$$y = a\text{Sin/Cos}(b(x \pm h)) \pm k$$

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

b ⟶ Horiz stretch or shrink Period = $2\pi/b$ and $b = 2\pi/\text{Period}$

h ⟶ Phase Shift - Horiz translation - the x-coord of start point

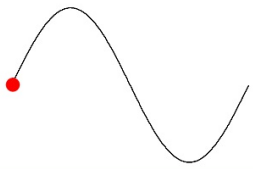
k ⟶ Vertical translation - Equation of the Midline

gives you y-coord of pts on midline

Starting points for $y = a\text{Sin/Cos}x$

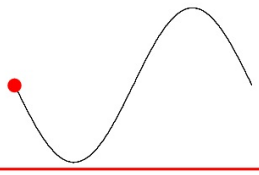
Sine Graphs

Positive **a**



Starts on the Midline and goes UP

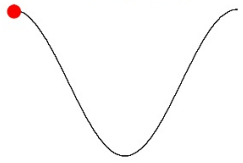
Negative **a**



Starts on the Midline and goes DOWN

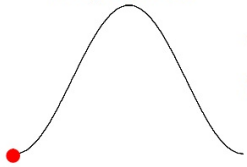
Cosine Graphs

Positive **a**



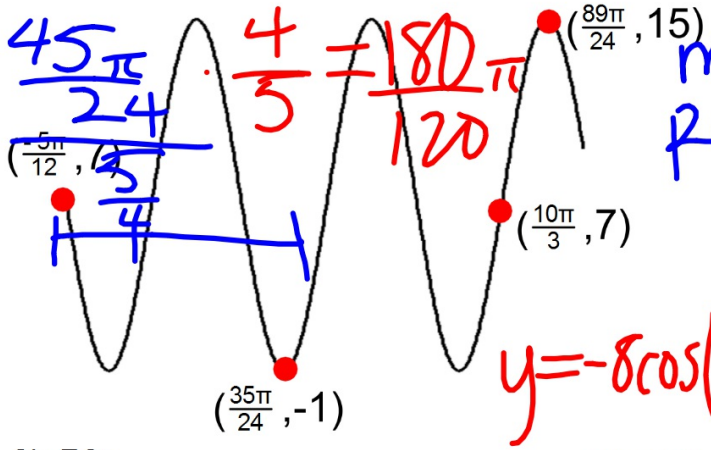
Starts at a Max

Negative **a**



Starts at a Min

1. Write both a Sine and Cosine equation for the graph shown below.



Amp
mid
period

$\frac{45\pi}{24} \cdot \frac{4}{3} = \frac{180\pi}{120}$

$k = 7$

$h = \frac{5\pi}{12}$

$a = 8$

$b = \frac{2\pi}{\frac{180\pi}{120}} = \frac{4}{3}$

$y = -8\cos\left(\frac{4}{3}\left(x - \frac{35\pi}{24}\right)\right) + 7$

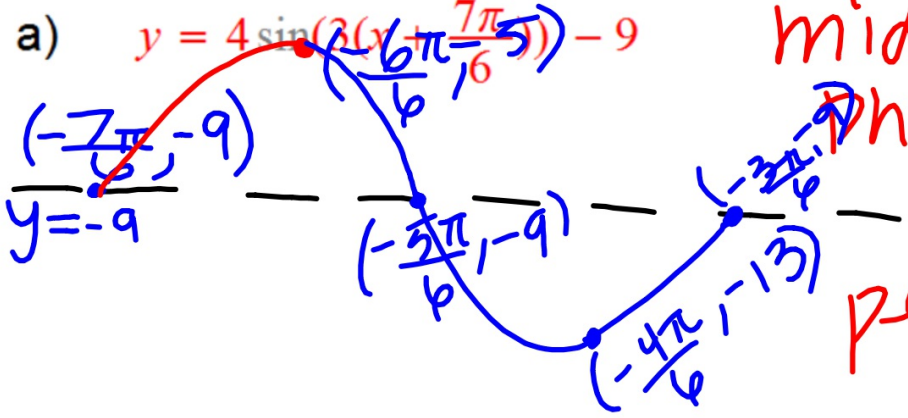
Sin EQ:

$y = -8\sin\left(\frac{4}{3}\left(x + \frac{5\pi}{12}\right)\right) + 7$

Cos EQ:

2. Graph one period of each function. Label the coordinates of all max, min, and pts on the midline.

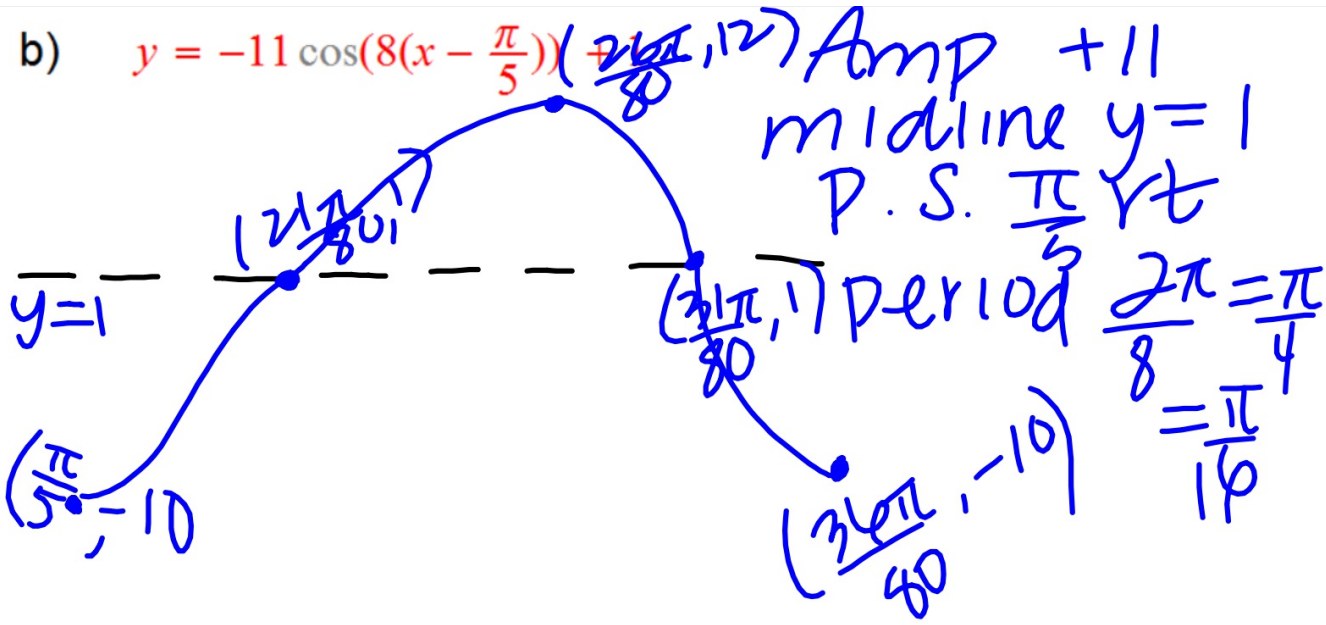
a) $y = 4\sin(2(x + \frac{7\pi}{6})) - 9$



Amp 4
midline $y = -9$
Phase shift $\frac{7\pi}{6}$

period $= \frac{2\pi}{3} \cdot \frac{1}{4} = \frac{\pi}{6}$

b) $y = -11\cos(8(x - \frac{\pi}{5}))$



$$y = a\cos(b(x \pm h)) \pm k$$

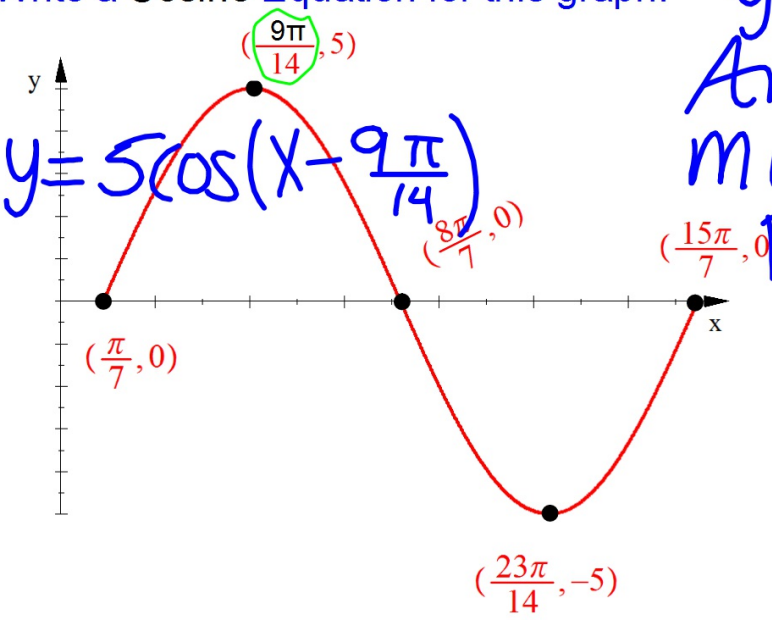
a ⟶ Vert strecth or shrink - Amplitude
Also x-axis reflection if negative

b ⟶ Horiz stretch or shrink Period = 2π/b and b = 2π/Period

h ⟶ Phase Shift - Horiz translation - x-coord of starting point

k ⟶ Vertical translation - Equation of the Midline
gives you y-coord of starting point (and pts on midline)

Write a Cosine Equation for this graph.



$y = a\cos(b(x \pm h)) \pm k$

Amp 5

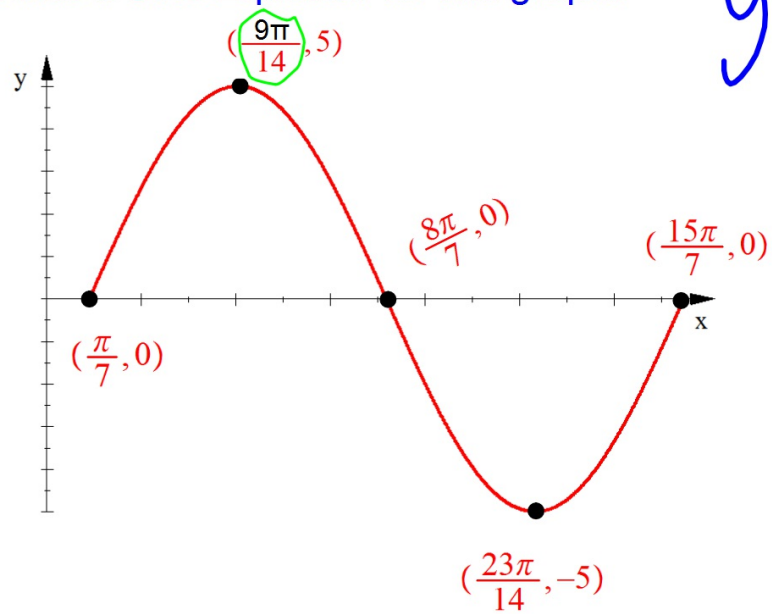
midline $y = 0$

P.S. $\frac{9\pi}{14}$ r.t.

period $= 2\pi$

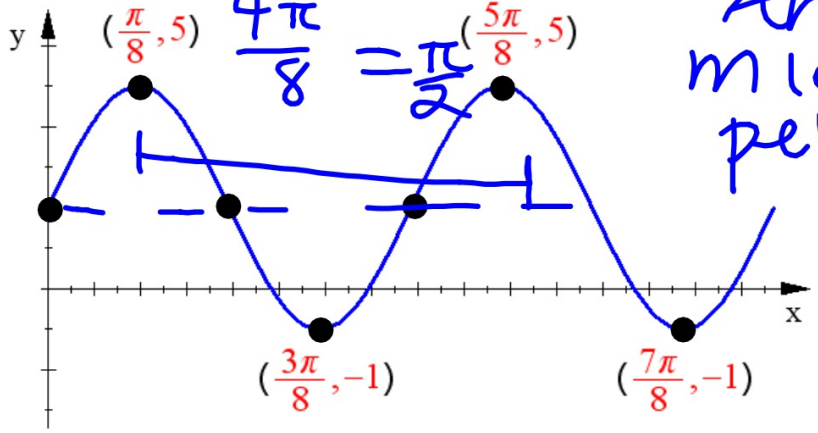
$b = \frac{2\pi}{2\pi} = 1$

Write a Sine Equation for this graph.



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

Write the equation of this graph as a Sine Function:



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

Amp 3

midline $y=2$

period $\frac{\pi}{2}$ $\frac{2\pi}{\frac{\pi}{2}} \cdot \frac{2}{\pi}$

$b=4$

Write the equation of this graph as a Cosine Function:

$y = 3\sin 4x + 2$

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