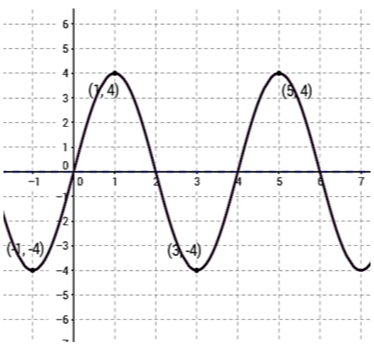
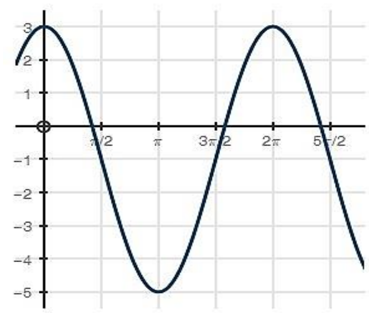
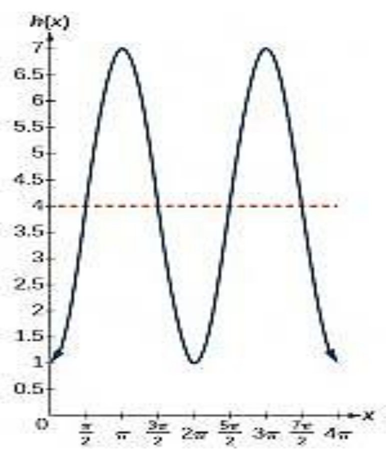
Math 229: Modeling with Sinusoidal Functions

$y = A\cos(B(t - t_0)) + D$ Cosine graphs begin at ___________________________ $y = A\sin(B(t - t_0)) + D$ Sine graphs begin on the _________________________	Steps: 1. Choose sine or cosine and **write down** the Standard Form of the function. This is your template! 2. Identify midline, y = D 3. Identify Amplitude: Amp = (Max – Min)/2 4. Identify Vertical Reflection and adjust the sign on A. 5. Identify period, T = time to go from peak to peak and solve for B: $B = \frac{2\pi}{T}$ 6. Identify a phase shift and set t_0 = initial value.

1. Find **an** equation of for each graph. (Note: There are infinitely many correct answers! Don't assume your function is not correct because it doesn't match the back of the book. **Check** by graphing your equation on Desmos!)

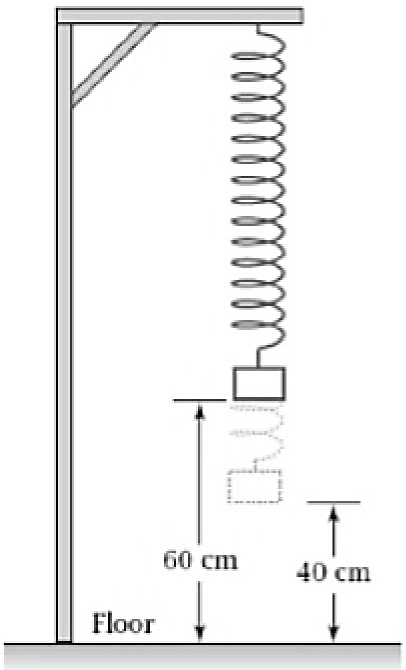






2. A weight attached to the end of a long spring that is bouncing up and down. As it bounces, its distance from the floor varies sinusoidally with time.
The lowest point of the weight is 40 cm above the floor and the highest point is 60 cm above the floor. The weight takes 1.0 seconds to go from its highest to lowest position. The weight is in its highest position at t = 0 seconds.

(a) Sketch a sinusoidal graph next to the picture of the weight, showing its height above the floor as a function of time.



(b) Find the amplitude, period, and midline of this function.

(c) Write a **cosine** function to model the height of the weight <u>above the floor</u>.

(d) Where is the weight 2.5 seconds after it starts bouncing?

(e) At what times will be weight be at a height of 50 cm? Relate this to the graph.

3. Some animal populations vary periodically with time. Suppose the population of elk at Fort Hunter Liggett was 1400 in 2006, then dropped to 1200 in 2009, then rebounded to 1400 by 2012, grew to 1600 by 2015 then was found to be in decline again.

(a) Sketch a sinusoidal graph that shows the elk population over time. Use set $t = 0$ at the year 2006.

(b) Find the amplitude, period, and midline.

(c) Write a sine function to model the population of elk over time.

(d) Predict what the population will be in 2020.