Mathematical Modeling – MAT 506/606
Fall 2013
Homework 2

Due date: September 6, 2013 (*Be sure to turn in all your* **Excel** *sheets*).

1. *(6 points)* For each of the data sets below, determine if it is reasonable to assume that y is proportional to x. If it is, approximate the constant of proportionality. If it is not, describe why this assumption is not reasonable.

(a)

x	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7
y	1	1.21	1.44	1.69	1.96	2.25	2.56	2.89

(b)

x	1	5	7	2	10	12	3	6
y	0.79	10.89	14.37	5.75	23.36	26.29	3.76	16.12

(c)

x	2	6	9	15	7	25	39	4
y	26	20	18	26	6	19	20	13

2. *(4 points)* Suppose you drive your car on a perfectly flat road at a constant speed with no wind. In this case, the amount of fuel, y, (in gallons) needed is directly proportional to the distance traveled, x (in miles).

a. If the distance traveled increases, what can we say about the amount of fuel needed?

b. If the relationship is given by $y = 0.04x$ and x increases by 50 miles, how much does y increase?

c. Now, suppose it takes 12 gallons of fuel to travel 282 miles. Find the constant of proportionality.

d. In words, describe the meaning of this constant of proportionality.

3. *(2 points)* Prove each of the following properties of proportionality:

a. If $ab \propto ac$ and $a \neq 0$, then $b \propto c$.

b. If $a \propto c^m$, then $a^{1/m} \propto c$.

4. *(4 points)* [**Graduate**] A snow-cone seller at a county fair wants to model the number of cones he will sell, C, in terms of the daily attendance a, the temperature T, the price p, and the number of other food vendors n. He makes the following assumptions:

- C is directly proportional to a and the difference between T and 85^{o}F.
- C is inversely proportional to p and n.

Derive a model for C consistent with these assumptions. For what values of T is this model valid?

5. *(4 points)* [**Graduate**] Suppose a biologist records the number of pulses per second of the chirps of a cricket at different temperatures (in ^{o}F). The data collected is shown in Table 1.

Table 1:

Temperature	72	73	89	75	93	85	79	97	86	91
Pulses/sec	16	16.2	21.2	16.5	20	18	16.75	19.25	18.25	18.5

(a) Fit a straight line to this data (where temperature is on the x-axis). How well does the model fit the data?

(b) What is the slope of this line? What does the sign of the slope tell you about the relationship between pulses/sec and temperature?