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

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

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

a = Vertical Stretch or Shrink Factor
   if a<0 x-axis reflection

h = Horizontal Translation

k = Vertical Translation

regardless of the parent function a, h and k have the same effect.

$y = a\operatorname{Sin}(x \pm h) + k$

a   Vertical stretch/shrink = Amplitude

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

h   Horizontal shift

k   Veritcal shift

Sin(x ± h) shows a Horizontal Translation of h units.

This is more commonly referred to as a

PHASE SHIFT

Sinx ± k shows a Vertical Translation of k units.

This shift will give the new equation of

The Midline

Describe the transformations represented in each equation:

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

7: Amplitude = 7
   or Graph is 7 times taller
   or Vertical Stretch Factor of 7

$X - \frac{\pi}{4}$: Phase shift is $\frac{\pi}{4}$ to the right.
   or Horizontal Translation $\frac{\pi}{4}$ units right
+4: Vertical Translation 4 units up
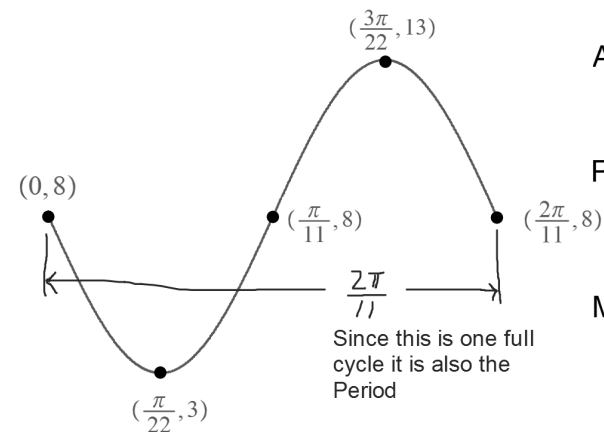   or Midline is $y = 4$

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

-3: Amplitude = 3
   and the graph is upside down.

5: Helps find the Period:
   Period = $\frac{2\pi}{5}$

-6: Midline is $y = -6$

$(\frac{3\pi}{22}, 13)$

$(0, 8)$

$(\frac{\pi}{11}, 8)$ $(\frac{2\pi}{11}, 8)$

$\frac{2\pi}{11}$

Since this is one full cycle it is also the Period

$(\frac{\pi}{22}, 3)$

Amplitude = 5

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

Midline: $y = 8$

Amplitude = 5
   a = -5

$(\frac{3\pi}{22}, 13)$

Midline: y = 8
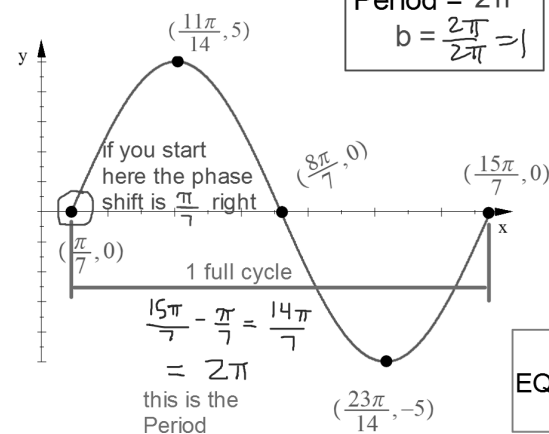   k = $+8$

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

$(0, 8)$

$(\frac{\pi}{11}, 8)$

$(\frac{2\pi}{11}, 8)$

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

Since this is one full cycle it is also the Period

$(\frac{\pi}{22}, 3)$

$y = -5 \sin 11x + 8$

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

$(\frac{11\pi}{14}, 5)$

y

if you start here the phase shift is $\frac{\pi}{7}$ right

$(\frac{8\pi}{7}, 0)$ $(\frac{15\pi}{7}, 0)$

x

$(\frac{\pi}{7}, 0)$

1 full cycle

$\frac{15\pi}{7} - \frac{\pi}{7} = \frac{14\pi}{7}$
   $= 2\pi$

this is the Period

$(\frac{23\pi}{14}, -5)$

Amplitude = 5
   a = 5

Midline: y = 0
   k = 0

Phase Shift: $\frac{\pi}{7}$ right
$(x \pm h) \longrightarrow (x - \pi/7)$

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

Write the equation of this Sine Function:

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

$(\frac{\pi}{8}, 5)$ $\frac{5\pi}{8} - \frac{\pi}{8} = \frac{4\pi}{8}$ $(\frac{5\pi}{8}, 5)$

$y = 2$

$(\frac{3\pi}{8}, -1)$ $(\frac{7\pi}{8}, -1)$
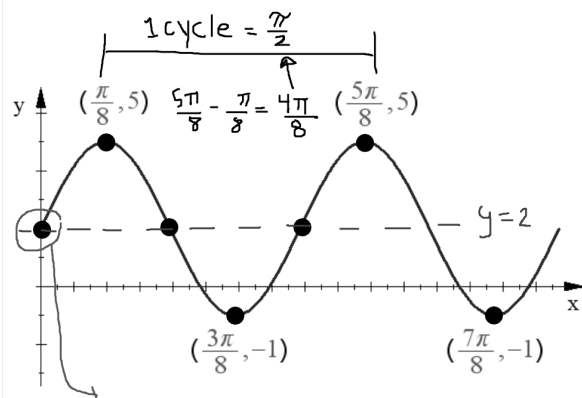
If you use this as a
starting point there
is no Phase Shift.
(it didn't move left
or right)

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

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

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

Midline: $\frac{5+-1}{2}$

$y = 2$

Equation: y = 3Sin(4x) + 2

y = Sinbx

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))