Warm-up

Match each function with its graph.

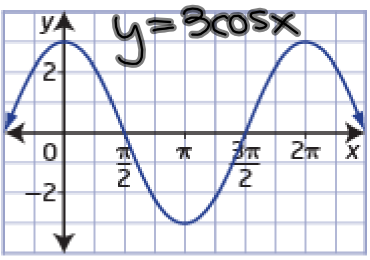
a) $y = 3\cos x$

b) $y = \cos 3x$

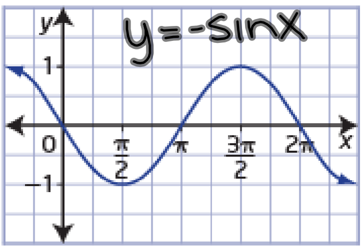
c) $y = -\sin x$

d) $y = -\cos x$

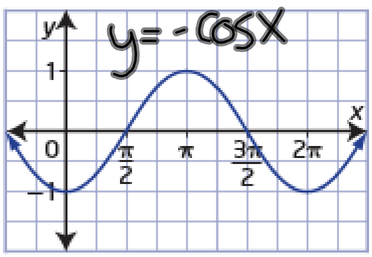
A



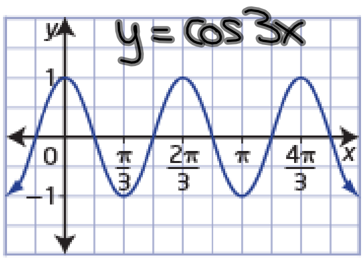
C



B



D



Equations in Standard Form

$$y = a\sin\left[b(x-c)\right]+d$$

a = ***Amplitude*** → influences how tall the sine curve is. (Vertical Stretch)

$b = \frac{360}{P}$ → influences how often the pattern repeats. (Horizontal Stretch)

c = ***Horizontal Translation*** → Influences how far to the left or the right that the graph will shift. (Phase Shift)

- If C is positive → Shift Right
- If C is negative → Shift Left

d = ***Vertical Translation*** → influences how far up and down the graph will shift.

- If d is positive → Shift Up
- If d is negative → Shift Down
- d is equal to your sinusoidal axis

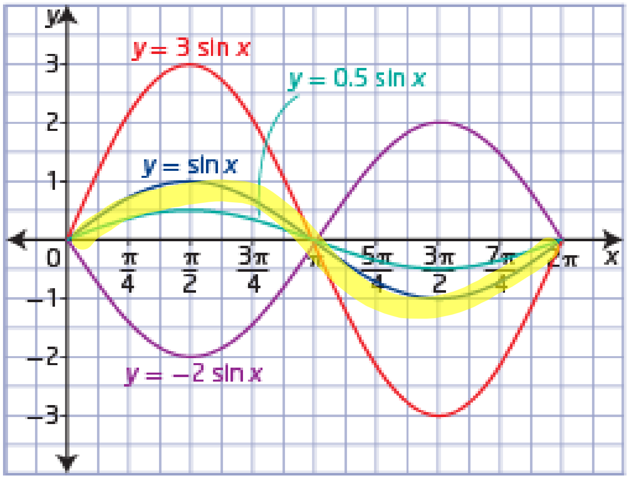
$$\frac{\text{min} + \text{max}}{2}$$

The Value of "a" applies a vertical stretch by a factor of |a|

For the graph of $y = 3 \sin x$, apply a vertical stretch by a factor of 3.

For the graph of $y = 0.5 \sin x$, apply a vertical stretch by a factor of 0.5.

For the graph of $y = -2 \sin x$, reflect in the x-axis and apply a vertical stretch by a factor of 2.



The Value of b effects the period of the graph and applies a horizontal stretch by a factor of $\frac{1}{|b|}$

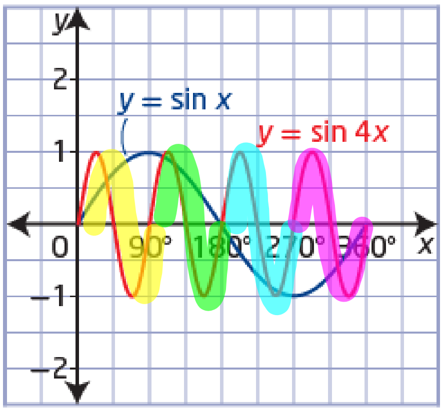
Thus, the period for $y = \sin bx$ or $y = \cos bx$ is $\frac{2\pi}{|b|}$, in radians, or $\frac{360°}{|b|}$, in degrees.

Find the period of the following functions in both radians and degrees.

$y = \sin 4x$

$b = 4$

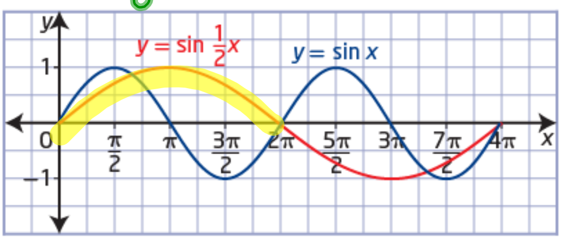
$P = \frac{360°}{b} = \frac{360°}{4} = 90°$



$y = \sin \frac{1}{2}x$

$b = \frac{1}{2}$

$P = \frac{2\pi}{1/2} = 4\pi$



State ***a, b, c, d, and P*** from the following sinusoidal equations:

$$y = -4\sin[3(\theta + 90^\circ)] - 1$$

$a = 4$ $b = 3$ $c = -90^\circ$ $d = -1$

$P = \frac{360^\circ}{b} = \frac{360^\circ}{3}$ Equation of sinusoidal axis: $y = -1$

$= 120^\circ$

$$y + 2 = \sin(3\theta - 90^\circ)$$

$y = \sin(3\theta - 90^\circ) - 2$

$y = 1\sin[3(\theta - 30^\circ)] - 2$

$a = 1$ $b = 3$ $c = 30^\circ$ $d = -2$

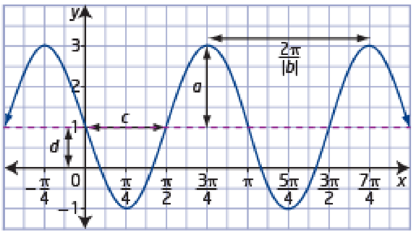
$P = \frac{360^\circ}{3} = 120^\circ$ Equation of sinusoidal axis: $y = -2$

Key Ideas

- You can determine the amplitude, period, phase shift, and vertical displacement of sinusoidal functions when the equation of the function is given in the form $y = a \sin b(x - c) + d$ or $y = a \cos b(x - c) + d$.

For: $y = a \sin b(x - c) + d$
$y = a \cos b(x - c) + d$

How does changing each parameter affect the graph of a function?



Vertical stretch by a factor of $|a|$
- changes the amplitude to $|a|$
- reflected in the x-axis if $a < 0$

Horizontal stretch by a factor of $\frac{1}{|b|}$
- changes the period to $\frac{360°}{|b|}$ (in degrees) or $\frac{2\pi}{|b|}$ (in radians)
- reflected in the y-axis if $b < 0$

Horizontal phase shift represented by c
- to right if $c > 0$
- to left if $c < 0$

Vertical displacement represented by d
- up if $d > 0$
- down if $d < 0$

$$d = \frac{\text{maximum value} + \text{minimum value}}{2}$$

- You can determine the equation of a sinusoidal function given its properties or its graph.

Homework

Finish worksheet

h) $\cancel{2\cdot}\ \frac{1}{\cancel{2}}(y+2) = 2\cdot 3\cos(x-90^\circ)$

$y+2 = 6\cos(x-90^\circ)$

$y = 6\cos(x-90^\circ)-2$