8A.3: Springing Sinusoids

Sine functions are the function of choice when we want to create a mathematical model for an event that is recurring or oscillating like a stretching spring. In this activity, we will use a Calculator Based Lab (CBL) unit and your graphing calculator to collect data and model the height of a bouncing spring over time.

Experiment Time:

Collect Data

1. Attach the spring to the desk or stand. Adjust the length of the spring so the weight will not hit the sensor
2. Turn on your TI-83/84 and go to [APPS] → [CBL/CBR] → [2:DATA LOGGER].
3. Choose DataLogger and press [ENTER]
4. Choose [Sonic] for the sensor and enter 30 for the sample number at an interval of .001 seconds each.
5. Extend the spring to the sensor and hold it on the sensor.
6. Choose [Go] from the menu. When the sensor starts clicking, release the spring. If you don't get a fairly consistent graph, try it again.
7. Hit [2nd] [Quit] twice to get out of the Application.

Analyze Data

8. Return to the [Graph] and hit [TRACE]. Find a middle portion of the graph that contains 2 or 3 periods that are almost identical. Find the coordinates $(time, height)$ for the first maximum and minimum on this portion of the graph.

   Maximum coordinates: _____

   Minimum coordinates: _____
9. Use these coordinates to calculate the amplitude, vertical shift, and period(the distance between the Max and Min is ½ of a period):

   Amplitude=

   Vertical Shift=

   Period=

10. Use this information to write a sine or cosine function to model the spring height. Graph your function in your calculator to verify that it approximates the middle of the data. Modify your function if it doesn't match well. Write your final function here:

    $h(t) =$