

$$y = a\sin(x-h) + k$$

a = Vertical Stretch or Shrink Factor: $|a|$ = Amplitude
if $a < 0$ x-axis reflection

h = Horizontal Translation

k = Vertical Translation Midline: $y = k$

$$y = a(x-h)^2 + k$$

Vertex: (h, k)

$$y = a|x-h| + k$$

Vertex: (h, k)

$$y = a\sqrt{x-h} + k$$

Starting Point: (h, k)

$$y = a\sin(x-h) + k$$

Starting Point: (h, k)

h and k represent the same thing in all these functions.

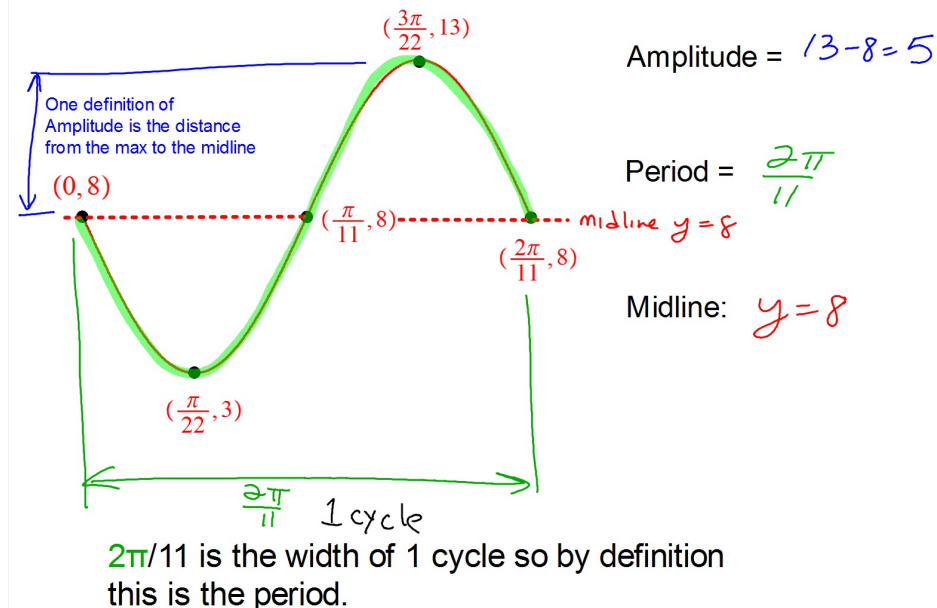
Describe the transformations represented in each equation:

$$y = 7\sin(x - \frac{\pi}{4}) + 4$$

- Amplitude = 7
- Vertical stretch factor of 7
- 7x taller
- $\frac{\pi}{4}$ RIGHT
- 4 units up
- midline: $y = 4$

$$y = -3\sin(5x) - 6$$

- upside down
- 3x taller (Amp = 3)
- period = $\frac{2\pi}{5}$
- Horiz. shrink factor of $\frac{1}{5}$
- 5x narrower
- midline: $y = -6$
- 6 units down



$$y = a\sin(bx) + k$$

a Vertical stretch/shrink = Amplitude

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

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

k Vertical shift = Midline

Amplitude = 5

$$a = -5 \text{ (upside down)}$$

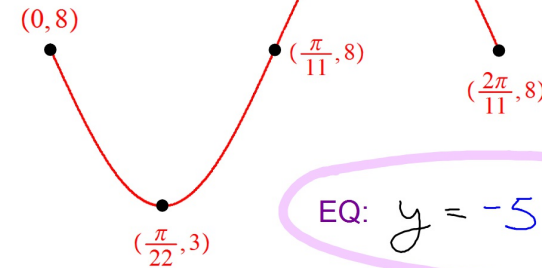
Midline: $y = 8$

$$k = 8$$

$$\text{Period} = \frac{2\pi}{11}$$

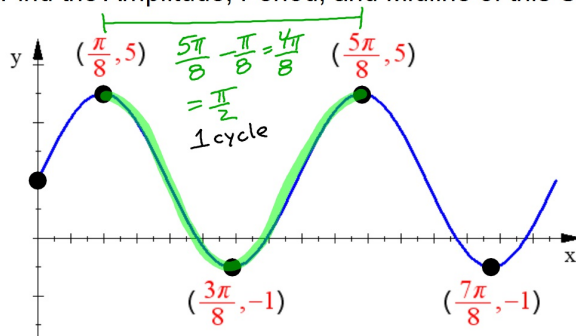
$$b = \frac{2\pi}{\frac{2\pi}{11}} = 2\pi \cdot \frac{11}{2\pi}$$

$$b = 11$$



$$\text{EQ: } y = -5 \sin(11x) + 8$$

Find the Amplitude, Period, and Midline of this Sine Function:



$$\text{Amplitude} = \frac{5 - (-1)}{2} = 3$$

$$a = 3 \text{ Not upside down}$$

$$\text{Midline: } y = \frac{5 + (-1)}{2} = 2$$

$$k = 2$$

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

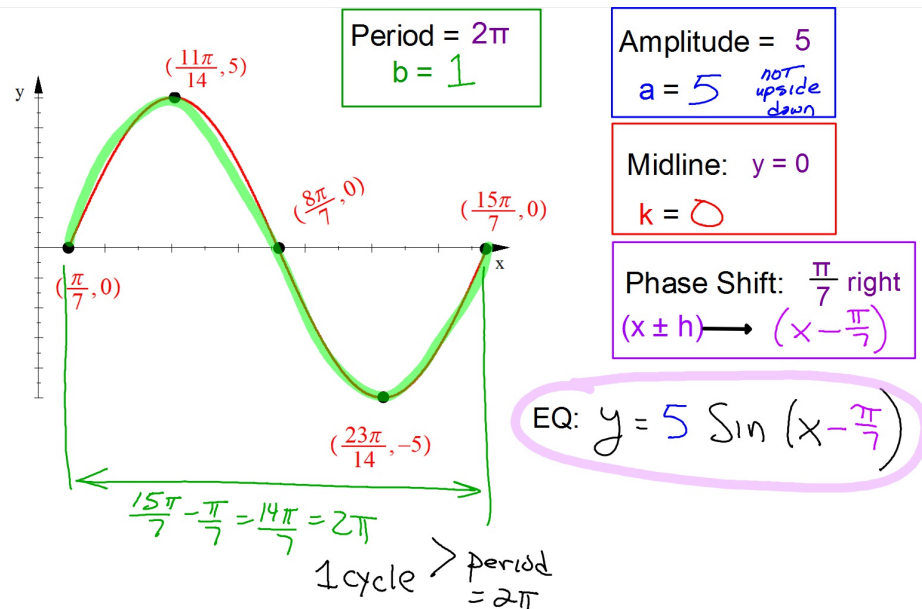
$$b = \frac{2\pi}{\frac{\pi}{2}} = 2\pi \cdot \frac{2}{\pi}$$

$$b = 4$$

$$\text{Equation: } y = 3 \sin(4x) + 2$$

$$y = a\sin(x - h) + k$$

h: Phase Shift



$$y = a \sqrt{x \pm h}$$

Phase Shift of h units

$$y = -a \sqrt{x \pm h}$$

Phase Shift of h units
and
Upside Down (x-axis reflection)

$$y = a \sqrt{-(x \pm h)}$$

Phase Shift of h units
and
Backwards (y-axis reflection)

When there is a y-axis reflection and a horizontal translation you must separate the two using a set of parentheses.

$$y = \sin bx$$

b affects the period
(horiz stretch or shrink)

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

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

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

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

Similar to the previous screen, when there is a y-axis reflection and a horizontal translation, when there is a horizontal stretch/shrink and a horizontal translation you must separate the two using an extra set of parentheses.

Write the equation of this function.

Parent function: $\sin x$

$h = -\frac{\pi}{6}$
Phase Shift: $\frac{\pi}{6}$ left

Period = 8π

Graph is upside-down

Midline: $y = -3$ $k = -3$

Amplitude = 10

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

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

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