TI -89
Calculator Guide

Green River Community College
Mathematics Division

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If you find any errors or have concerns about the contents, please contact

Rochelle Mitchell
rmitchel@greenriver.edu
(253)833-9111 Ext. 4507

Donnie Hallstone
dhallsto@greenriver.edu
(253)833-9111 Ext. 4353

BASIC OPERATIONS – TI 89

Turning on your calculator: The [ON] button is located in the lower left hand corner of your calculator.

The different colors on your calculator: The [2nd] key may be used to retrieve the operations in yellow "above" the main keys of your calculator. The GREEN diamond key may be used to retrieve the operations in green "above the main keys of your calculator.

Example: To **turn off** your calculator, press [2nd], [ON].

Returning to the home screen: The home screen is the main screen you see when you turn on your calculator. It is where you do your main calculations such as addition, etc. You may return to the home screen at any time by pressing the "HOME" key.

Parentheses: Your calculator recognizes basic order of operations (multiplication before addition, etc.). The parentheses keys [(] [)] may be used as grouping symbols to ensure that the operations inside the parentheses get done first.

Example: To enter $\frac{20}{3+2}$, press [2] [0] [÷] [(] [3] [+] [2] [)] [ENTER] (Result = 4)

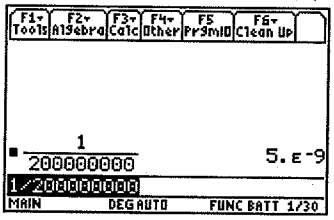
The Negative Key: The TI-89 distinguishes between subtraction [−] and the negative sign [(-)].

Example: $-4+6-2$ is entered [(-)] [4] [+] [6] [−] [2] [ENTER] (Result = 0)

Fractional and Decimal Answers: The TI-89 has a default set to always give answers as fractions. If you wish to have an answer given as a decimal, you should press GREEN, followed by [ENTER]

Example: To add ½ and ¼ , press [1] [÷] [2] [+] [1] [÷] [4] GREEN [ENTER]
(Result = .75)

Scientific Notation: Many times your calculator will give you an answer in scientific notation. If you see 5. E −9 in your display window, this implies 5×10^{-9} or 0.000000005.

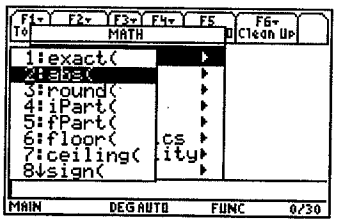


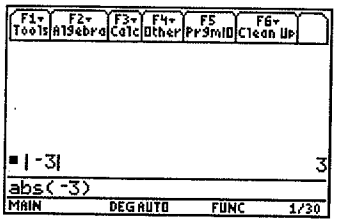
You may also perform calculations with numbers in scientific notation using the [EE] key.

Example: To find $(3.2\times10^{-8})\times(2.2\times10^{12})$, press [3] [.] [2] [EE] [(-)] [8] [×] [2] [.] [2] [EE] [1] [2] [ENTER] (Result = 70,400)

Absolute Value: The absolute value of a number ($|-3|$) can be calculated on your calculator using the command "abs".

On the TI-89, "abs" is located under the MATH menu (a popular menu). To get into the MATH menu, press [2nd] [5]. Press the right arrow key ([▶]) to access the "Number" menu. Then, press [2] for "abs(". Once you have done this, you may press the number for which you wish to take the absolute value followed by [)] and [ENTER].



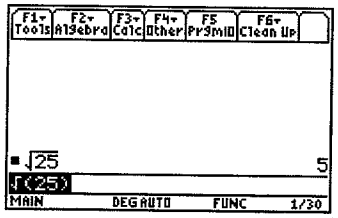


Exponents: The [^] key may be used to raise something to an exponent.

Example: 5^3 is entered [5] [^] [3] [ENTER] (Result = 125)

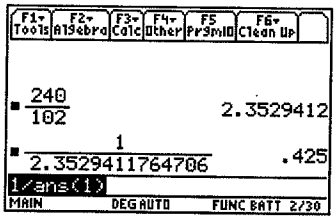
Square Root: The square root key is located in blue behind the [×] (times) key.

Example: $\sqrt{25}$ is entered [2nd] [×] [2] [5] [)] [ENTER] (Result = 5)



Retrieving Your Previous Answer: If you want to perform a new operation on your last answer, you may use the ANS option (located "behind" the [(-)] key).

Example: The latest answer on your viewing screen is 2.36488247 ($240 \div 102$) and you want to take 1 divided by this number. Press [1] [÷] [2nd] [(-)] [ENTER]



The nth Root: The TI-89 does not have a specific nth root option. However, you may enter nth roots by changing expression into exponent form.

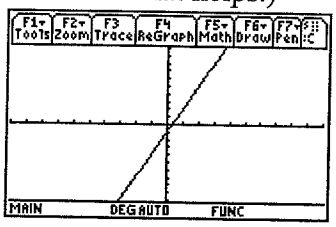
Example: $\sqrt[3]{8}$ is the same as $8^{1/3}$ which may be entered [8] [^] [(] [1] [÷] [3] [)] (Result = 2)

Retrieving and Editing Your Previous Entry: Your previous entry will automatically pop up after your calculation. If you want to edit this previous entry, use your arrow keys and change the numbers. The calculator's default is insert mode, so you may need to use the "BACK ARROW" key to delete entries. You may also use the delete (DEL) option located in green "above" the "back arrow" key.

GRAPHING – TI 89

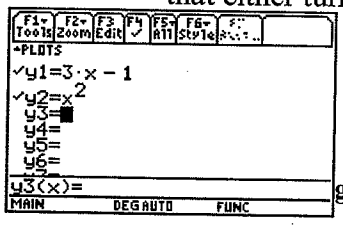
Basic Graphing: Graphing is controlled by the top row of keys, called the menu keys, in conjunction with the GREEN diamond key. (At any time in these graphing screens you wish to return to the main screen, hit the HOME key.) To enter the equation you wish to graph, hit GREEN [F1]. Using the "X" key for the letter *x*, type in the expression you wish to graph after the y1=, and then hit GREEN [F3] (GRAPH). If there is already an expression after y1=, you will need to hit [CLEAR] and then type it in

Example: To graph y = 3x – 1, hit GREEN [F1] [3] "X" [−] [1] GREEN [F3]. You should get the following picture. (If you do not see this picture, try hitting the following keys: [F2] [6] and see if that helps.)



Adding a graph: To add another graph, go back to the y= menu, by hitting GREEN [F1]. Use the down arrow key ([▼]) to move down to y2. Type in the new expression. To see both graphs, you may then hit GREEN [F3].

Viewing only one (or some) of the graphs: To turn one of the graphs off, go to the line you want to turn off. Hitting [F4] (the check symbol) at that point acts like a toggle switch that either turns that particular graph on or off.



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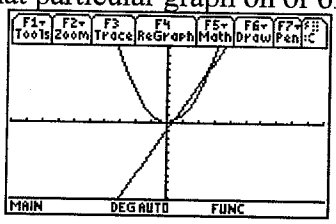

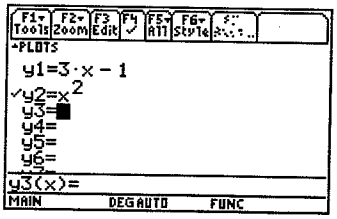

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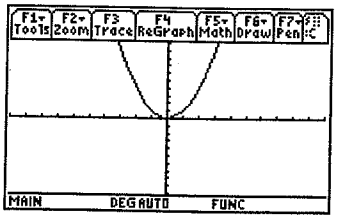
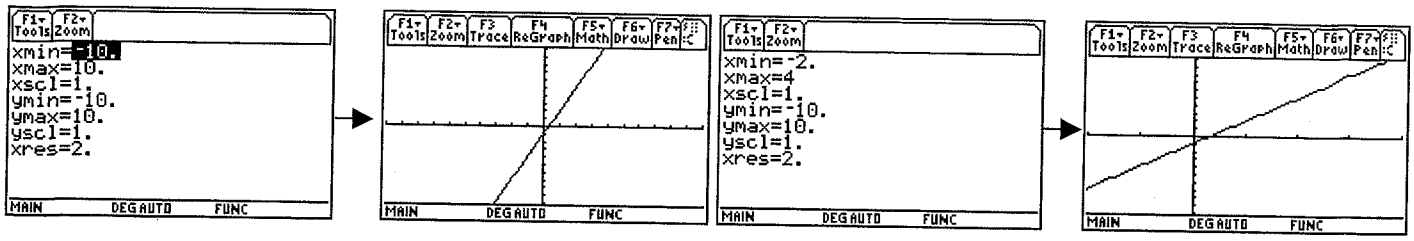


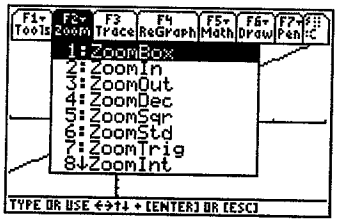
Tracing along a graph: If you have sketched a graph, you may use the use the GREEN [F3] (TRACE) key, along with the left and right arrow keys ([◀], [▶]) to see the points on the graph. You must hit GREEN [F3] first or the arrow keys would just move on the screen but not along the graph. If you have more than one graph on the screen, the up and down arrows ([▲], [▼]) will move between the different graphs.

Viewing Window: The viewing window refers to the part of the Cartesian coordinate system that shows on the screen. If you hit GREEN [F2] (WINDOW) you should see the screen below left. (If you do not see these values, hit [F2] [6] GREEN [F2] and you will.) xmin is the smallest x-value and xmax is the largest x value. xscl refers to where the calculator puts the tick marks on the x-axis. Similarly for ymin, etc. You may change any of the window values by using the up and down arrow keys to scroll down to the entry you want to change, and then just typing the new one. It is usually not necessary to change xscl, yscl or xres.

Example: Try changing the window with the following. Hit GREEN [F3] just to look at what your graph looks like now. Then hit GREEN [F2]. Change xmin to –2 by hitting [(-)] [2] [ENTER]. Change xmax to 4 by [4] [ENTER]. Hit GREEN [F3] again and see the difference the window makes. The graphs and windows are on the next page.

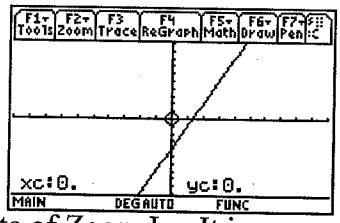


Zooming: Zooming includes many ways to change the viewing window quickly and efficiently. When you hit [F2] (Zoom), you will see the following options. Some of these are described below.



ZoomStd: This goes back to the standard viewing window, -10 to 10 for x and –10 to 10 for y. **It is a good idea to do this at the beginning and end of any graphing session.** You should do it now. The graph of y = 3x -1 is shown above on the standard window.

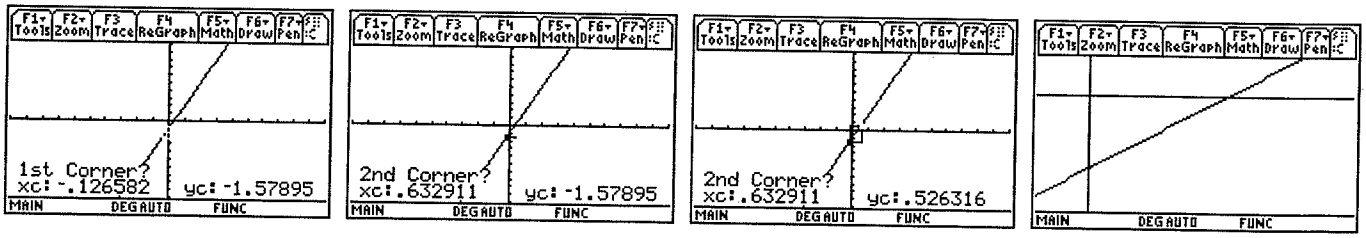
ZoomIn: This zooms in to get a closer in picture of the graph. You can choose the center of the area in which you are interested by using the arrow keys to move to where you want the center of the screen to be. After graphing, the keystrokes are [F2], [2], followed by the arrow keys if you want to change the center, then [ENTER]. The following is zoomed in once from the standard window without changing the center.



ZoomOut: This does the opposite of Zoom In. It is accessed with [F2] [3].

ZoomBox: This allows you to zoom in by creating a "box" around the part of the graph you want to see in your window.

Example: The following keystrokes will cause the sequence of windows shown, if you have y = 3x – 1 graphed. [F2] [6] [F2] [1] [F3] [F4] [F1] [◄] [▼] [▼] [▼] [▼] [▼] [▼] [▼] [ENTER] [►] [►] [►] [►] [►] [►] [▲] [▲] [▲] [▲] [▲] [▲] [▲] [▲] [ENTER]



ZoomDec: This is a useful zoom if you are going to be tracing along the graph and would like your x-values to be "nice" decimal numbers. From the standard viewing window, ZDECM will cause each horizontal pixel to be 0.1. To get ZDECM, you must do [F2] [4].

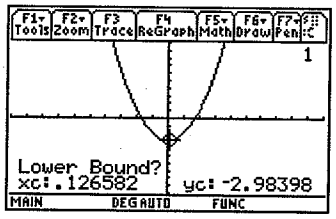
MAKING CALCULATIONS FROM A GRAPH – TI 89

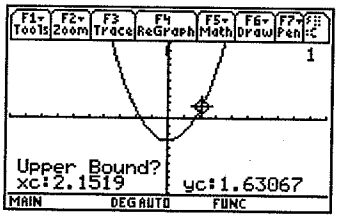
Calculating from the graph: Typing GREEN [F3] (GRAPH) [F5] (MATH) accesses useful functionality, summarized below. **You must press [F5] each time you use these operations.**

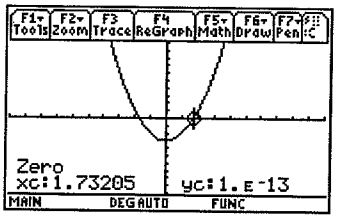
Value: Hitting this (located under [F5] (MATH) [1]) gives the graph with an Eval x= ___. Put in any x-value, hit enter, and the y-value of the point on the graph will be calculated. The coordinates will be listed as xc: and yc:. To do another x value, just type it in. If you have more then one graph showing, the up and down arrows will move between the different graphs. Note: With the TI 89, you need not pick an x-value that is in your window.

Zero: This will calculate where a graph crosses the x-axis (meaning a y-value of zero).

Example: Graph $y = x^2 - 3$ by pressing GREEN [F1] [CLEAR] "X" [^] [2] [−] [3] GREEN [F3]. Press [F5] [2]. Your cursor needs to be to the left of where the graph crosses the x-axis. Since it is already there, just hit [ENTER]. Then press [▶] 8 times to move the cursor to the right of where it crosses the x-axis. Hit [ENTER]. You would expect to get X=1.73205 and Y=0, but it actually shows Y =1E ⁻13. If you are familiar with scientific notation, 1E ⁻13 is the calculator's version of the number 0.0000000000001. There is round off error involved.







Minimum: To find the lowest point on a graph, use the Minimum option. The process is similar to that of finding a zero in that you must go to the left of the minimum, press [ENTER], and then go to the right of the minimum and press [ENTER].

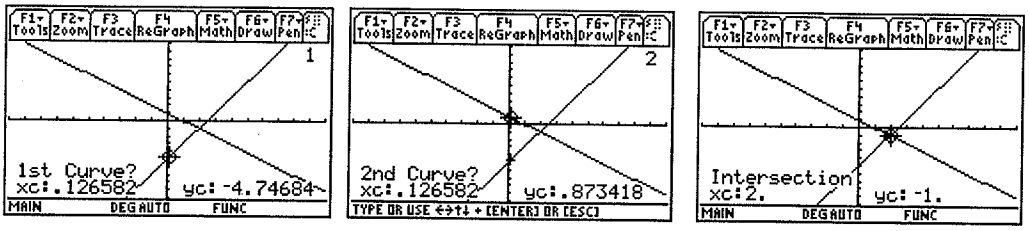
Example: On the same graph above, Hit [F5] [3]. Hit the left arrow key [◀] until you are to the left of the lowest point on the parabola. Hit [ENTER] and the right arrow key [▶] until you are to the right of the lowest point. Hit [ENTER]. The actual answer should be x = 0, y = ⁻3. However, you should expect to see something **like** X = ⁻4.09E⁻14 Y= ⁻3. The exact digits that you get will vary. Even though the digits may be different, the answer will be very close to the correct answer of 0.

Maximum: To find the highest point, use the Maximum option. The keystrokes are basically the same. Note the previous example has no maximum.

Intersection: If you have 2 or more graphs showing you can find where they intersect. To get to Intersection you use [F5] [5]. When you pick this option, it will ask you "1st curve?" while blinking on one of the graphs. Hit [ENTER]. If you need to, use the up and down arrows to get to the second graph. Hit [ENTER] [ENTER]. Then you have to give it the lower and upper bounds, as we did above.

Example: To find the intersection point of y = 2x – 5 and y = –x + 1, hit: GREEN [F1] [CLEAR] [2] "X" [−] [5] [ENTER] [(-)] "X" [+] [1] [ENTER] GREEN [F3] [F5] [5] [ENTER] [ENTER] You must be to the left of the intersection point and you already are. So hit

[ENTER]. Hit the left arrow key [▶] until you are to the right of the of the intersection point. Hit [ENTER]. Note that the answer is the point (2, -1).



TABLES - TI 89

Table: Along with the graphing functionality, the TI 89 has table related keys. This will produce a standard input-output table for the functions stored under the Y= menu.

Example: Type in y = 3x – 1. (GREEN [F1] [3] "X" [−] [1] GREEN [F3].) Hit GREEN [F5] (TABLE). You should see the table that is below left. (If you do not see the same values, see **Table Setup** below the tables, or try the arrow keys as described next.) Note that the up and down arrows ([▲] [▼]) allow you to move up or down to get to larger or smaller values. If you wanted to see the y-value when x is 10, scroll down to 10 in the x-column and you will see 29 for y.

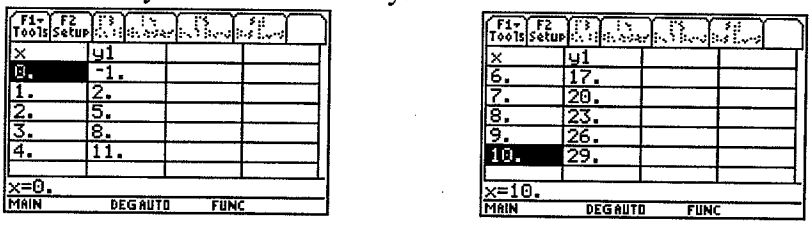
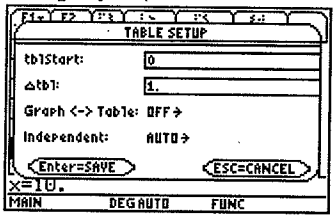
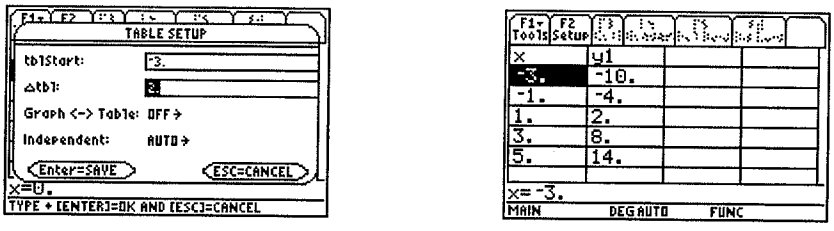


Table Setup: To change the first x-value in the table or the amount that x goes up by in the table, use the GREEN [F4] (TblSet) key. You will see a screen similar to the one below. tblStart is the starting x-value for a table. (0 for the above left table.) Δtbl is the amount that each successive x goes up by. (1 for the above tables.)



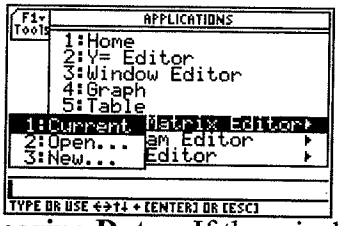
****Note: After your table is setup you have to again hit [ENTER] to save it and then get back to the table with GREEN [F5].**

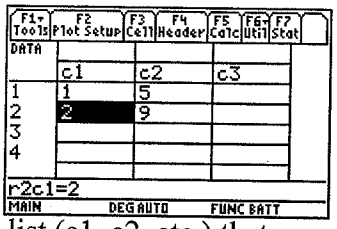
Example: To start a table for y = 3x-1 at x = -3 and pick only odd x-values (thus going up by 2), we would do the following. GREEN [F4] [(-)] [3] [▼] [2] [ENTER] [ENTER] GREEN [F5]. The two screens for this are shown below.



REGRESSION CURVES AND STAT PLOTS – TI 89

Entering Data – To enter data, press APPS. Press [6] for the Data/Matrix Editor. Then, press [1] or [ENTER]. Enter your independent (x) or input data under list "c1". Enter your dependent (y) or output data under "c2". Example: Enter the data below:

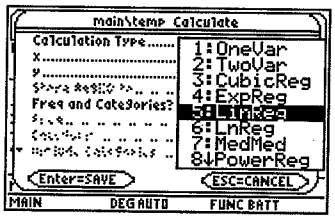




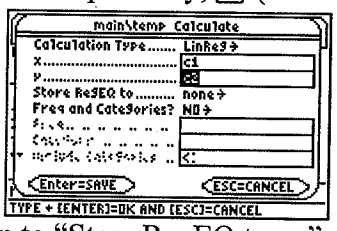
Clearing Data – If there is data under a list (c1, c2, etc.) that you wish to clear and you are in your list window, use your blue arrow keys to move to the first entry in the column you wish to clear. Now, press the black left arrow key. Continue to do so until the column is cleared.

Finding the Equation of the Regression Curve –

- When finished entering the data, press [F5] (Calc).
- Press the right arrow key ([▶]) and scroll down to the appropriate regression option (LinReg for linear regression, etc.).

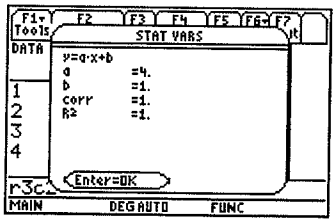


- Then, press [ENTER].
- Move the cursor down to the box next to "x". Here you will tell the calculator which list contains your input or "x" data.
- Type "c1" by pressing the "alpha" key, [ )] (for "c"), then [1]. Then, press [ENTER].
- Move the cursor down to the box next to "y". Here you will tell the calculator which list contains your output or "y" data.
- Type "c2" by pressing the "alpha" key, [ )] (for "c"), then [2]. Then, press [ENTER].



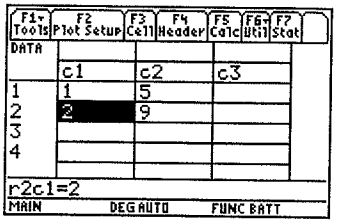
- Move your cursor down to "Store RegEQ to …". Press your right arrow key ([▶]). Then, move use your down arrow key ([▼]) to highlight "y1(x)" and press [ENTER].
- Finally, press [ENTER] again.
- You will see the regression equation.
- The "corr" is the correlation coefficient.

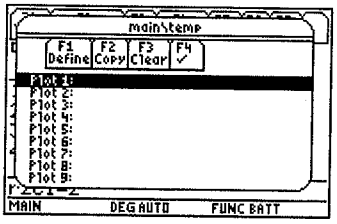
Example: A linear regression (LINR) was found below for the points (1, 5) and (2, 9)



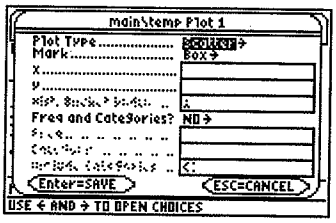
Plotting the Data –

- While viewing your lists (c1, c2, etc.), press [F2] for Plot Setup.



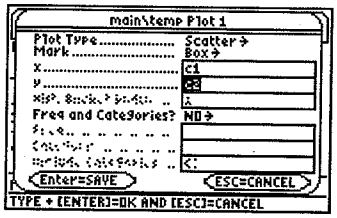


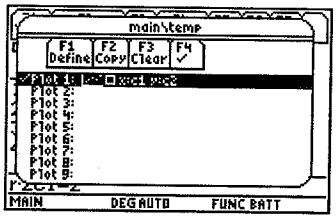
- Press [F1] to define Plot1.



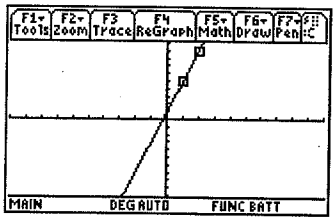
- Make sure that the Plot Type is "Scatter".
- Use your down arrow key ([▼]) to move to the box next to "x". Here, you will tell the calculator which list contains your input or "x" data.
- Type "c1" by pressing the "alpha" key, [ ] (for "c"), then [1]. Then, press [ENTER].
- Move the cursor down to the box next to "y". Here you will tell the calculator which list contains your output or "y" data.
- Type "c2" by pressing the "alpha" key, [ ] (for "c"), then [2]. Then, press [ENTER].

- Press [ENTER] to save this information.





- To graph the data points, press GREEN, followed by [F3] (for GRAPH). (You may need to change your window if you cannot see your data points.)



- **IT IS EXTREMELY IMPORTANT TO TURN OFF THE PLOT WHEN YOU ARE FINISHED WITH IT TO AVOID ERROR MESSAGES!!!** (You can do so by going back into the your lists and into Plot Setup (APPS [6] [1] [F2]). Then, press [F3] for Clear.

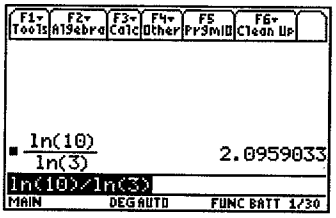
Calculating the Logarithm of a Number: Two options on your calculator allow you to calculate the log of a number: [LOG] (the common log or log base 10) and [LN] (the natural log or log base *e*).

Example: To calculate log(90), press the CATALOG key and scroll down to "log(". Press [ENTER] followed by [9] [0] [)]. Then, press GREEN [ENTER]. (Result ≈ 1.95)

Example: To calculate ln(90), press [2nd] "X". Now, press [9] [0] [)] GREEN [ENTER]. (Result ≈ 4.5)

Finding the Logarithm of a Number if the Base is not 10 or *e*: If you are dealing with a logarithm with a base besides 10 or *e*, you must use the change of base formula.

Example: To calculate $\log_3(10)$, you must find the quotient of ln(10) and ln(3) by pressing [2nd] "X" [1] [0] [)] [÷]. Then, press [2nd] "X" followed by [3] [)] GREEN [ENTER]. (Result ≈ 2.0959)



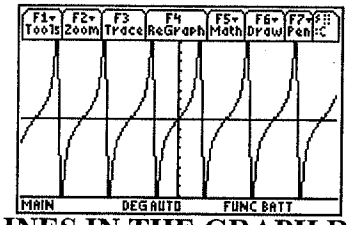
Calculating *e* Raised to a Power: The e^x option is located "above" the "X" key.

Example: To calculate e^2, press the GREEN "X". Then, press [2] [)] followed GREEN [ENTER]. (Result ≈ 7.389)

Degree and Radian Mode for Trigonometry: It is common to have to alternate between radian and degree mode for angles in trigonometry. The default of the calculator is radian mode. To switch to degree mode, press [MODE]. Then, use your down arrow ([▼]) to highlight "Radian". Then, use your right arrow and down arrow keys to highlight DEGREE. Once it is highlighted press [ENTER] twice. Similarly, you may follow the steps and highlight Radian to switch back to radian mode.

Graphing Trigonometric Functions: You may follow the general graphing directions on page 3 of the manual to graph trigonometric functions. One special feature that is helpful is "ZoomTrig". Once you have entered your function under the "Y=" menu, you may press [F2] (ZOOM), then [7] for ZoomTrig. This option will graph your function in an appropriate window. It will also allow you to "TRACE" with appropriate "x" values.

Example: To graph the function $y = \tan(x)$, press the GREEN [F1] (y=) [2nd] and the "T" key for "TAN". Now, press "X" and [)]. Then, press [F2] (ZOOM) and [7] (ZoomTrig).



****NOTE: THE VERTICAL LINES IN THE GRAPH REPRESENT ASYMPTOTES AND ARE NOT PART OF THE FUNCTION'S GRAPH!**

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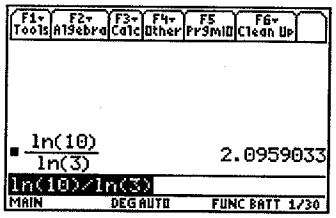

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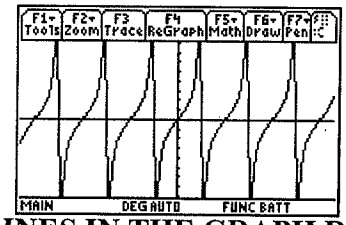
Example: To graph the function $y = \tan(x)$, press the GREEN [F1] (y=) [2nd] and the "T" key for "TAN". Now, press "X" and [)]. Then, press [F2] (ZOOM) and [7] (ZoomTrig).



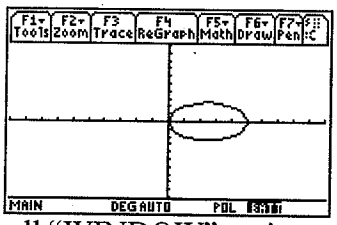
****NOTE: THE VERTICAL LINES IN THE GRAPH REPRESENT ASYMPTOTES AND ARE NOT PART OF THE FUNCTION'S GRAPH!**

OTHER GRAPHING – TI 89

Graphing Using Polar Coordinates: Often times, we graph relationships that are not functions using polar coordinates. To graph using these coordinates, we must change the mode of the calculator and enter the equation in a similar manner to previous graphing entries.

- To change the calculator into polar coordinate mode, press [MODE]. Under the heading "Graph", use your right arrow key ([▶]). Then, press [3] (POLAR) and [ENTER].
- Now, you are ready to enter your function by pressing GREEN [F1] (Y=). You will now be entering an equation for "r" in terms of "θ".

  Example: To enter $r = 5\cos(\theta)$, press [5] [2nd] followed by the "Z" key. Then, press the GREEN [^] (θ). Finally, press [)], GREEN [F3] (GRAPH)

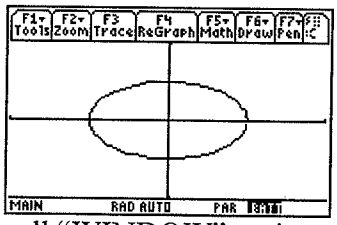


- It is important to make sure all "WINDOW" options are appropriate for your graph. After pressing [2nd] [F2] for WINDOW, you will see options for θmin, θmax, and θstep. These options allow you to set the amount of your graph that is shown. The smaller the θStep chosen, the more smooth the curve will look (and longer the picture will take to graph).

Graphing Using Parametric Equations: We also use parametric equations to graph relationships that are not functions (such as circles). Again, we must change the mode of the calculator and enter the equations in a similar manner to previous graphing entries.

- To change the calculator into parametric equation mode, press [MODE]. Under the heading "Graph", use your right arrow key ([▶]). Then, press [2] (PARAMETRIC) and [ENTER].
- Now, you are ready to enter your function by pressing GREEN [F1] (Y=). You will now be entering equations for "x" and "y" in terms of "t".

  Example: To enter the unit circle, you must enter $x = \cos(T)$ and $x = \sin(T)$.
  Under "xt1", press [2nd], "Z" "T" followed by [)] and [ENTER].
  Under "yt1", press [2nd], "Y" "T" followed by [)] and [ENTER].
  Finally, press the GREEN [F3] (GRAPH).



- It is important to make sure all "WINDOW" options are appropriate for your graph. After pressing GREEN [F2] for WIND, you will see options for tmin, tmax, and tstep. These options allow you to set the amount of your graph that is shown. The smaller the tstep chosen, the more smooth the curve will look (and longer the picture will take to graph).

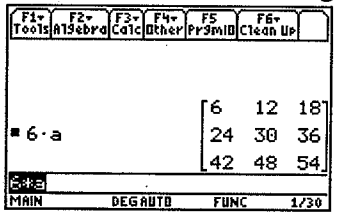
MATRICES – TI 89

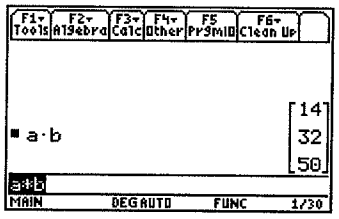
Matrices: Matrix creation on the TI 89 is controlled by the menus under the Data/Matrix Editor window, accessed by APPS [6] key. All matrices must be named and defined to use. If you hit APPS [6] [3] (New…) you get another menu to define the new matrix. Under Type you want to change from data to Matrix. This is done by [▶] [2]. Use [▼] [▼]to get to Variable:. You must give the matrix a name there, and then give the dimension of the matrix in the next two entries.

Example: To enter the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$ into name "a", you would hit APPS [6] [3] [▶] [2] [▼] [▼] [ALPHA], the equal sign (a), [▼] [3] [▼] [3] [ENTER] [ENTER] [1] [ENTER] [2] [ENTER] [3] [ENTER] [4] [ENTER] [5] [ENTER] [6] [ENTER] [7] [ENTER] [8] [ENTER] [9] [ENTER]

Use of Matrices: To use the matrix you need to first exit the editing mode by hitting HOME. To enter the matrix that we just input, hit HOME [ALPHA] equal sign (A) [ENTER]. It looks similar to a regular matrix. You may use matrices for all the regular operations.

Scalar Multiplication: To multiply $6\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$, hit [6] [×] [ALPHA] equal sign [ENTER]. You should get the matrix shown below left.

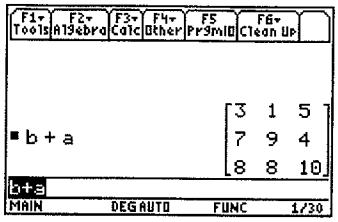




Matrix Multiplication: To multiply $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$, we must first store the second matrix as "b". APPS [6] [3] [▶] [2] [▼] [▼] [ALPHA] [(](inserts the letter b) [▼] [3] [▼] [1] [ENTER] [ENTER] [1] [ENTER] [2] [ENTER] [3] [ENTER] HOME [ALPHA] equal sign [×] [ALPHA] [(] [ENTER]. You should get the matrix shown above right. Note if you try to multiply in the opposite order, it won't work since the dimensions do not match up correctly.

Matrix Addition: To add $\begin{bmatrix} 2 & -1 & 2 \\ 3 & 4 & -2 \\ 1 & 0 & 1 \end{bmatrix} + \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$, we must first store the first matrix as "b". On the TI 89, we have to first delete the old "b". To do this we use [2nd] [−](VAR-LINK). Then use the down arrow [▼]until you are on b. Then hit [F1] [1] [ENTER]. To enter the new matrix, hit APPS [6] [3] [▶] [2] [▼] [▼] [ALPHA] [(] [▼] [3] [▼] [3] [ENTER] [ENTER] [2] [▶] [(-)] [1] [ENTER] [2] [ENTER] [3] [ENTER] [4]

ENTER (-) 2 ENTER 1 ENTER 0 ENTER 1 ENTER HOME ALPHA (+ ALPHA equal sign ENTER. The answer is below.



Inverses: To find the inverse of a matrix, we raise it to the negative one power. The matrix must be square and not have a determinant of 0. To find the inverse of $C=\begin{bmatrix}2 & 3\\ 1 & 2\end{bmatrix}$, you would do the following. APPS 6 3 ▶ 2 ▼ ▼ ALPHA) ▼ 2 ▼ 2 ENTER ENTER 2 ENTER 3 ENTER 1 ENTER 2 HOME ALPHA) ^ (-) 1 ENTER (Result is $C^{-1}=\begin{bmatrix}2 & -3\\ -1 & 2\end{bmatrix}$)

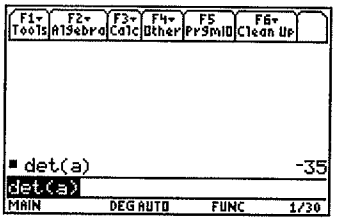
Solving Systems: To solve a system of n equations in n unknowns, let [A] be the coefficient matrix, and [B] be the constant matrix, and then find $[A^{-1}B]$.

Example: To solve the system $\begin{cases}4x+y-3z=11\\ 2x-3y+2z=9\\ x+y+z=-3\end{cases}$, the coefficient matrix [A] is $\begin{bmatrix}4 & 1 & -3\\ 2 & -3 & 2\\ 1 & 1 & 1\end{bmatrix}$ and the constant matrix [B] is $\begin{bmatrix}11\\ 9\\ -3\end{bmatrix}$. To find $\begin{bmatrix}x\\ y\\ z\end{bmatrix}$, you first delete the old a and b matrices by doing this: 2nd − (VAR-LINK). Then use the down arrow ▼ until you are on a. Hit F4 to select a. Then move to b and hit F4 again. Then hit F1 1 ENTER.

APPS 6 3 ▶ 2 ▼ ▼ ALPHA equal sign ▼ 3 ▼ 3 ENTER ENTER 4 ENTER 1 ENTER (-) 3 ENTER 2 ENTER (-) 3 ENTER 2 ENTER 1 ENTER 1 ENTER 1 ENTER HOME APPS 6 3 ▶ 2 ▼ ▼ ALPHA (▼ 1 ▼ 3 ENTER ENTER 1 1 ENTER 9 ENTER (-) 3 ENTER HOME ALPHA equal sign ^ ((-) 1) × ALPHA (ENTER. The answer is x = 2, y = -3, z = -2

Determinants: To find a determinant of a matrix, use the matrix math operations, which are found with 2nd 5 4. Hit 2, put in the matrix name, and then hit) ENTER.

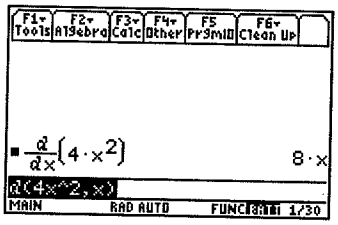
Example: The determinant of $[A]=\begin{bmatrix}4 & 1 & -3\\ 2 & -3 & 2\\ 1 & 1 & 1\end{bmatrix}$ is found by with 2nd 5 4 2 ALPHA equal sign) ENTER. (Result is −35.)



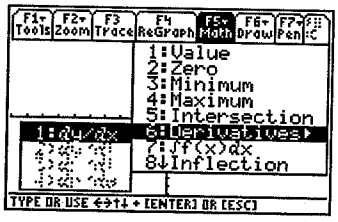
DERIVATIVES AND INTEGRALS – TI 89

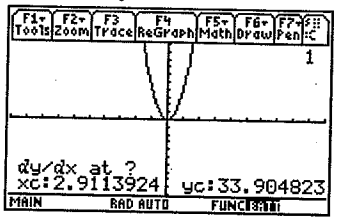
Calculating a Derivative: The TI-89 allows you to find the derivative of a function under the Calculus menu (Calc). This menu is located by pressing [F3] from the home screen. Once you obtain the command, you must enter the function you are differentiating followed by the variable with which you are differentiating. (Be sure to place commas between these items.)

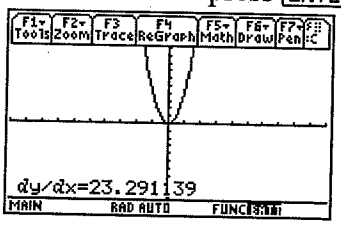
Example: To find the derivative of $y = 4x^2$, press [F3] [1] (differentiate) [4] "X" [^] [2] [,] "X" [)] [ENTER]



Approximating the Numerical Derivative: You may also approximate the derivative of a function at a point after you graph the function. To do so, first graph the function. (Try graphing $y = 4x^2$ from the previous example.) Then, go into the MATH menu by pressing [F5]. Press [6] for "derivatives" followed by [ENTER]. Use your right and left arrow keys to find the x-value for which you wish to find the derivative and press [ENTER].

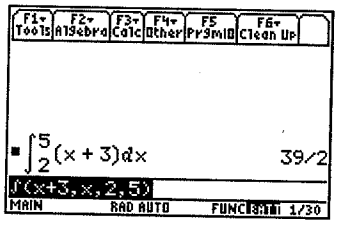






Approximating a Definite Integral: The TI calculator allows you to approximate a definite integral under the Calculus menu (Calc). This menu is located by pressing [F3] from the home screen. Once you obtain the command, you must enter the function you are integrating, the variable with which you are integrating, and the limits of integration. (Be sure to place commas between these items.)

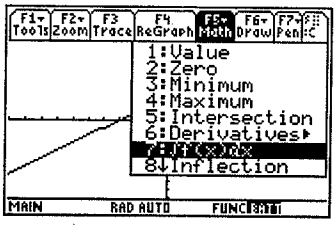
Example: To find $\int_2^5 (x+3)dx$, press [F3] [2] (Integrate) "X" [+] [3] [,] "X" [,] [2] [,] [5] [)] [ENTER].

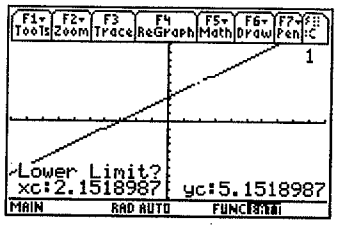


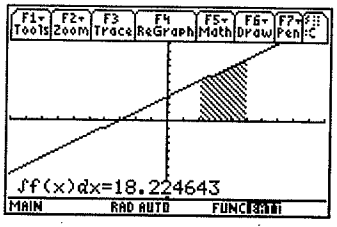
****NOTE: The indefinite integral of a function may be found by leaving off the limits of integration.**

Alternate Option for the Definite Integral: You may also approximate the definite integral of a function at a point after you graph the function. To do so, first graph the function. (Try graphing $y = x + 3$ from the previous example.) Then, go into the MATH

menu by pressing [F5]. Press [7] for integral. Use your right and left arrow keys to find the lower limit of the integral and press [ENTER]. Use your right and left arrow keys to find the upper limit of the integral and press [ENTER].

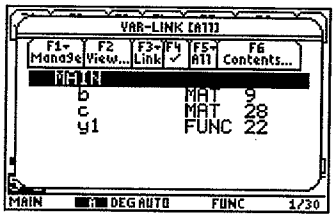


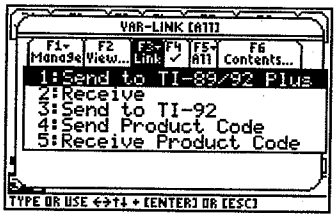




LINKING – TI 89

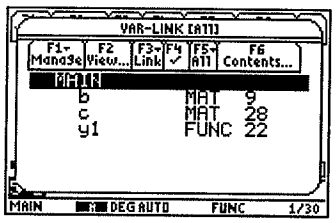
Linking: To send information from one calculator to another, you only need a linking cable. If you wish to send information to and from a computer, you need the linking software (available online from TI) and you need the calculator-serial port cable which is available for purchase form TI. These directions cover calculator-to-calculator linking. First attach the link cable to both calculators. Make sure the cable is pushed in firmly. Linking is controlled from the LINK menu, which is accessed with [2nd] [−] (VAR-LINK). That accesses the menu below left. Then hit [F3] (Link) to get the menu below right..

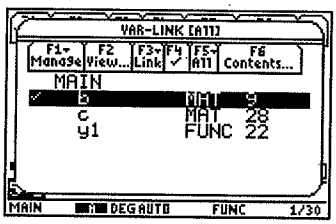




RECIEVE: From the menu shown above right, you hit 2: Receive. It should start waiting for information to be sent.

SEND: On the sending calculator, from the menu shown above right, you pick 1: Send to TI-89/92 Plus. You then get the menu shown below left. You then pick which items you want sent. A picture of a typical screen is shown below center. Each calculator will look a little different.





If you wanted to send the matrix b you would go down to that row so that the arrow is pointed at b and then hit [F4] (Check symbol). The check symbol in front of b means it has been selected, and it is ready for transfer. You may also select any others you wish to send. Then hit [F3] [F1] to transmit the information.