

CONCEPT: WRITING WAVE FUNCTIONS USING THE PHASE CONSTANT

- Sometimes you'll have to write a wave function for a wave that *doesn't* begin at $y=0$ or $y=\pm A$.

- We can write ANY wave function by using *either*

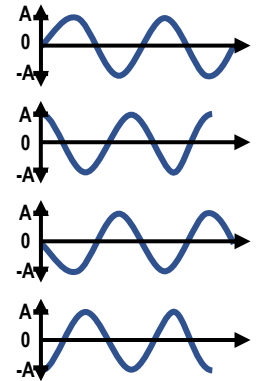
$$y(x, t) = A \sin(kx \pm \omega t \text{ ____})$$

$$y(x, t) = A \cos(kx \pm \omega t \text{ ____})$$

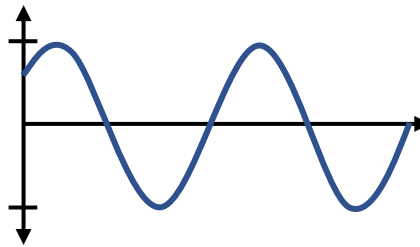
ϕ ("phi") = **phase constant** that "shifts" the graph left/right from its normal starting point.

If graph is shifted **RIGHT (+x)**, ϕ is [+ | -]

If graph is shifted **LEFT (-x)**, ϕ is [+ | -]



EXAMPLE: A transverse wave moving to the right has a wavenumber of 10 rad/m, angular frequency of 62.8 rad/s, and amplitude of 4m. At $t = 0$, the particle at $x = 0$ has a displacement of +3m. **a)** Write the wave function using a sine function. **b)** Write the wave function using a cosine function.



PHASE CONSTANT

- 1) Write $y(x, t)$ EQ with ϕ
- 2) Determine sign of ϕ
- 3) Plug in given values of t & x
- 4) Solve for ϕ
- 5) Write complete $y(x, t)$ EQ

- You can write the SAME wave function using sine *or* cosine, but the phase constant will be DIFFERENT.

PROBLEM: A wave traveling to the right has an Amplitude of 15cm, wavelength of 40cm, and oscillates 8 times per second. At $t = 0$, the displacement of a particle at $x = 0$ along this wave is +15cm. Write the wave function, including the phase constant, using a sine function.

- A) $y(x, t) = 0.15 \sin(0.40x - 8t - 1.57)$
- B) $y(x, t) = 0.15 \sin(15.7x + 50.3t)$
- C) $y(x, t) = 0.15 \sin(15.7x - 50.3t + 1.57)$
- D) $y(x, t) = 0.15 \sin(0.157x - 0.78t - 1.57)$

PHASE CONSTANT
1) Write $y(x, t)$ EQ with ϕ 2) Determine sign of ϕ 3) Plug in given values of t & x 4) Solve for ϕ 5) Write complete $y(x, t)$ EQ