Analyzing the data using your TI calculator

You can use your TI 83/84/85 to analyze data from experiments.

These instructions will mention the key to type. If this key is a "second function" key, the keystroke will be in square brackets and requires you to press the [2nd] *key first, e.g. to get,*[INS] *type* [2nd] [DEL].

1. Get in the right mode. Press [MODE] [▼] [▼] [▼] then select FUNC for the graphing mode.
2. Note: This is also where you can change to DEGREE mode if you don't get 1.0 for `sin(90)`.

Data is stored in lists

Experimental data is stored in `Lists`. These are numbered L1, L2, up through L6. You can see the data in lists by using the [STAT] `1Edit...` key sequence. This will display a screen similar to **Figure 1**

To access enter the lists in formulas, use the [2nd] [1] key sequence.

Filling a list using a formula that includes another list

In some cases you will want to make calculations that include data already in a list (in this example, the difference between the each data point)

1. Type [2nd] [STAT] to get [LIST]
2. [▶] to get to OPS menu (for OPERATIONS)
3. Press 7 for `▵List(`
4. The display will show `▵List(`
5. Type [2nd] 2 *--for the list you want the differences of--*) [STO▶] [2nd] *--then* 3 *for the list to store in--* [ENTER].

Storing data in a list

1. **You will usually want to clear the lists in your calculator.**
   a. Press [STAT] **5** then [ENTER]
   b. Press [STAT] **1** from the STAT EDIT menu. This will display the first three lists (L1, L2, and L3) on the screen. If any of them are not blank and you want to clear them, use the [▲] and [▶] arrows to highlight the title of a list. Then press [CLEAR] [ENTER] to clear that list. Press [2nd] [MODE] to [QUIT].
2. **Decide which list will contain your data, then enter your data:**
   a. [STAT] **1** to get the List editing display.
   b. If needed, use the arrow navigation keys to get to the first entry line in the list number you want: L1, L2, etc.
   c. After entering each number, press the [ENTER] key to move to the next entry line for that list.

Example Lists numbers can be changed.

The example lists can be changed if you desire. In general, these instructions assume on set of experimental data, with time stored in List1 *and the observed/recorded data stored in* List2.

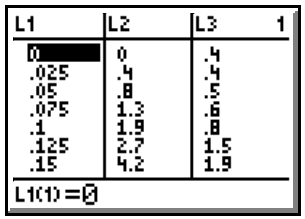

Figure 1

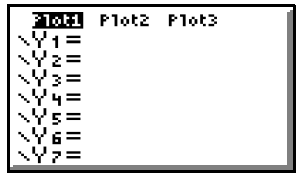

Figure 2

Filling a list using a formula

1. Type [2nd] [STAT] to get [LIST]
2. [▶] to get to OPS menu (for OPERATIONS)
3. Press **5** for `seq(`
4. The display will show `seq(`
5. Key in the following (with commas between them): *your expression* (function), *the variable your function uses* (usually x), *the starting value of the variable, the ending value of the variable, the amount to increment the variable --usually 1--*) [STO▶] [2nd] [1] **--1** to get [L1]-- [ENTER].
   a. *This example creates a sequence of numbers that follow the pattern described by your expression. There are other keys in Step 3 that will process other operations.*
6. The screen will display the results of the first few calculations.
   a. If you get an error message, select GOTO and check your formula in step 5 above.
   b. See **Figure 4** for a sample sequence and its results.

Other formulas:

1. You can also type [2nd] 1 *--then the List you want to calculate from--* **x** **2** *--or any other formula--* [STO▶] [2nd] 2 *--the list you want to store into--* [ENTER].
   a. *This example takes the List1 values, multiplies them by 2, and stores the results in List2.*

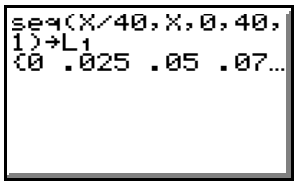

Figure 4

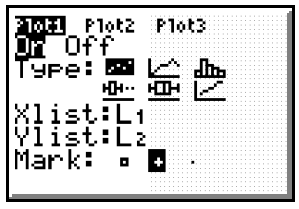

Figure 3

Graphing two lists

1. To graph two lists, they must contain the same number of data points. Scroll to the bottom of your lists, and if one has more data points than the other, delete any extras using the [DEL] key until you see the _ _ _ at the end of each list
2. Clear the graphs:
   a. Press [Y=] to display the Y= editor.
   b. If there are any functions (equations) listed, clear them by using the [CLEAR] key (see **Figure 2**).
3. If Plot2 or Plot3 are selected (dark highlighting) in the top row, use the [▲] and [▶] navigation keys to move to them, then the [ENTER] key to deselect them. When you move down out of the top row, only Plot1 should be highlighted.
4. Back in Plot1, select [2nd] [STAT PLOT] 1. (See **Figure 3**)
5. The first two rows in settings for Plot1 should be: On , and ⌐··· . The last row should be +.
6. In the x-axis we want time, in Xlist: press [2nd] [L1] (*or another list number*).
7. In the y-axis we want distance, so in Ylist: press [2nd] [L2] (*or another list number*).
8. Press [ZOOM] 9 to select 9:ZoomStat. Your calculator should now show a graph zoomed in on the area that contains your data.

Fitting an equation to your data.

1. Press [STAT] [▶] to open the CALC menu.
2. Select your "regression" type:
   a. If your graph looks like a linear relationship, select 4:LinReg(ax+b)
   b. If your graph looks like half a parabola, select 5:QuadReg.
3. The regression type you selected above will display on the screen.
4. Press [2nd] [L1] [,] [2nd] [L2] [,] [VARS] [▶] 1 to display the VARS Y-VARS FUNCTION secondary menu, then press 1 to select Y1.
   a. The screen should display one of the functions below:
5. Press [ENTER] and your results should show up in one of the formats below:
6. Visually check how well your data fits your equation.
7. Press [GRAPH] to show your equation on the graph of your data (it may take a few seconds to add the equation's line to the graph).
8. Are you still satisfied with your choice of regression type? If not, go back and try the other to see if it is a better visual fit.

Plotting Residuals

Plot a graph of the difference (absolute value) between your data and the equation's data.

The difference between your "y" data and the equation's "y" data for any given "x" point is called the "residual" at that point. Plotting residuals can help you to see if the differences are "random" (some positive, some negative, no visible pattern) or if there is a pattern. A pattern suggests that the equation may not be in the correct format (e.g. you plotted a linear equation and a quadratic equation would fit better).

1. Create a column to put the calculated residuals in.
   a. Press [STAT] 1 to display the lists. Move the curser to the right and up into the header for L3.
   b. Press [2nd] [INS] to insert a new column between L2 and L3. The Name= prompt appears in the bottom entry line, and caps lock is activated. Type R E S I D (for residual) using the letter keys, then press [ENTER].
2. Press [▼] repeatedly to examine the residuals. If you see any patterns, record it in your lab book.
3. Press [2nd] [STAT PLOT] 2 to get the Stat Plots editor.