$y = a\text{Sin/Cos}(bx) + k$

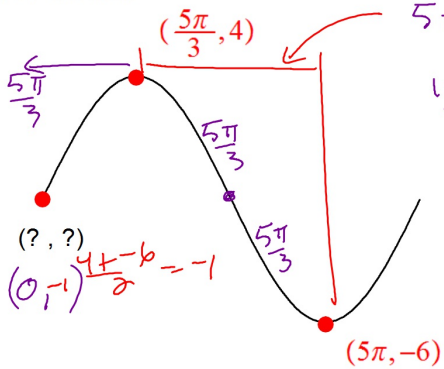
a Vertical stretch/shrink = Amplitude

If a<0: Upside down (x-axis reflection)

b Horizontal stretch or shrink Period = $2\pi/b$

k Veritcal shift = Midline

Find the coordinates of the "starting point" and write the equation of this Sine Function.



$5\pi - \frac{5\pi}{3} =$

$\frac{15\pi}{3} - \frac{5\pi}{3} = \frac{10\pi}{3}$

period =

$\frac{10\pi}{3} \cdot 2 = \frac{20\pi}{3}$

$b = \frac{3}{10}$

Midline: y = -1

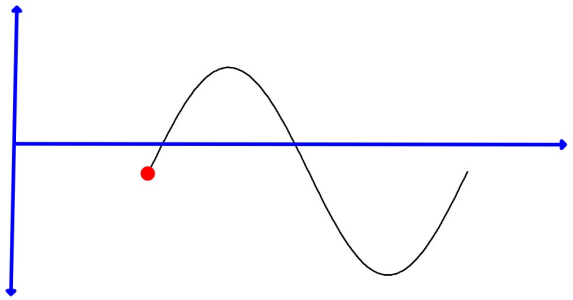
Amplitude = 5

EQ:

y = 5Sin(3x/10) - 1

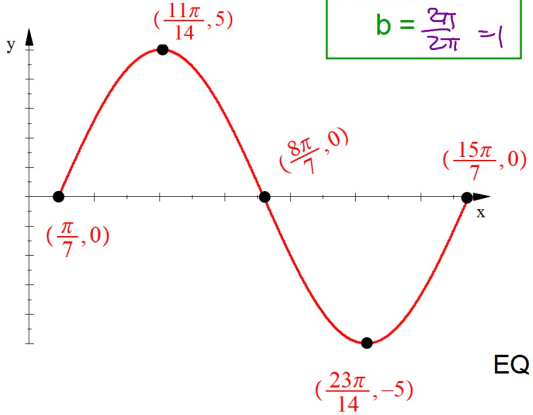
What if the "starting point" isn't on the y-axis?

Then there would be a Horizontal Translation to include.



$y = a\text{Sin}(x-h) + k$

h Horizontal Shift: Phase Shift



Period = 2π

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

Amplitude = 5

$a = 5$

Midline: $y = 0$

$k = 0$

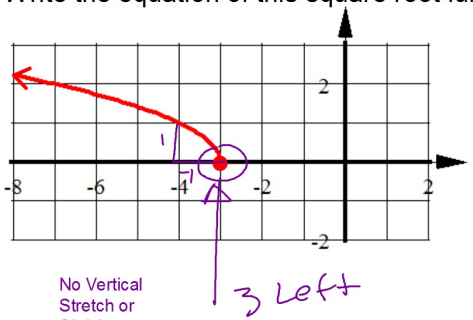
Phase Shift: $\frac{\pi}{7}$ right

$(x \pm h) \rightarrow (x - \frac{\pi}{7})$

EQ: $y = 5 \sin(x - \frac{\pi}{7})$

Review from Chapter 7 that applies to Chapter 13:

Write the equation of this square root function.

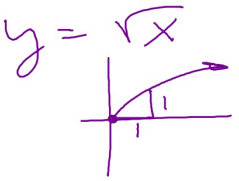


No Vertical Stretch or Shrink

3 Left

and

Backwards



Parent Square Root Function

$y = \sqrt{-(x+3)}$

When there is a y-axis reflection and a horizontal shift you must separate them inside the radical using parentheses.

$y = \sin bx$

$y = \sin(x - h)$

b affects the period
(horiz stretch or shrink)

h affects the horizontal position.
(horiz translation left or right)

How do you write an equation that has both a b and an h?

$y = \sin(b(x-h))$

You must separate the horizontal shift and the horizontal stretch/shrink inside the function using parentheses.

Write the equation of this function.

Parent function: Sinx

Phase Shift: $\frac{\pi}{6}$ left

Period = 8π

Graph is upside-down

Midline: $y = -3$

Amplitude = 10

$b = \frac{2\pi}{8\pi} = \frac{1}{4}$

$y = -10 \sin(\frac{1}{4}(x + \frac{\pi}{6})) - 3$

$$y = -12\text{Sin}(3(x - \frac{7\pi}{10})) + 2.1$$

Period = $\frac{2\pi}{3}$

Amplitude = 12

Phase Shift:

$\frac{7\pi}{10}$ RT

Eq of Midline: $y = 2.1$

$$y = a\text{Sin}(b(x-h)) + k$$

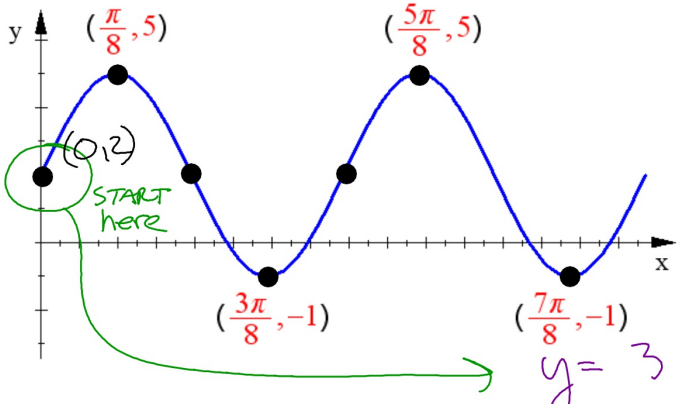
a ⟶ Amplitude - Vert strecth or shrink.
Also x-axis reflection if negative

b ⟶ Leads to the Period = 2π/b - Horiz stretch or shrink

h ⟶ Phase Shift - Horiz translation - gives the "new" starting point

k ⟶ Equation of the Midline - Vert translation

Write the equation of this graph as a Sine Function:



Amplitude= 3

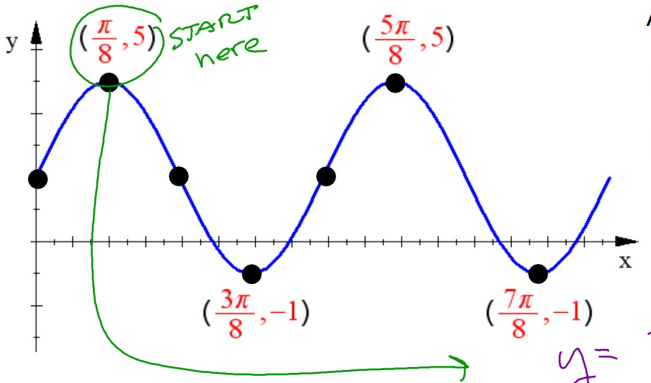
Period = $\frac{\pi/2}{b = \frac{2\pi}{\pi/2} = 4}$

Midline: y=2

Phase Shift:
NONE

$y = 3\sin 4x + 2$

Write the equation of this graph as a Cosine Function:



Amplitude= 3

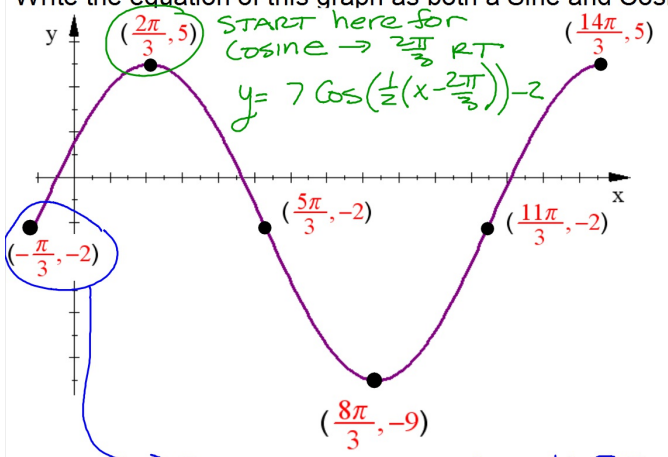
Period = π/2
b = 4

Midline: y=2

Phase Shift:
$\frac{\pi}{8}$ RT

$y = 3\cos\left(4\left(x - \frac{\pi}{8}\right)\right) + 2$

Write the equation of this graph as both a Sine and Cosine Function



START here for Cosine → $\frac{2\pi}{3}$ RT

$y = 7\cos\left(\frac{1}{2}\left(x - \frac{2\pi}{3}\right)\right) - 2$

Period 4π

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

Amplitude 7

midline $y = -2$

START HERE FOR SIN: $y = 7\sin\left(\frac{1}{2}\left(x + \pi/3\right)\right) - 2$

$\pi/3$ Left