

$P.S. = \text{Right } \pi$

$y = \cos(2x + \frac{\pi}{4})$

$A = 1$

$y = \cos\left[2\left(x + \frac{\pi}{8}\right)\right]$

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

$P.S. = \text{Left } \frac{\pi}{8}$

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

$A = 1$

$T = \pi$

$P.S. = \text{Right } \frac{\pi}{2}$

$y = \sin(\pi x + 2)$

$A = 1$

$T = 2$

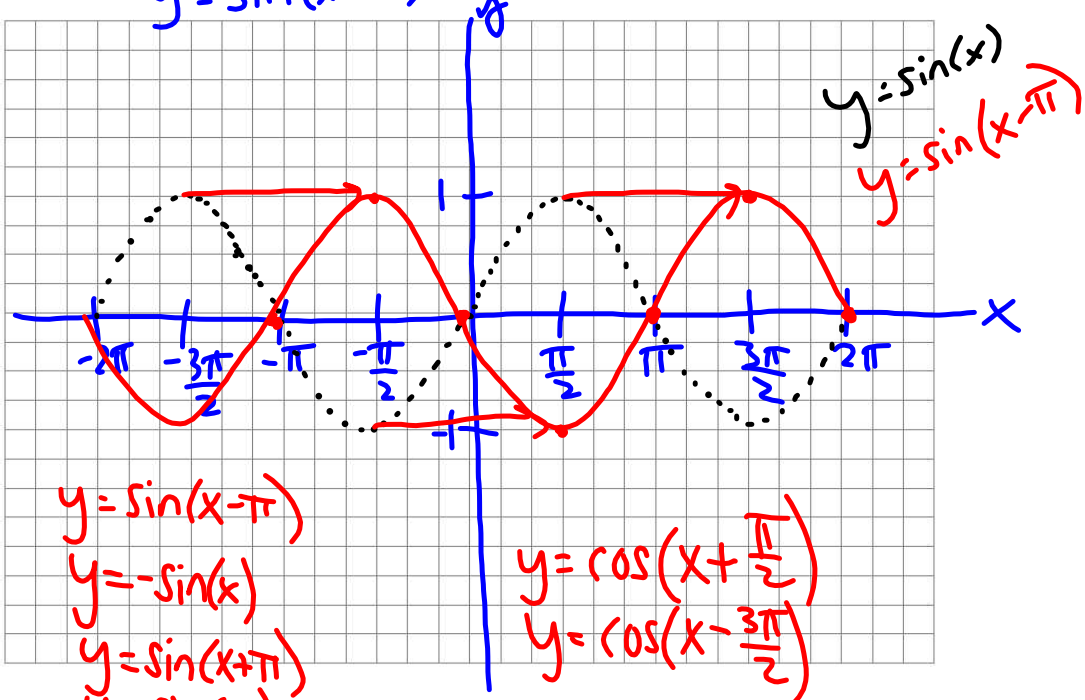
$P.S. = \text{Left } \frac{2}{\pi}$

$y = \sin(2x - 6\pi)$

$y = \cos\left[\frac{4}{3}\left(\theta + \frac{\pi}{4}\right)\right]$

(note the factored form)

$y = \sin(x - \pi)$



$y = \sin(x - \pi)$

$y = -\sin(x)$

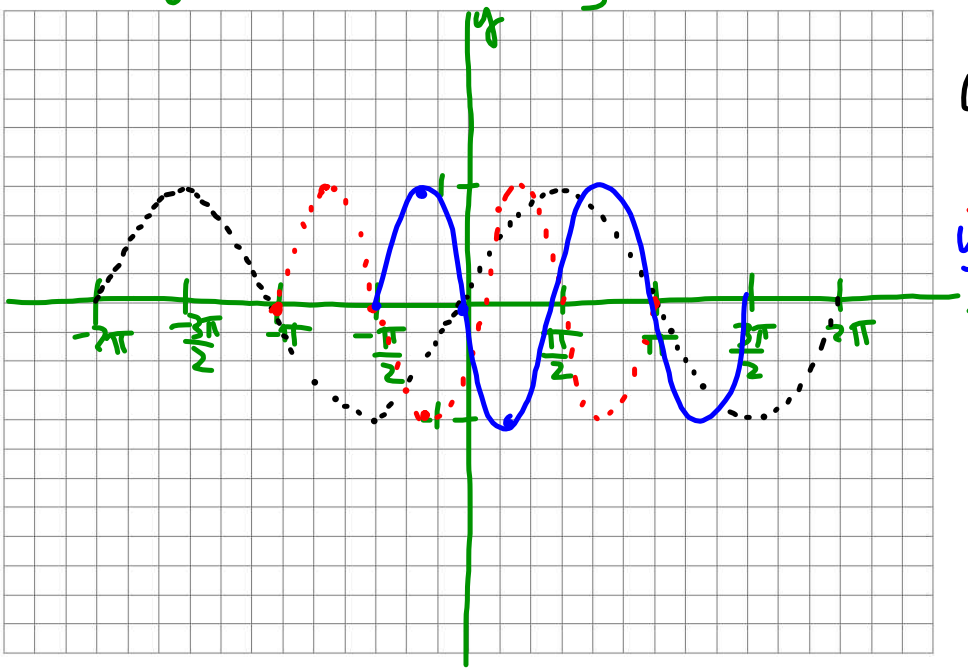
$y = \sin(x + \pi)$

$y = \sin(-x)$

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

$y = \cos\left(x - \frac{3\pi}{2}\right)$

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



$y = \sin(x)$

$y = \sin(2x)$

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

State the amplitude, period, and phase shift for each function. Then graph the function.

3. $y = \sin\left(\theta - \frac{\pi}{2}\right)$

17. $y = 2\sin\left(\theta + \frac{\pi}{2}\right)$

19. $y = 3\cos\left(\theta - \frac{\pi}{3}\right)$

27. $y = \cos\frac{1}{2}(\theta - 90°) + 2$

Compare each pair of graphs.

47. $y = -\cos 3\theta$ and $y = \sin 3(\theta - 90°)$