Graphing Calculator
Graphing with the TI-89

I. Introduction

The TI-89 has fifty keys, many of which perform multiple functions when used in combination. Each key has a symbol printed on its face. When a key is pressed the calculator does whatever is printed on the face of the key. This is often referred to as the primary function of the key. For example, the primary function of the ON key is to turn the calculator on, the + key performs addition, and ∧ raises numbers to powers.

In addition to their primary functions many keys have second, or shifted functions. These are the symbols written in yellow, purple or green above the keys. To have the calculator do what is written in yellow you must first press the 2nd (yellow) key. For example, to turn the calculator off press the 2nd key and then the ON key. To perform functions written in green you must press the ◆ (green) key. To type letters into the calculator you must first press the **alpha** (purple) key.

II. Plotting Points in a Scattergram

We can use the calculator to create a scattergram of the data displayed in the table at right. As you follow the steps below, compare the screen on your calculator to the screenshots to the right.

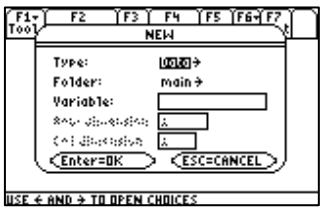
x	*y*
2	25
5	28
8	58
11	130

START HERE … if you have never plotted a scattergram with this calculator. Otherwise, skip to page 2.

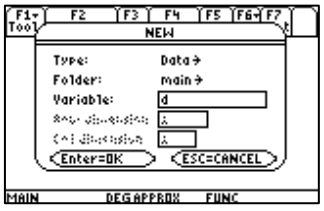
To set up the data screen, first press the **APPS** key. Your calculator window should look like the picture at the right.

Press **6** (**Data/Matrix Editor**). We will use the Data window to enter the table values.

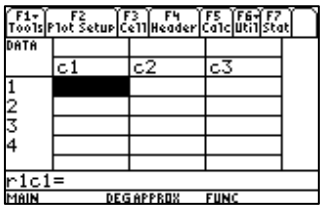
Since this is the first time plotting a scattergram, a new data file must be created. Press **3** (**New**).



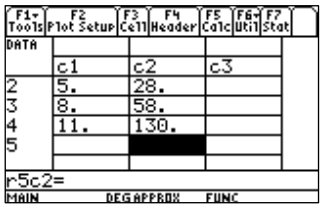
Press the right arrow key, ▶, then type **1** (**Data**). Press ▼, then ▼ and in the box next to Variable type alpha then an arbitrary letter. We chose the letter d in this example, but you may enter any alpha character or string of characters here. Press ENTER twice, **ENTER**, **ENTER**.



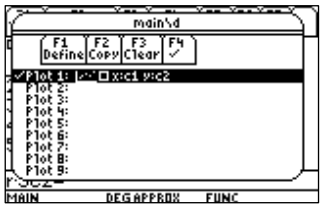
START HERE … if you **have** plotted a scattergram with this calculator before. Press **APPS**, then **6** (**Data/Matrix Editor**), then **1** (**Current**) to get the data window as shown on the right.
If you have any numbers (data) in the columns you may clear them out by pressing ▶ or ◀ to place the cursor in the column you want to clear, then press **2nd**, **F6** (F1), then 5 (**Clear Column**).



To enter the new data: Enter the *x* values from the table in column 1 (c1). Press **ENTER** after each entry.
Press ▶, ◆, and ▲ to position the cursor at the top of column 2 (c2).
Enter the y values in column 2, pressing **ENTER** after each entry.

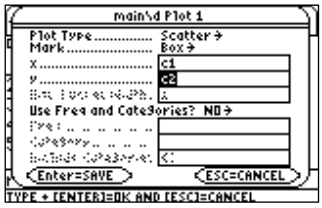


To prepare the calculator to plot the data points, press **F2** (**Plot Setup**).

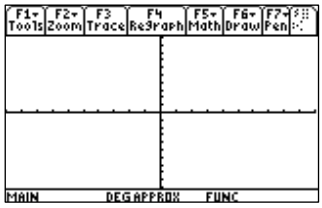


Press **F1** (**Define**)

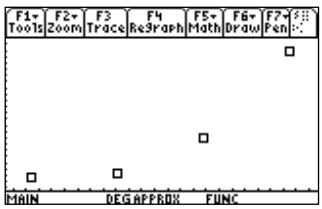
Press the following sequence of keys to select the type of graph, **scatter**, the type of marks used, **box**, and to label the *x*-column as **c**1 and the *y*-column as **c**2. Press , **1** (**Scatter**), . . **1**(**Box**), . **alpha c1**, . **alpha c2**, then enter twice **ENTER**, **ENTER**.



Finally, to see the scattergram, press ◆, then **F3** (**GRAPH**). The window needs to be adjusted to see the scattergram.

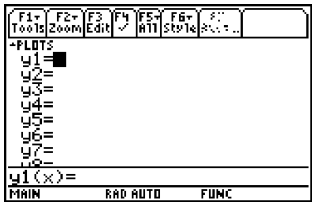


To adjust the window, press **F2** (**Zoom**), then **9** (**ZoomData**). ZoomData automatically adjusts the calculator window so that all the points in the scattergram are visible.

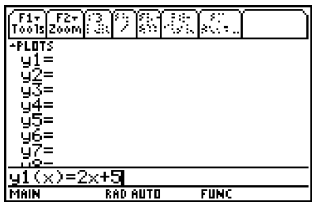


III. Entering an equation

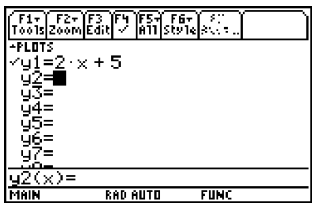
Start by pressing ◆, then **Y=** (F1). The rectangle next to **y1=** is called the cursor. The cursor indicates where characters will appear when a key is pressed. If there are expressions next to any of the **y=**, use the ▼ or ▲ key to move the cursor to the line containing the expression and press **CLEAR** to remove the equations.



Now with the cursor at **y1=** enter **2*x* + 5**. Use the **X** key to enter the variable ***x***. What you type in will appear in the entry line at the bottom of the screen.

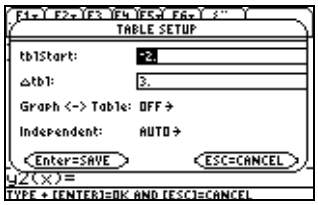


Press **ENTER**. Notice the equation is placed next to **y1=** at the top of the screen.

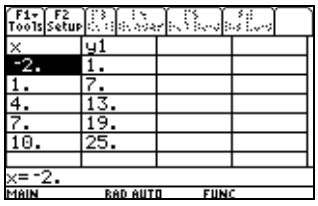


IV. Displaying Values in a Table

Press ◆ then **TblSet** (F4). **TblStart** is the first input value in the table and **ΔTbl** is the increment for the input values. Enter –2 for **TblStart** (be sure to use the (–) key) then use the ▼ to move into the **ΔTbl** field. Enter 3 for **ΔTbl** and press **ENTER**.

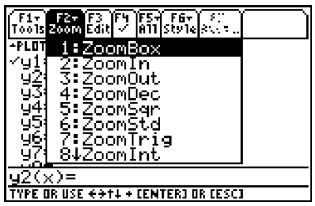


Press ◆ then **TABLE** (F5) to display the table. Notice that the *x* values start at –2 and increase by an increment of 3. These are the instructions that you gave the calculator in the previous window. You can scroll up or down the table using ▲ or ▼.

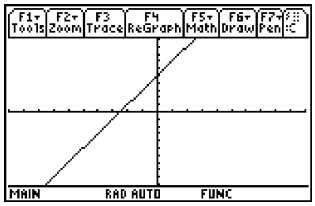


V. Graphing an Equation

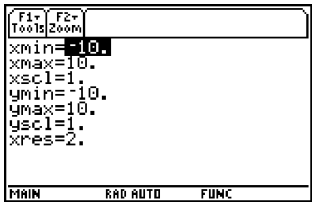
Open the pull-down **Zoom** menu by pressing **F2**.



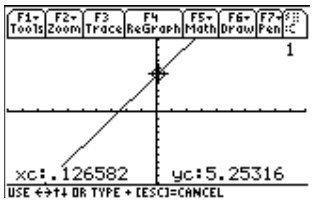
Press **6** to select **ZoomStd**. You should get the graph of $y = 2x + 5$. The ZoomStd command tells the calculator to graph the equation in the standard screen.



The standard screen includes the *x*-axis from –10 to +10, and the *y*-axis from –10 to +10. Verify this by pressing **WINDOW** (◆,F2). xscl=1 means the *x*-axis is scaled so that each mark represents one unit. Notice the *y*-axis is also scaled with one mark representing one unit. **xres=2** is the resolution setting and should usually be left at 2.

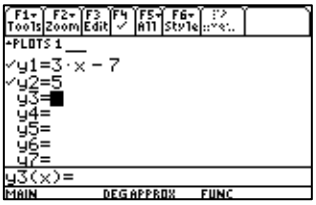


Return to the graph by pressing ◆, then **GRAPH** (F3). Press **Trace** (F3). The calculator places the cursor on the graph of the line $y = 2x + 5$. Move the cursor along the line by pressing ◀ or ▶. Notice at the bottom of the screen the coordinates of the cursor are indicated by **xc:** and **yc:.**

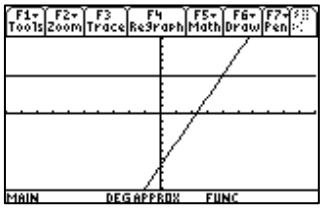


VI. Using "Intersect" to Solve an Equation.

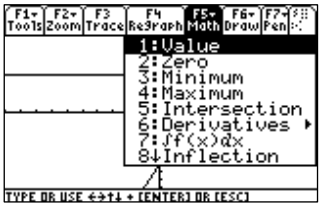
We can use the "Intersect" feature on the calculator to solve the equation $3x - 7 = 5$. In the Y= screen (◆, Y=), enter the equations $y1 = 3x - 7$ and $y2 = 5$.



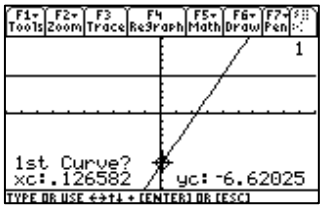
Press ◆ then **GRAPH** (F3) to see the graph. Notice the graph of $y1$ is a straight line with a slope of 3, and $y2$ is a horizontal line.



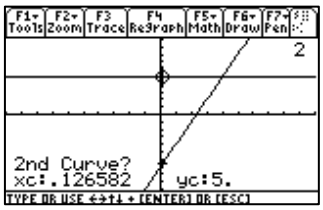
To find the point of intersection of the two lines, press Math (F5).



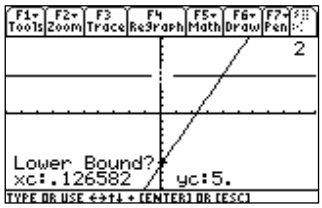
We are looking for a point of intersection, so press **Intersection** (5).



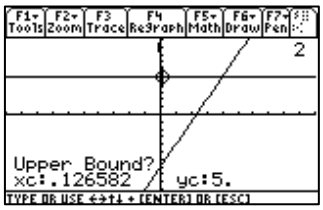
The cursor appears on one of the graphs. The calculator prompts you to tell it which two graphs (curves) you are finding the intersection of. Notice the prompt "1st Curve?". Press **ENTER** to indicate that the cursor is on one of the curves. The cursor jumps to the other graph and prompts you with "2nd Curve?".



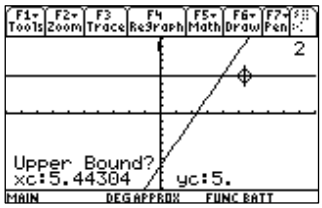
Press **ENTER** to indicate that the cursor is on the other curve. Now the prompt is "Lower Bound". The calculator needs to know some left and right-hand boundaries to search between, starting with the left, or "Lower Bound".



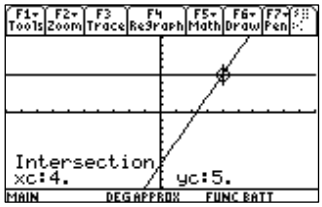
Use ◀ to move the cursor to a point on the graph somewhere to the left of the point of intersection, and then press **ENTER**. If the cursor is already to the left of the point of intersection, just press **ENTER**. The new prompt is "Upper Bound".



Use ▶ to move the cursor to the right of the point of intersection.



Press **ENTER**. The cursor jumps to the point of intersection and displays the coordinates of the point as **xc:** and **yc:**.

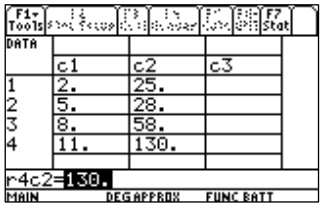


VII Linear Regression

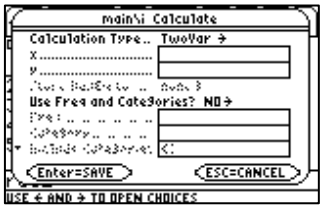
Using the data in the table at the right, we'll use the calculator's linear regression feature to find a linear equation that best fits the data. First, we need to enter the data into the stat lists. If you need to refresh your memory on how this is done, go to section II of this supplement and follow the first seven steps of "Plotting Points in a Scattergram".

x	*y*
2	25
5	28
8	58
11	130

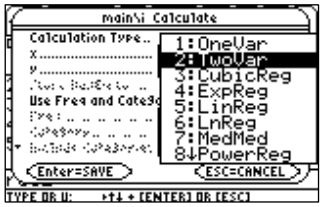
When the data has been correctly entered your screen should look like the picture at the right.



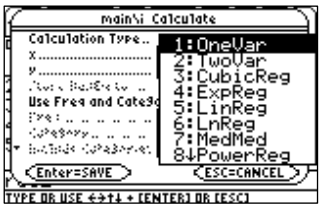
To perform the linear regression function, first press **CALC**(2nd, F5).



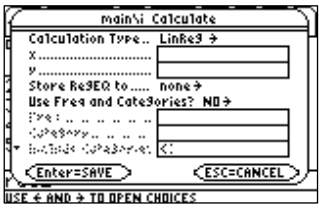
We want to perform a calculation on the data, so press the right arrow ▶.



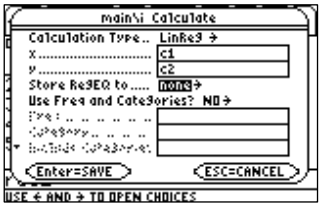
Select **LinReg** (5) to perform a linear regression. Note there are other types of regression besides linear. In this window the options include quadratic regression (QuadReg (9)) and exponential regression (ExpReg (4)) among others.



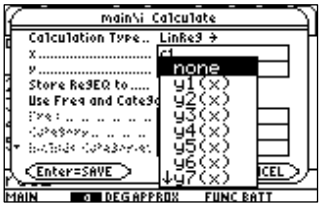
In the box next to x…… type **alpha**, **C1,** ▼, and then, in the box next to y…… type **alpha**, **C2,** ▼.



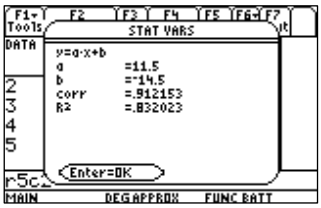
When we perform the regression, the equation is stored as a statistics variable named RegEQ. To see the graph of the equation we store the equation in y1(x). Press right arrow ▶.



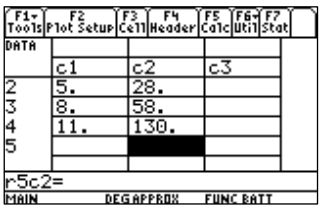
Press down arrow ▼, then **ENTER** to select y1(x).



Press **ENTER** to save and to see the regression equation information. This output describes a linear equation with slope 11.5 and *y*-intercent -14.5, so the equation is $y = 11.5x - 14.5$. We are not going to use *corr* or R^2 for our purposes.

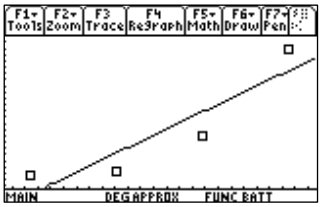


Press **ENTER**. This takes you back to the data window.



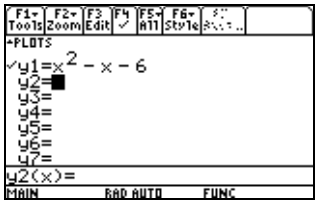
To graph the regression equation along with the scattergram, first plot the scattergram by turning on the plot in Plot Setup. If you need to refresh your memory on these steps, go to section II, "Plotting Points in a Scattergram", and read steps 8 through 12.

Press ◆, then **GRAPH** (F3). If you don't see all of your points in the scattergram, press **Zoom** (F2), then **ZoomData** (9).

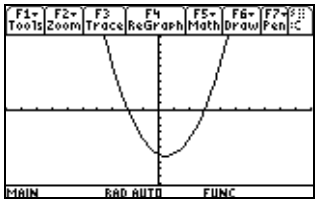


VIII. Finding the *x*-intercepts of a graph

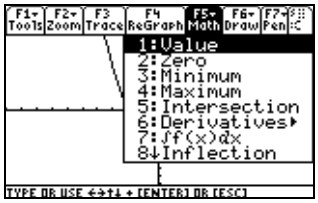
Clear the previous equations and enter the equation $y = x^2 - x - 6$.



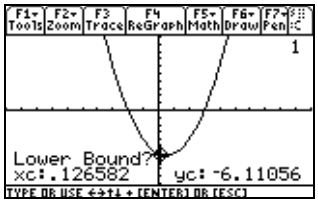
Graph the equation. Be sure the window is set so that you can see all of the *x*-intercepts. In this example use the standard window.



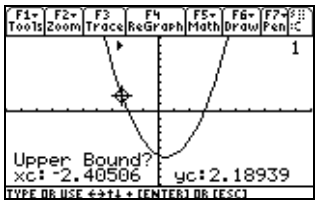
Press **F5**. The menu under MATH has several options. We are looking for the zero values so press **2**.



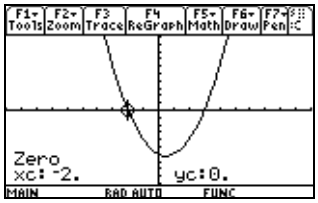
The calculator will only look for one *x*-intercept at a time and it will only look for one within a range of *x* values that you must specify. **Lower Bound?** on the screen is a prompt for you to enter the smallest *x* value in the range.



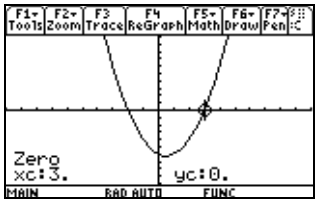
Use ◀ to move the cursor to the left of the leftmost *x*-intercept and press **ENTER**. The right-pointing black triangle on the screen indicates the smallest *x* value the calculator will consider in looking for an *x*-intercept. **Upper Bound?** on the screen is a prompt for you to enter the largest *x* value in the range.



Use ▶ to move the cursor to the right of the leftmost *x*-intercept and press **ENTER**. You should have placed the lower and upper bounds to that there is one and only one *x*-intercept between the triangles horizontally. The cursor is on the *x*-intercept and its coordinates are listed at the bottom of the screen: (–2,0).



Repeat the procedure to find the other *x*-intercept.



IX. Problems for Practice

Use a calculator to make a scattergram of each of the following data tables.

1.

x	y
1	7
7	50
15	101
25	190

2.

x	y
2	25
5	28
8	58
11	130

Use a calculator to make a table of values for the following equations. Use **TblStart = –2** and **ΔTbl = 3**

3. $y = 3x + 2$

4. $y = \frac{2}{3}x + 4$

Use a calculator to draw the graphs of the following equations.

5. $y = 3(2 - x)$

6. $y = 5 + 2(x - 1)$

7. Use the "Intersect feature to solve the equation; $2x - 3 = 4$

8. Find the point of intersection of the graphs of $y = 5(x + 1)$ and $y = -2(x + 3)$

9. Use linear regression to find a model of best fit (equation) for each of the tables. Graph the regression model and the scattergram in the same window. Round decimals to two places.

a)

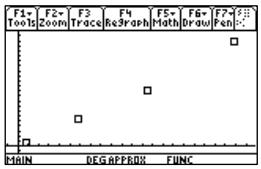
x	y
1	7
7	50
15	101
25	190

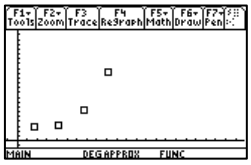
b)

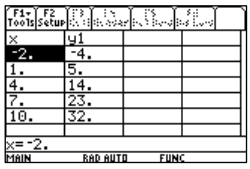
x	y
2	25
5	28
8	58
11	130

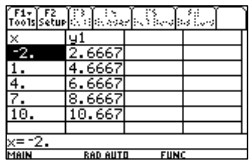
10. Find the *x*-intercepts of $y = x^2 + 3.9x - 2.7$

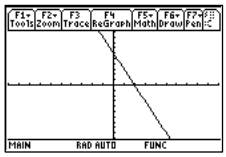
Answers: (standard window)

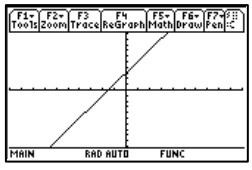
1. 

2. 

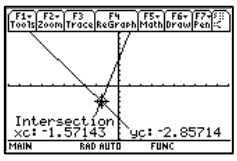
3. 

4. 

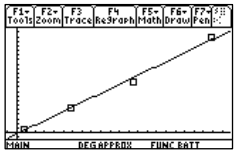
5. 

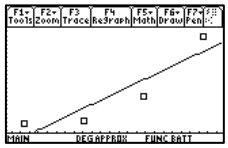
6. 

7. $x = 3.5,\ y = 4$

8. 

9. a) $y = 7.55x - 3.59$ b) $y = 11.5x - 14.5$





10.