

Names: _____

With your partner(s), read through the instructions and do the activities described. Only one report should be submitted from each group. This report is due Monday.

1. An earthquake occurred at 9:40 A.M. on Nov. 1, 1755 at Lisbon Portugal, and started a *tsunami* (often called a tidal wave) in the ocean. It produced waves that traveled more than 540 ft/sec (370 mph) and reached a height of 60 ft. Assume that the crests of the waves hit the shore every thirty minutes.
 - (a) (Computation) Estimate the length between the crests of the waves. Round your answer to a reasonable degree of accuracy.

 - (b) (Explanation) Write a paragraph explaining your solution to a layperson. In particular, make sure you clearly explain the problem and the solution, describing any variables you introduce and including units. A picture would also probably be helpful. If you include a picture, you need to reference the picture in your written description and explain what you want the person to understand from the picture.

2. The function

$$P = 120 + 30 \sin(2\pi t)$$

models the blood pressure (in millimeters of mercury) for a person who has a (high) blood pressure of 150/90; t represents time in seconds.

(a) What is the period of the function? Interpret this in terms of blood pressure.

(b) How many heartbeats are there each minute?

(c) Graph this function (by hand) to model a ten second time interval. Mark and label the points on the graph that correspond to heartbeats. Make sure you label your axes and include units.

3. The table shows monthly normal mean temperatures for the last 30 years in Charleston, SC.

Month	Temperature
1	48
2	51
3	58
4	64
5	72
6	78
7	82
8	81
9	76
10	66
11	58
12	51

A scatter plot suggests that the mean monthly temperatures follow a sinusoidal curve over time:

$$y = a \sin(b(t - h)) + k$$

- (a) Given that the period is 12 months, find b .
- (b) Assuming that the high and low temperatures in the table determine the range of the sinusoidal, find a and k .
- (c) Find a value of h that will put the minimum at $t = 1$ and the maximum at $t = 7$.

- (d) Use *Mathematica* to graph your sinusoidal model along with a scatter plot of the data, and attach a print-off to your report. How good is the fit?
- (e) Use your sinusoidal model to predict dates in the year when the mean temperatures in Charleston will be 70° . (Assume that $t = 0$ represents January 1.)
- (f) Use the **FindFit** command in *Mathematica* to obtain a regression model. (See Regression Models on the course website for a refresher on using the **FindFit** command.) Record the formula for the model below.
- (g) Use *Mathematica* to graph the sinusoidal regression model along with a scatter plot of the data, and attach a print-off to your report. How good is the fit?
- (h) Use the sinusoidal regression model to predict dates in the year when the mean temperatures in Charleston will be 70° . (Again, assume that $t = 0$ represents January 1.)