Pre-Calculus A
Writing Equations of Sine and Cosine (b and c)

Name : Key
Date : ______________ Period : ______

LEARNING TARGETS

- I can write a sine or cosine function with a phase shift to model a scenario.

For the following curve, **assume there has been no reflection**. Please identify:

-the scale of the x-axis : $\pi \div 2 = \frac{\pi}{2}$

$a=1$ -the a-value (always positive if no reflection): $\frac{1}{2}(\max - \min) = \frac{1}{2}(1 - -1) = \frac{1}{2}(2) = 1$

$d=0$ -the d-value: max - amp : $1-1=0$

-the midline: $y=0$

-the fundamental period (how long it takes the graph to complete a full max/min cycle): -2π to 2π

Find the difference (take bigger - smaller) $= 2\pi - -2\pi = 2\pi + 2\pi = 4\pi$

$b=\frac{1}{2}$ -the b-value using the fact that the fundamental period is $\frac{2\pi}{b}$:

Period $= \frac{2\pi}{b} \Rightarrow \frac{4\pi}{1} = \frac{2\pi}{b} \Rightarrow \frac{4\pi b}{4\pi} = \frac{2\pi}{4\pi} \Rightarrow b = \frac{2}{4} = \frac{1}{2}$

$c=\pi$ -the phase shift if the curve is sine

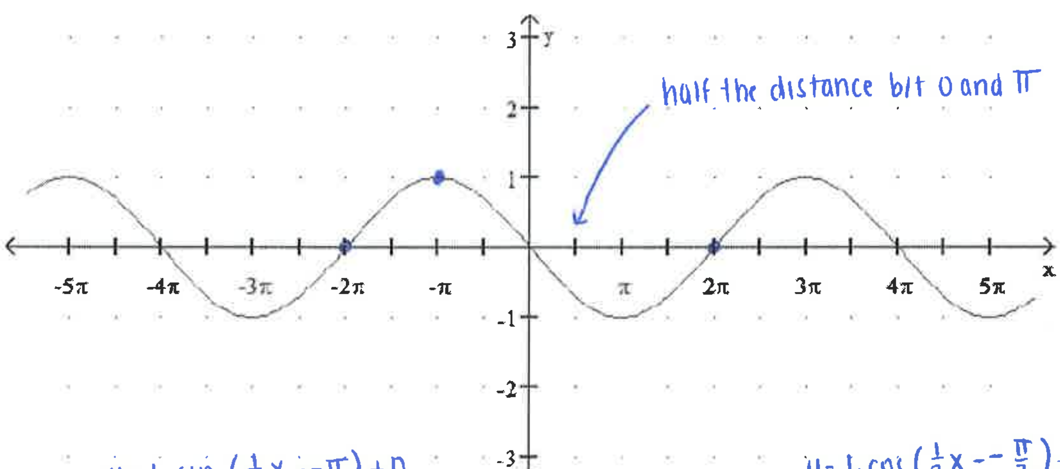
~Pick a starting point on the midline : -2π ← the graph of sine moved left 2π units

P.S $= \frac{c}{b} \Rightarrow \frac{-2\pi}{1} = \frac{c}{1/2} \Rightarrow c = \frac{1}{2}(2\pi) \Rightarrow c = \pi$

$c = -\frac{\pi}{2}$ -the phase shift if the curve is cosine

~Pick a point starting at a maximum value : $-\pi$ ← the graph of cosine moved left π units

P.S. $= \frac{c}{b} \Rightarrow \frac{-\pi}{1} = \frac{c}{1/2} \Rightarrow c = -\frac{\pi}{1} \cdot \frac{1}{2} \Rightarrow c = -\frac{\pi}{2}$



$y = 1 \cdot \sin\left(\frac{1}{2}x - -\pi\right) + 0$

Sine equation: $y = 1 \cdot \sin\left(\frac{1}{2}x + \pi\right) + 0$

$y = 1 \cdot \cos\left(\frac{1}{2}x - -\frac{\pi}{2}\right) + 0$

Cosine equation: $y = 1 \cdot \cos\left(\frac{1}{2}x + \frac{\pi}{2}\right) + 0$

For the following curve, **assume there has been no reflection**. Please identify:

-the scale of the x-axis : $\frac{\pi}{4} \div \frac{2}{1} \Rightarrow \frac{\pi}{4} \cdot \frac{1}{2} = \frac{\pi}{8}$

a=1 -the a-value: $a = \frac{1}{2}(\max - \min) = \frac{1}{2}(1 - -1) = \frac{1}{2}(2) = 1$

d=0 -the d-value: $d = \max - \text{amp} = 1 - 1 = 0$

-the midline: $y = 0$

-the fundamental period: $-\frac{\pi}{8}$ to $\frac{7\pi}{8}$: $\frac{7\pi}{8} - -\frac{\pi}{8} = \frac{7\pi}{8} + \frac{\pi}{8} = \frac{8\pi}{8} = \pi$

b=2 -the b-value using the fact that the fundamental period is $\dfrac{2\pi}{b}$:

$\frac{\pi}{1} = \frac{2\pi}{b} \Rightarrow \frac{\cancel{\pi} b}{\cancel{\pi}} = \frac{2\cancel{\pi}}{\cancel{\pi}}$

$b = 2$

$C = -\frac{\pi}{4}$ -the phase shift if the curve is sine

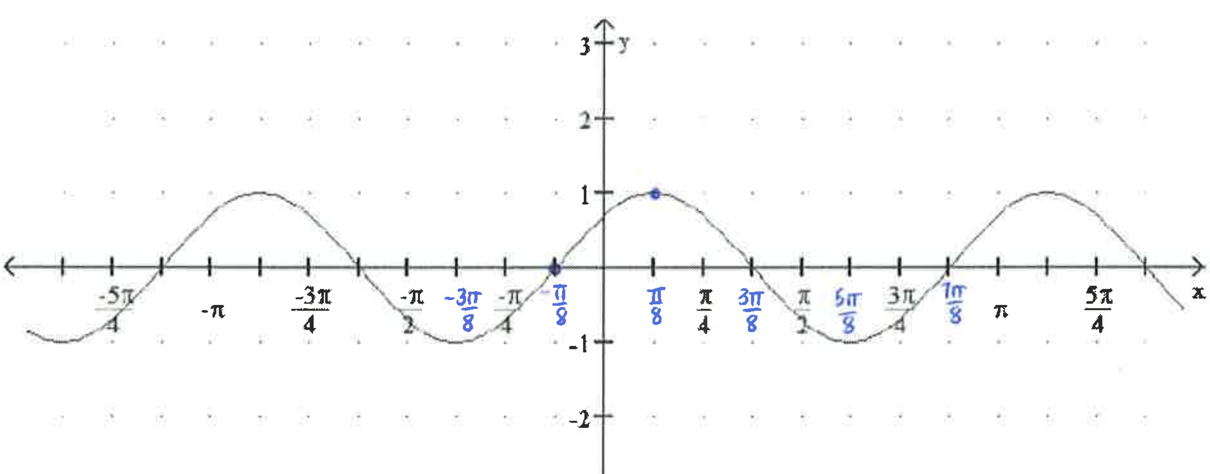
~Pick a starting point on the midline : $-\frac{\pi}{8} \Rightarrow \frac{\pi}{8}$ units to the left

$P.S. = \frac{c}{b} \Rightarrow -\frac{\pi}{8} = \frac{c}{2} \Rightarrow \frac{\cancel{8}c}{\cancel{8}} = \frac{-2\pi}{8} \Rightarrow c = -\frac{\pi}{4}$

$C = \frac{\pi}{4}$ -the phase shift if the curve is cosine

~Pick a point starting at a maximum value : $\frac{\pi}{8}$ units to the right

$P.S. = \frac{c}{b} \Rightarrow \frac{\pi}{8} = \frac{c}{2} \Rightarrow \frac{\cancel{8}c}{\cancel{8}} = \frac{2\pi}{8} \Rightarrow c = \frac{\pi}{4}$



$y = 1\sin(2x - -\frac{\pi}{4}) + 0$

Sine equation: $y = \sin(2x + \pi/4)$ Cosine equation: $y = 1\cos(2x - \frac{\pi}{4}) + 0$