MT 1800 – Calculus I
Worksheet 1.1c – Linear Models

Name _____ **Due Date _____** **40 points**

Purpose: In this worksheet, we study two different linear models.

Procedure: Work with your classmates to determine the linear models. You will use your models to make some predictions. This worksheet will be collected and graded. Each of you must turn in your own copy. Show all work and justify your conclusions.

Model I: An Exact Linear Relationship

Taxi Libre en vehículo de 2 puertas
Banderazo $ 5.80
Cada 250 mts. $ 0.78

www.flickr.com

http://blog.luxuryproperty.com/wp-content/uploads/2008/05/mexico-city-taxi.jpg

De acuerdo con estadísticas del gobierno del Distrito Federal, circulan diariamente por la ciudad un promedio de 80 mil unidades de taxis que dan 780 mil servicios.

It turns out that there is a linear relationship between the Cost, C , in pesos, of a trip in a green taxi cab in Mexico City, and the distance traveled. Let's find the model!

7. (2 pts) With a little help of some Spanish speaker, figure out how much it costs to flag a green taxi cab ☺. Hint: that is what is called a "Banderazo".

It costs _____ to flag a green taxi cab.

8. (2 pts) Don't let your Spanish translator go too far. Now you have to figure out what "Cada 250 mts. $0.78" means.

"Cada 250 mts. $0.78" means _____

9. (2 pts) How can we translate the information in 7 and 8 into information that we can use to construct a linear model? Describe in words.

Hint: y=mx+b is the point slope equation of a line!

10. (3 points) Find the linear model that tells you the Cost, C , in pesos, of a trip in a green taxi cab in Mexico City as a function of the distance traveled.

11. (6 pts) Using Your Models.

    a. The longest road in Mexico City is called Insurgentes and it is 60km long (60,000 meters). How much would it cost to travel the whole of Insurgentes from South to North?

    b. Suppose you are staying at a friend's in the south of Mexico City. If you take a cab to go to the Zocalo, and the meter says you have to pay $95.00, how far from your friend's house did you travel?

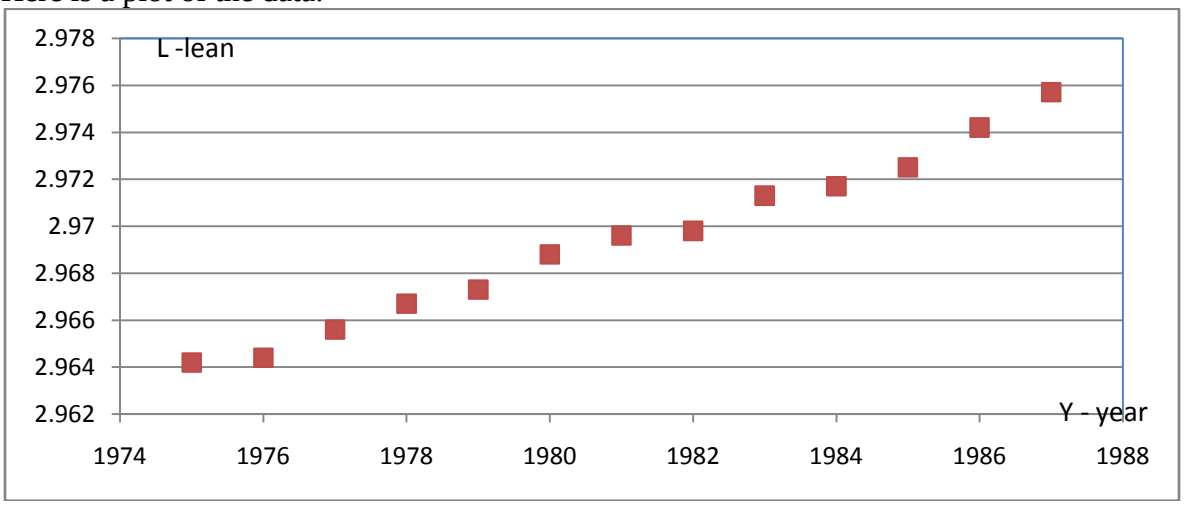
Model II: Fitting a Line to Data - Leaning Tower of Pisa

The Leaning Tower of Pisa is an architectural wonder. Engineers concerned about the tower's stability have done extensive studies of its increasing tilt. Measurements of the lean of the tower over time provide much useful information. The following table gives measurements for the years 1975 to 1987.
The variable "lean" represents the difference between where a point on the tower would be if the tower were straight and where it actually is. The lean is measured in meters.

Data

Year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Lean	2.9642	2.9644	2.9656	2.9667	2.9673	2.9688	2.9696	2.9698	2.9713	2.9717	2.9725	2.9742	2.9757

Here is a plot of the data:



2. (4 pts) Fitting a Line to the Data

Use a straight edge to fit a reasonable line to your graph. You can increase the accuracy of your linear model by trying to make certain that the data points are distributed equally above and below the line. Sketch your line on your scatter plot.

3. (9 pts) Finding a Linear Model to Fit the Data

Each of you should find the equation of your line. You may get slightly different answers in your group, but they should all be relatively similar. Your model will predict lean as a function of the year.

a. Independent variable is _____

b. Dependent variable is _____

c. Select two points on your line. It's a good idea to select points that are not too near each other.

point 1 = (_____, _____)

point 2 = (_____, _____)

d. Slope of your line (round answer to 5 places after decimal)

$$\frac{\Delta \text{ dependent variable}}{\Delta \text{ independent variable}} =$$

e. Use the information above to find the equation of the line that passes through your two selected points. Be sure to use the variables "Y" and "L". (SHOW YOUR WORK BELOW.)

$L(Y) =$ _____

4. (3 pts) Answer the following questions using your model (show work below each answer). Do not forget to specify units where needed.

a. In the year 1990 the lean of the tower will be: _____

b. What year was the lean of the tower 2.96 meters? _____

5. (5 pts) Practical Interpretations of the Slope and Vertical Intercept of Your Model

a. For each year, we can anticipate an associated increase/decrease (circle one) of _____ *meters* in the lean of the tower.

b. How does the value in part a. relate to the slope of the line?

c. Does the vertical intercept of your model have practical meaning? Explain.

d. Is there a year where the lean is zero? If so, find it. Does this have any practical meaning? Write a few sentences to explain what this says about your model.

6. (4 pts) Some Final Observations about Your Model.

   a. What is a reasonable domain for this function? Hint: You can use the internet to find out about the history of the tower.

      Reasonable domain: _____

   b. What is the resulting range for this function? _____

   c. Explain how you found your answers to parts a. and b. above.