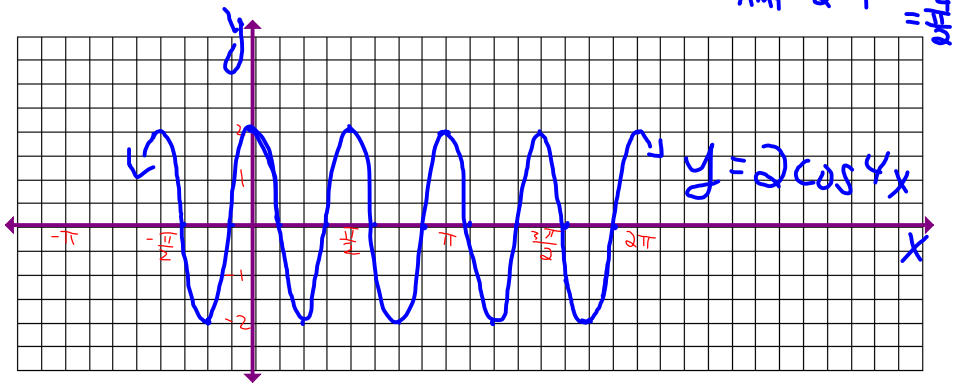
Lesson #5.3: Sinusoidal Functions of the Form

$f(x) = a\sin[k(x-d)] + c$ and $f(x) = a\cos[k(x-d)] + c$

Example #1: Determine the amplitude and period of the sinusoidal function.
Then, transform the graph of $y = \cos x$ to sketch a graph of the function: $y = 2\cos 4x$

Amp = 2 per = $\frac{2\pi}{4} = \frac{\pi}{2}$



Example #2: Consider the function: $y = -2\sin\left[4\left(x-\frac{\pi}{6}\right)\right] - 3$

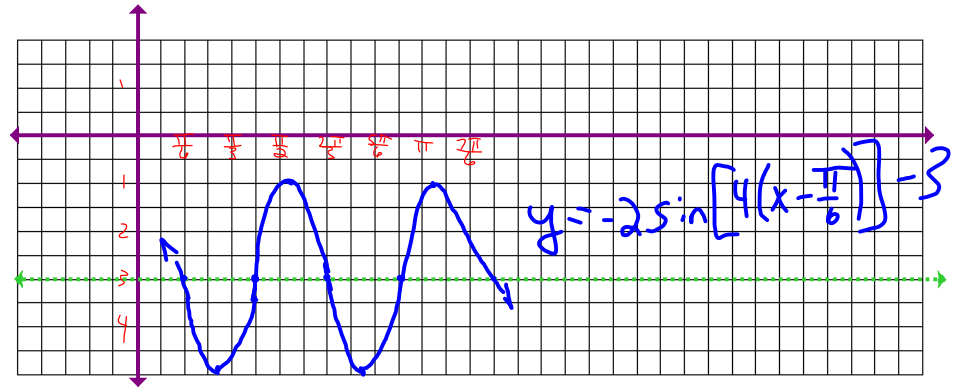
a) What is the amplitude? 2

b) What is the period? $\frac{\pi}{2}$

c) Describe the phase shift. $\frac{\pi}{6}$ (right $\frac{\pi}{6}$)

d) Describe the vertical translation. -3 (Down 3)

e) Sketch a graph of the function over two cycles.



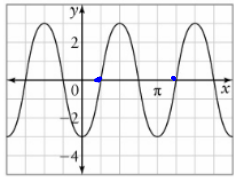
Period = $\frac{2\pi}{k}$ $\quad y = a\sin[k(x-d)]+c$

Example #3: Model the graph shown using a sine function.

a) From the graph, determine (using the sine function):

i) the amplitude 3 ii) the period π

iii) the phase shift $\frac{\pi}{4}$ iv) the vertical translation 0



b) Write an equation for the function:

$a=3,\ k=2 \quad d=\frac{\pi}{4} \quad c=0$ So $y=3\sin[2(x-\frac{\pi}{4})]$

c) Graph the function you found in part b) and compare it to the given graph. Verify that the two graphs match.

d) Determine a model for the above graph using a cosine function.

$y=-3\cos(2x)$

e) Verify that the graph of your equation in part d) matches the given graph.

Example #4: A Ferris wheel at an amusement park completes one revolution every 40 s. The wheel has a diameter of 16 m and its centre is 12 m above the ground.

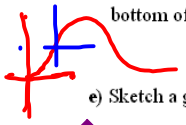
a) If you were to model the height above the ground of a rider with respect to time using a sine function, determine the amplitude and period of the function.

amp = 8 period = 40s

b) Determine the vertical translation for the function in part a).

12 m

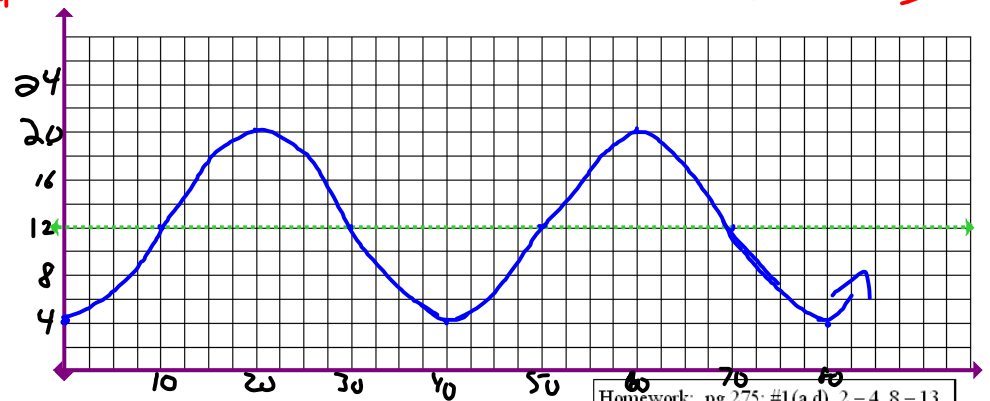
c) Use graphing technology to determine the phase shift necessary if the rider must enter the ride at the bottom of the wheel.



d) Model the height, h, in metres, above the ground of a rider using a sine function in the form $h = a\sin[k(t-d)] + c$, where t represents the time, in seconds.

$h=8\sin[\frac{\pi}{20}(t-10)]+12$

e) Sketch a graph of the model over two cycles.



Homework: pg 275; #1(a,d), 2 – 4, 8 – 13, 18, 19, 20

$$\text{Per} = \frac{2\pi}{k}$$

$$40 = \frac{2\pi}{k}$$

$$k = \frac{2\pi}{40}$$

$$= \frac{\pi}{20}$$