

Calculator Guide

To Enter a List

1. Turn on calculator
2. Press **STAT** choose **EDIT**
3. Enter numbers into list of your choice, press **ENTER** after each number.

***To clear a list:** Arrow up to the list name, press **CLEAR** then **ENTER**

To graph a scatter plot

1. Enter two lists
2. Press **2nd Y=** (Stat Plot)
3. Choose a plot, make sure all other are off unless you are plotting two plots.
4. Turn on the plot by pressing **ENTER**
5. Down arrow to type, right arrow to $\square \cdot \cdot \cdot$, press **ENTER**
6. Down arrow to Xlist, type in the appropriate list (**2nd 1** for L1)
7. Down arrow to YList, type in the appropriate list (**2nd 2** for L2)
8. Down arrow to Mark and choose an appropriate mark by scrolling onto it a pressing **ENTER**
9. Press **WINDOW**, set an appropriate window for your lists of numbers.
10. Press **Graph**
11. To trace around in the graph, press **TRACE** and use the right and left arrows.

ERRORS you might see:

DIM MISMATCH - Your lists are not the same length. On a scatter plot the two lists must be equal in length.

To order a list

1. Enter the list
2. Press **STAT** choose **SORTA** (for ascending) or **SORTD** (for descending) type list number.
3. Press **ENTER**

***To choose and item, press the number that corresponds to that item.**

To get statistics

1. Enter a list
2. Press **STAT**, right arrow to **CALC**, choose **1-Var Stats**
3. Type in list number (i.e. List 1 is **2nd 1**, etc.)
4. Press **ENTER**
5. You get: \bar{x} = mean

$\sum x$ = sum of all the data

$\sum x^2$ = sum of the squares of the data

Sx = sample standard deviation

σx = population standard deviation

n = the number of numbers in the list

minX = the minimum number in the list

Q1 = the first quartile (25th percentile)


Med = median (50th percentile)

Q3 = the third quartile (75th percentile)


MaxX = the maximum number in the list

} 5 number summary

To graph a histogram

1. Enter a list
2. Press **2nd Y=** (Stat Plot)
3. Choose a plot, make sure all other are off unless you are plotting two plots.
4. Turn on the plot by pressing **ENTER**
5. Down arrow to type, right arrow to , press **ENTER**
6. Down arrow to Xlist, type in the appropriate list (**2nd 1** for L1)
7. Down arrow to Freq, type in an appropriate list number or a 1 depending on how the frequency is measured (to type in 1 you must press the **ALPHA** key to turn off alpha lock, then press 1)
8. Press **WINDOW**, set an appropriate window for your list of numbers.
9. Press **Graph**
10. To trace around in the graph, press **TRACE** and use the right and left arrows.

To graph a box and whisker plot

1. Enter a list
2. Press **2nd Y=** (Stat Plot)
3. Choose a plot, make sure all other are off unless you are plotting two plots.
4. Turn on the plot by pressing **ENTER**
5. Down arrow to type, right arrow to , press **ENTER**
6. Down arrow to Xlist, type in the appropriate list (**2nd 1** for L1)
7. Down arrow to Freq, type in a 1 (to type in 1 you must press the **ALPHA** key to turn off alpha lock, then press 1)
8. Press **WINDOW**, set an appropriate window for your list of numbers.
9. Press **Graph**
10. To trace around in the graph, press **TRACE** and use the right and left arrows. This trace gives the five number summary.

Other

Press **2nd STAT** to get to **LIST**, right arrow to **MATH**. There are many commands in here you might find useful. For example, if you want the sum of a list you could choose **sum**(then type in the list number followed by a) then press ENTER. The mean, median and standard deviation can be done this way as well.

Commands: Sum(put a list number or a sequence command in here) - this adds a list
 Seq(expression, variable, start, stop, step) - this gives a list of numbers
 Prod(put a list number or a sequence command in here) - this multiplies a list
 mean(put a list number in here) - this gives the mean of a list
 median(put a list number in here) - this gives the median of a list

To solve an equation using a table.

Suppose I want to solve the equation $2x^2 + 3x - 7 = x^3 - 4x^2 + 2x + 3$ using a table. This equation has three solutions, we will find one of them.

First, put the left side of the equation in as Y_1 and the right side in as Y_2 . So you have $Y_1 = 2x^2 + 3x - 7$ and $Y_2 = x^3 - 4x^2 + 2x + 3$.

Go to TBLSET (2nd WINDOW) and make TblStart = 0 and $\Delta Tbl = 1$. Now look at the table (press TABLE (2nd GRAPH)). You should see

X	Y_1	Y_2
0	-7	3
1	-2	2
2	7	-1
3	20	0
4	37	11
5	58	38
6	83	87

X=0

Can you see that one solution to the equation falls between $x = 1$ and $x = 2$ because the Y_1 and Y_2 trade places (one is larger, then the other is larger) between $x = 1$ and $x = 2$?

So now we go back to the TBLSET and set TblStart to equal the smallest of the two x values and we set ΔTbl to one-tenth of what it was. TblStart = 1 and $\Delta Tbl = 0.1$. Look at the table and you should see:

X	Y_1	Y_2
1	-2	2
1.1	-1.28	1.691
1.2	-.52	1.368
1.3	.28	1.037
1.4	1.12	.704
1.5	2	.375
1.6	2.92	.056

X=1

Can you see that one solution to the equation falls between $x = 1.3$ and $x = 1.4$ because the Y_1 and Y_2 trade places (one is larger, then the other is larger) between $x = 1.3$ and $x = 1.4$?

So now we go back to the TBLSET and set TblStart to equal the smallest of the two x values and we set ΔTbl to one-tenth of what it was. TblStart = 1.3 and $\Delta Tbl = 0.01$. Look at the table, this time you can't see where they change places. Scroll down until you find where the Y's change places. Do you see that it is between 1.36 and 1.37?

Continue resetting TblStart and ΔTbl until you get the desired accuracy. When comparing Y values, make sure you scroll on top of them to see the true value at the bottom of your screen.

The solution to the nearest ten-thousandth is $x = 1.3649$.

To solve an equation using a graph and the intersect command.

Suppose I want to solve the equation $2x^2 + 3x - 7 = x^3 - 4x^2 + 2x + 3$ using a graph. This equation has three solutions, we will find all of them.

First, put the left side of the equation in as Y_1 and the right side in as Y_2 . So you have $Y_1 = 2x^2 + 3x - 7$ and $Y_2 = x^3 - 4x^2 + 2x + 3$.

Now, get a good graph of this. Start with a standard window (ZOOM 6) and adjust it.

I can see two of the three solutions in the standard window.

I will adjust as follows. $X_{\min} = -3$, $X_{\max} = 8$, $X_{\text{scl}} = 1$, $Y_{\min} = -30$, $Y_{\max} = 100$, $Y_{\text{scl}} = 10$. I can now see all three solutions.

Each solution is found the same way and each is done separately.

To find any solution, press CALC (2nd TRACE) and choose intersect (#5).

Now the calculator will ask for three things.

First it asks, First curve? It is asking you if the curve it is showing is one of the curves you want. If the answer is yes, press ENTER.

Next it asks, Second curve? It has chosen another curve and wants to know if this is the other curve you want. If the answer is yes, press ENTER.

Finally, it asks, Guess? This time it wants you to scroll to the specific intersection you want solved. Scroll clear back to the left most one, you can barely see it above the word Guess. When you get there, press ENTER. You get the point $x = -1.24581$ and $y = -7.633344$. This tells us that when $x = -1.24581$, $Y_1 = Y_2$.

Now, follow this same procedure to find the other two solutions to this equation.

You will get $x = 1.3649111$ and $x = 5.8808991$.

Equation Solver

Your calculator has an equation solver built into it. It is in the MATH menu on the TI82 and in the catalog on the TI83. Your calculator can only solve equations that equal zero. If your equation does not equal zero, manipulate it until it does. Remember, do the same things to both sides to get one side to equal zero.

When you choose SOLVE from the MATH menu or catalog your screen shows SOLVE(

You must fill in the parentheses. To fill in the parentheses type in the expression followed by a comma, followed by the variable to solve for, followed by a comma, followed by a guess, followed by the right parenthesis. **SOLVE(expression,variable,guess)**

EXAMPLE 1

Solve the equation $1000x^2 + 34000x = 100,000,000$

Get one side equal to zero: $1000x^2 + 34000x - 100,000,000 = 0$

This equation has 2 solutions. We will look for a positive solution first, so we will use a guess of 5.

Press MATH and choose 0 (for SOLVE) on the TI82 or press 2nd 0 (for catalog) then LN (for S) then down arrow until you are at Solve, then press ENTER.

Then type in $1000x^2 + 34000x - 100000000, X, 5)$ ENTER.

We get a solution of $x = 299.68$.

If we want the other solution, we type this in again with a guess of -10. The easy way to do this is to press 2nd ENTER and scroll back and make changes.

It turns out that we get the same solution again, that means our guess is not good enough, so do it again with a guess of -100. We get a second solution of $x = -333.68$.

EXAMPLE 2

Suppose we want to solve the equation $2x^2 + 3x - 7 = x^3 - 4x^2 + 2x + 3$. This equation has three solutions, we will find all of them. First, put the left side of the equation in as Y_1 and the right side in as Y_2 . So you have $Y_1 = 2x^2 + 3x - 7$ and $Y_2 = x^3 - 4x^2 + 2x + 3$.

Type in Solve($Y_1 - Y_2, X, 5$) ENTER. (The Y_1 and Y_2 come from the Y-Vars menu. On the TI82 you type 2nd VARS, then choose function then the Y, on the TI83 you type in VARS go right to Y-VARS, choose function, then the Y.)

We get $x = 5.88089912$ which is one of the solutions. We still have two solutions to find. Type in Solve($Y_1 - Y_2, X, -10$) and we get $x = -1.245810243$. The third solution is tricky to find, we really need to know if it is between the two solutions we have, or beyond them. From our previous work, we know the remaining solution is between the two we have so try Solve($Y_1 - Y_2, X, 0$). This time we get $x = 1.364911123$, and we have found all three solutions. Compare these three solutions to those found with the intersect command. Why the difference?

ERRORS you might see:

Bad Guess - It is exactly that, the only problem is your guess. Try another guess.

No sign chng - This generally means that there is no solution to the equation. If you are sure of a solution, check that everything is typed in correctly and try again. This has nothing to do with your guess.

ARGUMENT - You have not put in all three parts. In side the parentheses you must put an expression followed by a comma followed by x followed by a comma followed by a guess.

To set a window to match data from a list

1. Determine scale (SCL). If the list has an easy to count by finite difference, use that for the scale, unless there will be too many tick marks if you do so.

To calculate a scale follow these steps:

- a) Maximum Value from the list - Minimum value from the list
 - b) Divide the difference in part a by 10.
 - c) Round the answer to b to an *easy to count by number*. Easy to count by numbers include {1, 2, 5, 10, 25, 50, 100, 200, 500, 1000, etc.}.
2. Calculate MIN. MIN = the largest multiple of scale that is less than the smallest number in the list. Sometimes you will need the next multiple because the largest is too close to the smallest number in the list.
 3. Calculate the MAX. MAX = the smallest multiple of scale that is larger than the largest number in the list. Sometimes you will need the next multiple because the smallest is too close to the largest number in the list.

To set a window to match a function from a problem situation

First identify what the domain (set of inputs) represents. What numbers are reasonable and what do you want to look at? For example, if the problem situation represents the salary of a job after a specific number of years working for a company then the input represents numbers of years worked for a company. Negative numbers are not reasonable. We probably want to look at a career, so the numbers 0 to 30 or 40 are reasonable.

Now that we have established this, we must determine the Xscl. Determine the Xscl (input scale) by finding one tenth of the difference between the largest and the smallest value in the input list. Round this to a convenient number. We like 1, 5, 10, multiples of 10, 100, multiples of 100, etc.

After you have determined the Xscl, find the Xmin. To do this, choose the first multiple of the Xscl that is smaller than the smallest reasonable input value. For example, if the Xscl is 5 and the smallest reasonable input is 0, the Xmin will be -5. If the Xscl is 10 and the smallest input is 9, the Xmin will be 0.

Next find the Xmax. To do this, choose the first multiple of the Xscl that is larger than the largest reasonable input value. For example, if the Xscl is 5, and the largest reasonable input is 40, the Xmax will be 45. If the Xscl is 10 and the largest reasonable input is 100, the Xmax will be 110.

The Y information is a little more difficult because you have to do actual calculations. You must find the output that corresponds with the smallest reasonable input and the output that corresponds with the largest reasonable input. Determine the Yscl (output scale) by finding one tenth of the difference between these two outputs. Round this to a convenient number. We like 1, 5, 10, multiples of 10, 100, multiples of 100, etc.

After you have determined the Yscl, find the Ymin. To do this, choose the first multiple of the Yscl that is smaller than the smallest calculated output. For example, if the Yscl is 10000 and the smallest calculated output is 22000, the Ymin will be 20000.

Next find the Ymax. To do this, choose the first multiple of the Yscl that is larger than the largest calculated output. For example, if the Yscl is 10000, and the largest calculated output is 84000, the Ymax will be 90000.

ERRORS you might see:

WINDOW RANGE - This error means that you have an Xmin greater than an Xmax or a Ymin greater than a Ymax.

Regression Equations

To find the regression equation for a table of data you must first enter the data into L_1 and L_2 . If you don't remember how, look it up.

Now that the data is entered, you should look at a scatter plot to determine which regression is appropriate. If the scatter plot looks like a linear function, then a linear regression is appropriate, if it looks exponential then an exponential regression is appropriate, etc.

Once you have decided on the appropriate regression press STAT go right to CALC and choose the appropriate regression from the list of choices. LinReg ($ax + b$) is linear, QuadReg is quadratic, CubicReg is cubic (3rd degree), QuartReg is quartic (4th degree), ExpReg is exponential. There are others, but these are the ones we will use.

Once you choose the regression type, the calculator jumps back to the home screen and is waiting for you to enter the lists. You should type in L_1 (2nd 1), L_2 (2nd 2), Y_1 (VARs, right to YVars, choose Function, then choose the Y).

Your calculator shows the function type, the parameters, and the r values. If your calculator does not show the r values, you need to turn on the diagnostics. To do so, press Catalog (2nd 0), then press the green D, press the down arrow until you get to the diagnostic ON command, press enter, now press enter again. The calculator will display DONE. Now redo the the regression command.

Matrix Operations

To ENTER a matrix

1. Press MATRIX
2. Right to EDIT
3. Choose a matrix
4. Enter the dimensions: # rows, then # columns, then each number. Press ENTER after each.

To get a matrix for use in a calculation

1. Make sure you are in the main window
2. Press MATRIX
3. Choose the matrix needed

Coded Messages

1. Write the message in English
2. Translate it to numbers using A=1, B=2, C=3, etc. Use 0 for spaces.
3. Put this numerical data into a message matrix, you choose the number of rows. Put the data in column by column **not** row by row. Fill in spaces at the end with zeros.
4. Make an encryption key matrix. This matrix must be **square**. It's dimensions will equal the number of rows in the message matrix. This matrix must have an inverse. To check if it has an inverse, make sure it's determinate is **not** zero.
5. **To code the message:** $[\text{Encryption Key}] * [\text{Message}] = [\text{Coded Message}]$
6. **To decode a message:** $[\text{Message}] = [\text{Encryption Key}]^{-1} * [\text{Coded Message}]$, translate this back to English using 1=A, 2=B, 3=C, etc. Remember zero is a space.

Using your calculator to check your answer

1. Simplifying an expression.

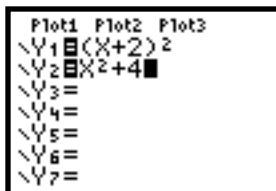
Put the original into Y_1 and your answer into Y_2 . Look at a table. If $Y_1 = Y_2$ for all values of X , you are correct.

Example:

Simplify $(x + 2)^2$.

Student #1

$$(x + 2)^2 = x^2 + 4$$



Student enters functions into Y=

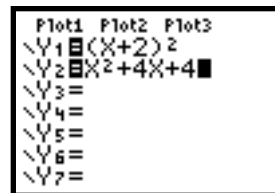
X	Y1	Y2
36	1369	1229
36	1444	1300
37	1521	1373
38	1600	1448
39	1681	1525
40	1764	1604
41	1849	1685

X=35

Student sees from the table that she is incorrect

Student #2

$$\begin{aligned} (x + 2)^2 &= (x + 2)(x + 2) \\ &= x^2 + 2x + 2x + 4 \\ &= x^2 + 4x + 4 \end{aligned}$$



Student enters functions into Y=

X	Y1	Y2
-3	1	1
-2	0	0
-1	1	1
0	4	4
1	9	9
2	16	16
3	25	25

X=-3

Student sees from the table that she is correct

2. Evaluating a function.

Put the original function into Y_1 and turn it off. Put the function evaluation in y_2 in correct function notation. Put your answer in Y_3 . Look at a table, if $Y_2 = Y_3$, then you are correct.

Example :

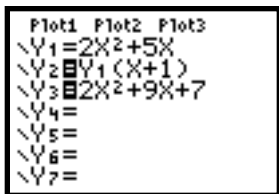
$f(x) = 2x^2 + 5x$. Find $f(x + 1)$

$$f(x + 1) = 2(x + 1)^2 + 5(x + 1)$$

work shown here

$$= 2x^2 + 9x + 7$$

Enter functions into calculator Y = menu



Look at Table

X	Y2	Y3
-4	3	3
-3	7	7
-2	13	13
-1	21	21
0	31	31
1	43	43
2	57	57
3	73	73
4	91	91

X=-4

From the table, we can see the answer is correct.

Error Messages

ARGUMENT - You have not put in all the parts needed for the function you are using. For the SOLVE command, inside the parentheses you must put an expression followed by a comma followed by x followed by a comma followed by a guess.

Bad Guess - It is exactly that, the only problem is your guess. Try another guess.

DIM MISMATCH - Your lists are not the same length. On a scatter plot the two lists must be equal in length. If you aren't graphing data, then this command means that you have a STAT PLOT turned on and you need to turn it off. Turn it off by pressing 2nd GRAPH, choose the plot that is on, once inside choose OFF. Remember to press ENTER once the cursor is on the OFF.

INVALID DIM - Usually this means that your lists are empty or that your lists are not the same length. If you are not trying to plot data, you have a STAT PLOT turned on. Turn it off by pressing 2nd GRAPH, choose the plot that is on, once inside choose OFF. Remember to press ENTER once the cursor is on the OFF.

No sign chng - This generally means that there is no solution to the equation. If you are sure of a solution, check that everything is typed in correctly and try again. This has nothing to do with your guess.

SYNTAX - This error means that you have a typing error. Choose GOTO and the calculator will show the location of the error. Fix the error and press ENTER.

WINDOW RANGE - This error means that you have an Xmin greater than an Xmax or a Ymin greater than a Ymax.