MA 110 SECTION 1.3 LINEAR REGRESSION **HOMEWORK: 1, 7, 9, 13, 15, 23**

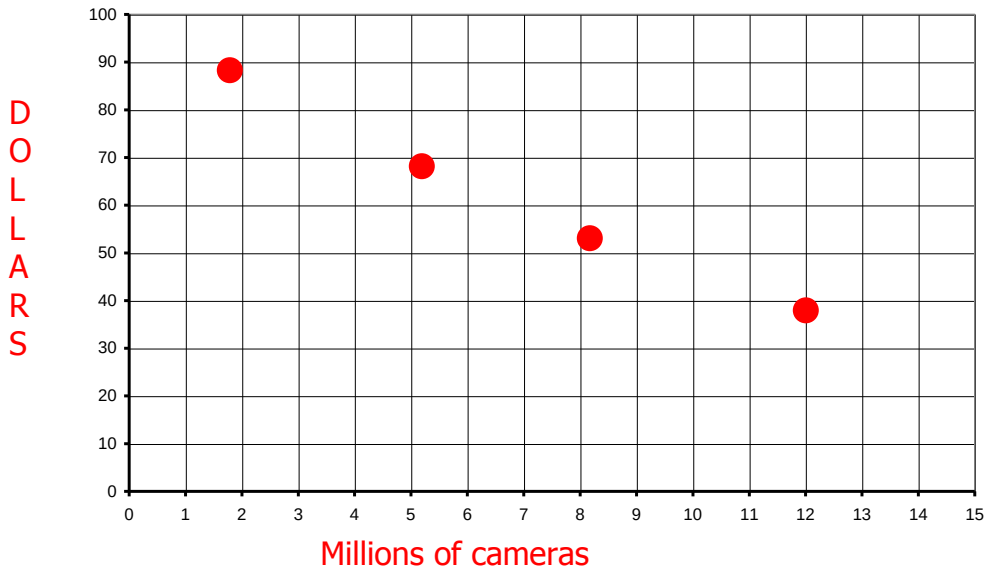
A **mathematical model** is a function used to estimate the behavior of a real-world problem. Some real-world situations can be modeled with a linear function. Two real-world variables say height of a tree and the diameter of a tree, can be **linearly related**. This means that as the diameter of the tree increases by one unit, the height of the tree increases by a constant amount. This **rate of change** is the slope of the linear model. **Regression analysis** is the process for finding a linear model for an appropriate set of data. This process is also called **curve fitting**. We will concentrate on **linear regression**.

EXAMPLE:

A manufacturer of a popular automatic camera wholesales the camera to retail outlets throughout the United States. Using statistical methods, the financial department in the company produced the price-demand data in the following table, where p is the wholesale price per camera at which x million cameras are sold.

X (Millions)	Price ($) per camera
2	87
5	68
8	53
12	37

A. Use the columns to form 4 ordered pairs and plot those points on the grid provided. You will estimate on the vertical axis.



B. You can plot this using your TI calculator. Use the following directions:

ENTER DATA

1. Press the STAT button
2. Choose the 1:Edit option
3. Columns labeled L_1, L_2, and L_3 should be visible. There are six lists L_1 through L_6. Choose a list in which to enter your data. If there is already data in the list, you can type over it – but it is better to clear the list. Use your arrow keys to highlight the label of the list that you want to clear. Press the CLEAR button followed by the down arrow button.
4. Type your first value in the first row and press enter, continue until your list is complete.

SCATTER PLOTS

1. You will have two lists of data that are paired for these types of plots. Enter your list in two separate locations by following the above directions.
2. After entering your data, press 2nd Y= (STATPLOT) and choose 1: Plot 1
3. Toggle the plot on (the ON will be "highlighted")
4. Choose the Type: ("highlight" the 1st little picture for a scatter plot)
5. Xlist should be set for L1 and Ylist should be set for L2 – if not arrow down to Xlist And type 2nd 1 & arrow down to Ylist and type 2nd 2. (Or you may use lists other than 1 and 2.)
6. Choose your mark – by "highlighting" the 1st mark
7. Now choose your window settings: press WINDOW and choose X_{min}, X_{max}, Y_{min}, Y_{max} appropriately from the data in your table or use Zoom 9.
8. Press GRAPH to see your scatter plot – you may want to clear or "turn-off" any functions your have entered in your Y= screen.

C. Find the equation (in y = mx + b form) for the line that has the best fit to the data plot. This line is called a regression line. The calculator will find it for us.

REGRESSION EQUATION

Press **STAT**, arrow to **CALC**, and select **4:LinReg(ax+b)**
Press 2nd **L_1 , 2nd L_2**
Press ENTER

Or if you want the equation stored automatically:
Press 2nd **L_1 , 2nd L_2 , VARS Y-VARS 1:Function 1:Y1**

Write your equation here: You can use 2 decimals places for a and b.

y = -4.96 x + 94.75

D. Look at the graph of the regression line and the data plot in the same window. Does it fit the data plot nicely?

E. Interpret the slope of your linear model in terms of the problem.

For each million cameras that the manufacturer wants to sell, they must decrease the price per camera by $4.96.

F. Use your regression line to estimate the demand if the cameras are priced at $75 each.

75 = -4.96 x + 94.75
4.96 x = 19.75 ➔ x = 3.98 3.98 million cameras

G. What should the price of the cameras be if the company wants the demand to be 15 million?

p = -4.96(15) + 94.75 = $20.35