TI -86
Calculator Guide

Green River Community College
Mathematics Division

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BASIC OPERATIONS – TI 86

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 "above" the main keys of your calculator. These operations will be in yellow for the TI-86.

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

Clearing the screen: You may clear the screen at any time by pressing the [CLEAR] button.

Clearing the menu bar(s) or returning to the "Home" Screen: The menu bars "pop up" on the bottom of the screen. The "home" screen of your calculator is the screen where you perform all calculations (such as addition, etc.) You may clear the menu bars and/or return to the "home" screen at any time by pressing [EXIT] several times.

Example: Press [GRAPH] to see a new screen. To return to the "home" screen, press [EXIT].

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.

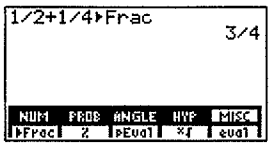
Example: To enter $\frac{20}{3+2}$, press [2] [0] [÷] [(] [3] [+] [2] [)] [ENTER] (Result = 4)

The Negative Key: The TI-86 distinguishes between subtraction [−] and the negative sign [(-)].

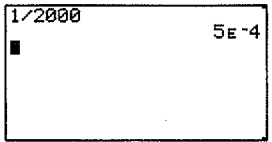
Example: $-4+6-2$ is entered [(-)] [4] [+] [6] [−] [2] [ENTER] (Result = 0)

Fractions: An answer is given as a fraction by using the popular MATH menu. After you enter your desired calculation, you must press [2nd] [×] (to get into the MATH menu). Then, press [F5] for MISC, followed [MORE]. Finally, press [F1] for ▸ Frac.

Example: To add ½ and ¼ , press [1] [÷] [2] [+] [1] [÷] [4], then [2nd] [×] [F5] [MORE] [F1]. Be sure to press [ENTER] when you are all done!



Scientific Notation: Many times your calculator will give you an answer in scientific notation. If you see 5 E −4 in your display window, this implies 5×10^{-4} or 0.0005.



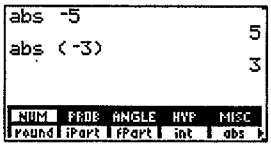
You may also perform calculations with numbers in scientific notation using the [EE] key.

Example: To find $\left(3.2\times10^{-8}\right)\times\left(2.2\times10^{12}\right)$, 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-86, "abs" is located under the MATH menu (a popular menu). To get into the MATH menu, press [2nd] [×] (the times key). Then, press [F1] for NUM. Finally, press [F5] for "abs".

  Example: To find $|-5|$, press [2nd] [×] [F1] [F5] [(-)] [5] [ENTER]. (Result = 5)



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

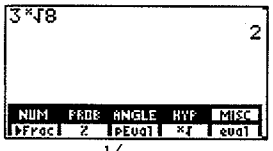
Example: 5^3 is entered [5] [^] [3] [ENTER] (Result = 125)

Square Root: The square root key is located in "above" the [x^2] key.

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

The nth Root: The nth root (or root higher than 2) of a number is taken by using the MATH menu ([2nd] [×]). Under this menu, you want to choose MISC by pressing [F5]. Then, press [MORE]. Before pressing [F4] ($\sqrt[x]{\ }$), you must enter the index.

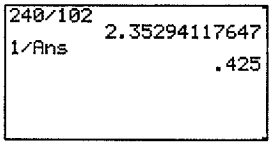
Example: To calculate $\sqrt[3]{8}$, press [3] (for the index). Then, press [2nd] [×](times). Press [F5], [MORE], [F4]. Finally, press [8] [ENTER]



Alternate Method: $\sqrt[3]{8}$ is the same as $8^{1/3}$ which may be entered [8] [^] [(] [1] [÷] [3] [)] (Result = 6)

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]



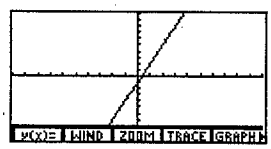
Retrieving and Editing Your Previous Entry: If you want to edit your previous entry, press [2nd] [ENTER] and use your arrow keys, the delete key ([DEL]), and the insert key ("above" [DEL]) to edit the numbers.

Example: You enter $36+2(4^2-1)$ getting a result of 66. However, you meant to square 5 instead of 4. Press [2nd] [ENTER], move your cursor by using your left arrow key ([◄]) and replace the 4 with a 5. (Result = 84)

GRAPHING – TI 86

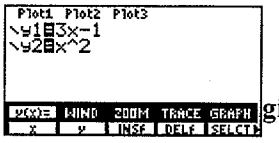
Basic Graphing: Graphing is controlled by the top row of keys, called the menu keys, but on the TI 86 you must first get into the graphing menu, which you do with the [GRAPH] key. (At any time in these graphing screens you wish to return to the main screen, hit [2nd] [EXIT] (QUIT).) To enter the equation you wish to graph, hit [GRAPH] [F1]. Using the [x-VAR] key or [F1] for the letter x, type in the expression you wish to graph after the y1=, and then hit [2nd] [F5] (the GRAPH menu item, not the actual [GRAPH] key).

Example: To graph y = 3x – 1, hit [GRAPH] [F1] [3] [x-VAR] [–] [1] [2nd] [F5]. You should get the following picture. (If you do not see this picture, try hitting the following keys: [F3] [F4] [EXIT] and see if that helps.)



Adding a graph: To add another graph, go back to the y(x)= menu, by hitting [F1]. Use the down arrow key ([▼]) or [ENTER] key to move down to y2. Type in the new expression. To see both graphs, you may then hit [2nd] [F5]. You may put in a total of 10 graphs.

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 [F5] (SELCT) at that point acts like a toggle switch that either turns that particular graph on or off.



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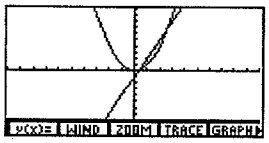

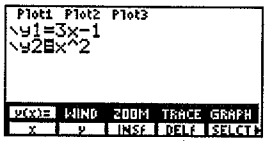

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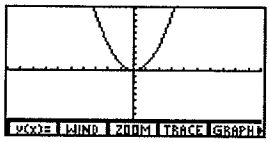
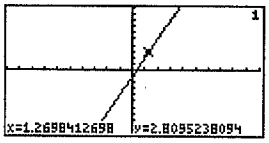
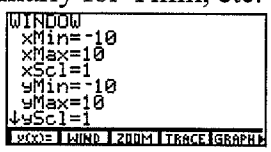


Tracing along a graph: If you have sketched a graph, you may use the use the [F4] (TRACE) key, along with the left and right arrow keys ([◀], [▶]) to see the points on the graph. You must hit [F4] first or the arrow keys would just move on the screen but not along the graph. If you have more than one graph on the screen, the up and down arrows ([▲], [▼]) will move between the different graphs.

Example: If you start with the picture at the top of this page, [F4] [▶] [▶] [▶] [▶] [▶] [▶] [▶] [▶] [▶] gives this picture

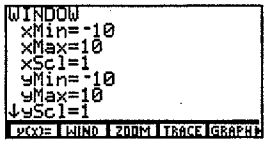


Viewing Window: The viewing window refers to the part of the Cartesian coordinate system that shows on the screen. If you hit [GRAPH] [F2] you should see the following screen. (If you do not see these values, hit [F3] [F4] [F2] and you will.) Xmin is the smallest x-value and Xmax is the largest x value. 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 or Yscl.

Example: Try changing the window with the following. Hit [GRAPH] just to look at what your graph looks like now. Then hit [F2]. Change Xmin to –2 by hitting [(-)] [2] [ENTER]. Change Xmax to 4 by [4] [ENTER]. Hit [F5] again and see the difference the window makes.



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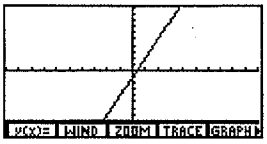

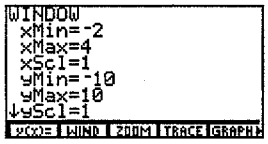

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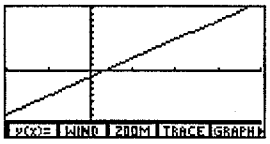
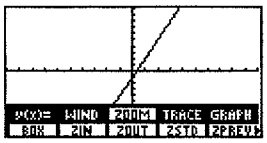
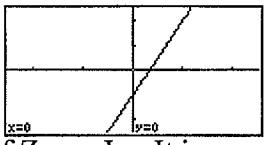


Zooming: Zooming includes many ways to change the viewing window quickly and efficiently. When you hit [F3] (ZOOM), you will see the following options. Some of these are described below.



ZSTD: 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.

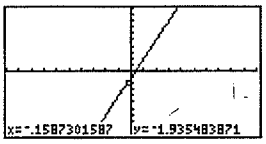
ZIN: This zooms in to get a closer in picture of the graph. You can choose the center of the area in which you are interested by using the arrow keys to move to where you want the center of the screen to be. After graphing, the keystrokes are [F3] [F2], followed by the arrow keys if you want to change the center, then [ENTER]. The following is zoomed in once from the standard window without changing the center.

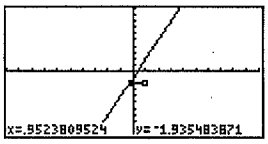


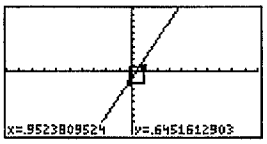
ZOUT: This does the opposite of Zoom In. It is accessed with [F3] [F2].

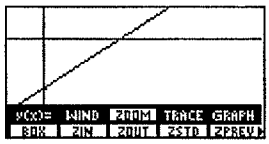
BOX: This allows you to zoom in by creating a "box" around the part of the graph you want to see in your window.

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









ZDECM: 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 [GRAPH] [F3] [MORE] [F4].

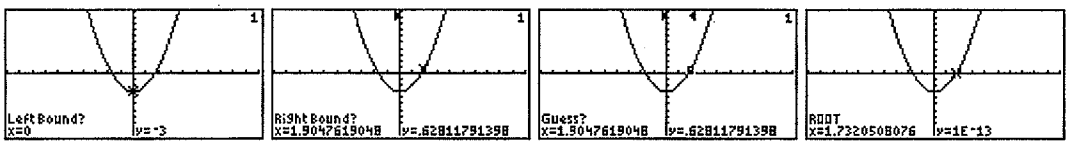
MAKING CALCULATIONS FROM A GRAPH – TI 86

Calculating from the graph:

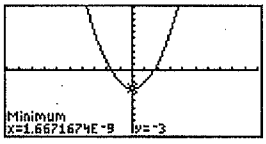
EVAL: Hitting this (located under [GRAPH] [MORE] [MORE]) gives the graph with an Eval x= ___. Put in any x-value, hit enter, and the y-value of the point on the graph will be calculated. If you have more then one graph showing, the up and down arrows will move between the different graphs. Note: With the TI 86, you need not pick an x-value that is in your window.

Typing [GRAPH] [MORE] [F1] (MATH) accesses useful functionality, summarized below. **You must press [GRAPH] [MORE] [F1] each time you use these operations.**

ROOT (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 [GRAPH] [F1] [x-VAR] [^] [2] [−] [3] [2nd] [F5] [F3] [F4] [EXIT]. Press [MORE] [F1] [F1]. 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 [▶] 12 times to move the cursor to the right of where it crosses the x-axis. Hit [ENTER]. For a guess, you can just hit [ENTER] again. You would expect to get X=1.7320508 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.



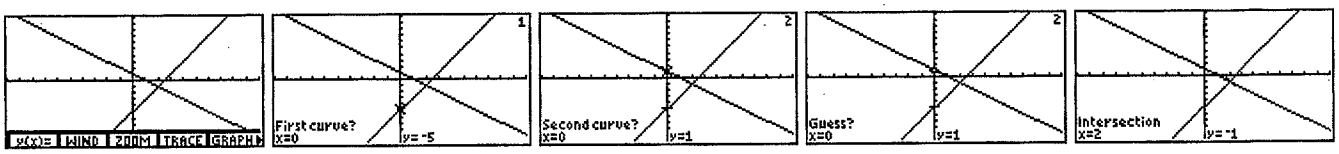
FMIN: To find the lowest point on a graph, use the FMIN key. The process is similar to that of finding a zero in that you must go to the left of the minimum, press [ENTER], go to the right of the minimum, press [ENTER], make a guess, and press [ENTER].
Example: On the same graph above, Hit [GRAPH] [MORE] [F1] [F4]. 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] [ENTER]. The actual answer should be x = 0, y = ⁻3. However, you should expect to see something **like** X = 1.6671674E⁻6 Y= ⁻3. The exact digits that you get will vary, depending on where you put your left and right bounds. If you are familiar with scientific notation, 1.6671674E⁻6 is the calculator's version of the number 0.0000016671674. There is round off error involved. Even though the digits may be different, the answer will be very close to the correct answer of 0.



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

ISECT: If you have 2 or more graphs showing you can find where they intersect. To get to ISECT you sue [GRAPH] [MORE] [F1] [MORE] [F3]. When you pick this option, it will ask you "First 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].

Example: To find the intersection point of y = 2x – 5 and y = –x + 1, hit: [GRAPH] [F1] [2] [X-VAR] [–] [5] [ENTER] [(-)] [X-VAR] [+] [1] [2nd] [F5] [MORE] [F1] [MORE] [F3] [ENTER] [ENTER] [ENTER]. Note that the answer is the point (2, -1).



TABLES - TI 86

Table: Along with the graphing functionality, the TI 86 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. ([GRAPH] [F1] [3] [X-VAR] [–] [1] [2nd] [F5] [F3] [F4].) Hit [TABLE]. You should see that you have a choice of [F1] (TABLE) or [F2] (TBLSET). You probably will see the table that is below left. (If you do not see the same table, 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.

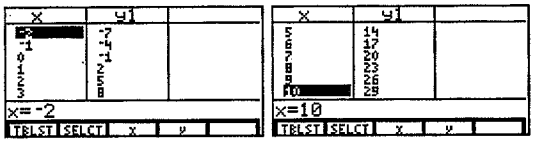
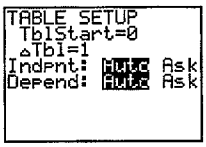
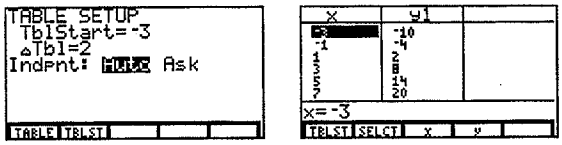


Table Setup: To change the first x-value in the table or the amount that x goes up by in the table, use the [F1] (TBLSET) key or [TABLE] [F2] (TBLST). Tblstart is the starting x-value for a table. (0 for the above left table.) ΔTbl is the amount that each successive x goes up by. (1 for the above tables.)



****Note that after your table is setup you have to get back to the table with the [F1] (TABLE) key.**

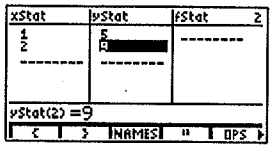
Example: To start a table for y = 3x-1 at x = -3 and pick only odd x-values (thus going up by 2), we would do the following. [TABLE] [F2] [(-)] [3] [ENTER] [2] [F1]. The two screens for this are shown below.



REGRESSION CURVES AND STAT PLOTS – TI 86

Entering Data – To enter data, you must get into the STAT menu. To do this, press [2nd] [+]. Under this menu, you will want to EDIT lists by pressing [F2]. Enter your independent (x) or input data under list "xStat". Enter your dependent (y) or output data under "yStat".

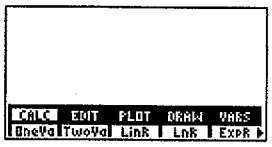
Example: Once you are in the lists, enter the following data.



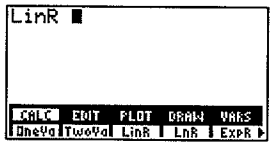
Clearing Data – If there is data under a list (xStat, yStat, etc.) that you wish to clear and you are in your list window, use your arrow keys to move up and highlight the list name you wish to clear. (If you want to clear xStat, xStat should be highlighted.) Then, press [CLEAR] and [ENTER].

Finding the Equation of the Regression Curve –

- To find the equation of a regression line or curve, you must first exit out of the lists to your home screen by pressing [EXIT].
- Now, you want to go back into the STAT menu by pressing [2nd] [+].
- You now want to calculate (CALC) the equation, so you must press [F1].

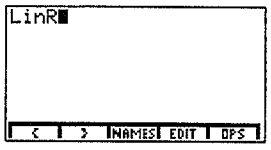


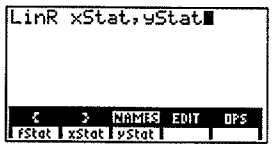
- Then, you must find the regression option you need (LinR for linear regression) and press the appropriate function key (F1, etc.). If you do not see the appropriate regression option, you may press [MORE] for other options.

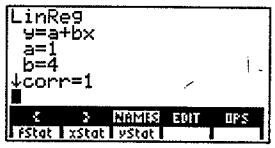


- Now, you must enter the lists for which you wish to find the regression equation. To do so, press [2nd] [−] (LIST). Then, press [F3] for NAMES. Then, press [F2] (xStat) [,] [F3] (yStat). Finally, press [ENTER].

  Example: The following linear regression was calculated for the points (1, 5) and (2, 9) as inputted under "Entering Data".



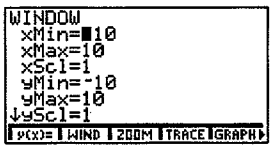




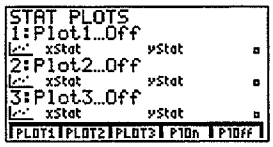
- The "corr" is the correlation coefficient and "n" is the number of data points that you have entered.
- For linear regressions (LINR), the "a" is the y-intercept and the "b" is the slope.

Plotting the Data –

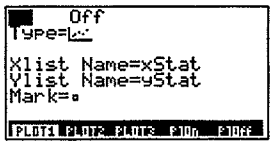
- To plot the data points, you must first change the viewing window to fit your data. To do so, press [GRAPH], then [F2] (WINDOW). Choose the appropriate xMin, xMax, etc. for your data.



- Now, press [2nd] [+](STAT). Then, press [F3] for PLOT.

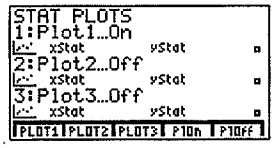


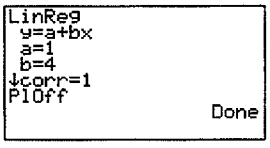
- Press [F1] for PLOT1.
- Make sure that ON has a blinking highlight and press [ENTER].
- Be sure that all options are appropriate: the picture highlighted should be a graph with dots, the Xlist should highlight your input data list (usually xStat), the Ylist should highlight your output data list (usually yStat), and the Mark is your preference.



- Now, press [GRAPH]. Then, [F5] if necessary.

- **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 STAT and PLOT menus (by pressing [2nd] [+] [F3]). Then, press [F5] for PlOff followed by pressing [ENTER].





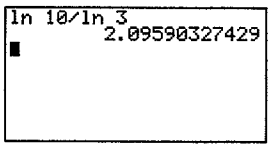
LOGARITHMS, EXPONENTS, AND TRIGONOMETRY – TI 86

Calculating the Logarithm of a Number: Two keys 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), simply press [LOG] [9] [0] [ENTER]. (Result ≈ 1.95)

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 to find logarithm.

Example: To calculate $\log_3(10)$, you must find the quotient of ln(10) and ln(3) by pressing [LN] [1] [0] [÷] [LN] [3] [ENTER]. (Result ≈ 2.0959)



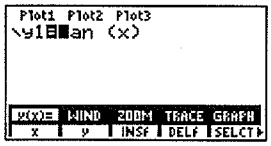
Calculating *e* Raised to a Power: The e^x option is located "behind" the [LN] key.

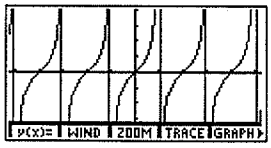
Example: To calculate e^2, press [2nd] [LN] [2] [ENTER]. (Result ≈ 7.389)

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 [2nd] [MORE] (MODE). Then, use your down arrow ([▼]) and right arrow key ([▶]) to highlight Degree. Once it is highlighted press [ENTER]. You may now press [EXIT] to get back to the home screen. 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 or ZTrig". Once you have entered your function under the "y(x)=" menu, you may press [2nd] [F3] (ZOOM), [MORE], then [F3] then ZTrig. 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 [GRAPH] [F1] (y(x)=) [TAN] [(] [X-VAR] [)]. Then, press [2nd] [F3] (ZOOM). Then, press [MORE] and [F3] (ZTRIG).





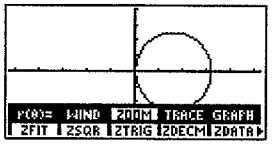
****NOTE: THE VERTICAL LINES IN THE GRAPH REPRESENT ASYMPTOTES AND ARE NOT PART OF THE FUNCTION'S GRAPH!**

OTHER GRAPHING – TI 86

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 [2nd] [MORE] (MODE). Then, use your down arrow key ([▼]) and right arrow key ([▶]) to highlight "Pol". Press [ENTER].
- Now, you are ready to enter your function by pressing [GRAPH] [F1] (r(θ)=). You will now be entering an equation for "r" in terms of "θ".

  Example: To enter $r = 5\cos(\theta)$, press [5] [COS] [(] [F1] [)]. (The [F1] is for the θ symbol.) Then, press [2nd] [F5] (GRAPH). You may then press [F3] (ZOOM) [MORE] [F3] (ZTRIG) for a better picture.

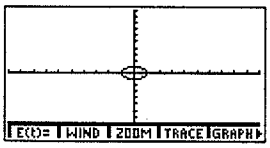


- It is important to make sure all "WINDOW" options are appropriate for your graph. After pressing [F2] for WIND, you will see options for θMin, θMax, and θStep. These options allow you to set the amount of your graph that is shown. The smaller the θStep chosen, the more smooth the curve will look (and 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 polar coordinate mode, press [2nd] [MORE] (MODE). Then, use your down arrow key ([▼]) and right arrow key ([▶]) to highlight "Param". Press [ENTER].
- Now, you are ready to enter your function by pressing [GRAPH] [F1] (E(t)=). 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 [COS] [(] [F1] [)]. Under "yt1", press [SIN] [(] [F1] [)]. (The [F1] is for "t".) Then, press [2nd] [F5] (GRAPH).



- It is important to make sure all "WINDOW" options are appropriate for your graph. After pressing [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 86

Matrices: Matrix operations on the TI 86 are controlled by the menus under the MATRX window, accessed by [2nd] [7] key. There are many parts to the matrix menu, some of which are summarized below.

NAMES: All matrices must be named to use. If you hit [F1] for NAMES, you should see all the names stored thus far. You will use this sub menu to insert matrices into the calculator memory when you want to manipulate them.

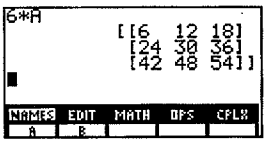
EDIT: To enter or change matrices, you use the EDIT option, [F2]. You may then see something similar to the picture below. It depends on whether you had a matrix stored there already. You pick the dimension, and then enter the individual elements, row by row.

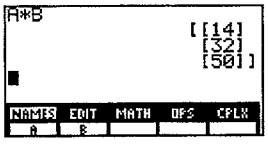
Example: To enter the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$ into name A, you would hit [2nd] [7] [F2] [LOG] (the letter A - when it asks for name it puts the calculator into alphabet mode) [ENTER] [3] [ENTER] [3] [ENTER] [1] [ENTER] [2] [ENTER] [3] [ENTER] [4] [ENTER] [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 [EXIT]; **DO NOT** hit [2nd] [7] from the editing mode. To enter the matrix that we just input, hit [2nd] [7] [F1] [F1] [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] [×] [2nd] [7] [F1] [F1] [ENTER].

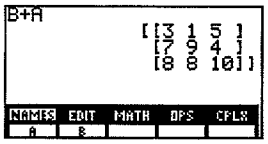
You should get the matrix shown below left.





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. Hit [2nd] [7] [F2] [SIN](inserts the letter B) [ENTER] [3] [ENTER] [1] [ENTER] [1] [ENTER] [2] [ENTER] [3] [ENTER] [EXIT] [2nd] [7] [F1] [F1] [×][F2] [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]. Hit [2nd] [7] [F2] [SIN] [ENTER] [3] [ENTER] [3] [ENTER] [2] [ENTER] [(-)] [1] [ENTER] [2] [ENTER] [3] [ENTER] [4] [ENTER] [(-)] [2] [ENTER] [1] [ENTER] [0] [ENTER] [1] [ENTER] [EXIT] [2nd] [7] [F1] [F2] [+] [F1] [ENTER]. The answer is below.



Inverses: To find the inverse of a matrix, use the [2nd] [EE] (x^{-1}) key. 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. [2nd] [7] [F2] [COS] [ENTER] [2] [ENTER] [2] [ENTER] [2] [ENTER] [3] [ENTER] [1] [ENTER] [2] [ENTER] [EXIT] [2nd] [7] [F1] [F3] [2nd] [EE] [ENTER] (Result is $C^{-1} = \begin{bmatrix} 2 & -3 \\ -1 & 2 \end{bmatrix}$)

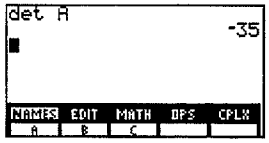
Solving Systems: To solve a system of n equations in n unknowns, let [A] be the coefficient matrix, and [B] be the constant matrix, and then find [$A^{-1}B$].

Example: To solve the system $\begin{Bmatrix} 4x + y - 3z = 11 \\ 2x - 3y + 2z = 9 \\ x + y + z = -3 \end{Bmatrix}$, 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 hit:

[2nd] [7] [F2] [F1] [ENTER] [3] [ENTER] [3] [ENTER] [4] [ENTER] [1] [ENTER] [(-)] [3] [ENTER] [2] [ENTER] [(-)] [3] [ENTER] [2] [ENTER] [1] [ENTER] [1] [ENTER] [1] [ENTER] [EXIT] [2nd] [7] [F2] [F2] [ENTER] [3] [ENTER] [1] [ENTER] [1] [1] [ENTER] [9] [ENTER] [(-)] [3] [ENTER] [EXIT] [2nd] [7] [F1] [F1] [2nd] [EE] [×] [F2] [ENTER]. The answer is x = 2, y = -3, z = -2

Determinants: To find a determinant of a matrix, use the MATRX MATH option, which is found with [2nd] [7] [F3]. Hit [F1], put in the matrix name, and then hit [ENTER].

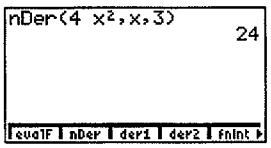
Example: The determinant of [A] = $\begin{bmatrix} 4 & 1 & -3 \\ 2 & -3 & 2 \\ 1 & 1 & 1 \end{bmatrix}$ is found by with [2nd] [7] [F3] [F1] [2nd] [7] [F1] [F1] [ENTER]. The answer is –35.



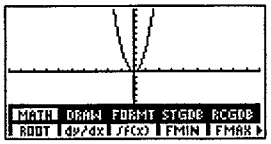
DERIVATIVES AND INTEGRALS – TI 86

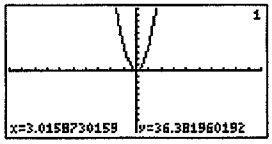
Approximating a Numerical Derivative: The TI calculator allows you to find the derivative of a function at a point using the "nDer" command. This command is located under the CALC menu (behind the [÷] key). Once you obtain the command, you must enter the function you are differentiating, followed by the variable with which you are differentiating, followed by the value. (Be sure to place commas between these items.)

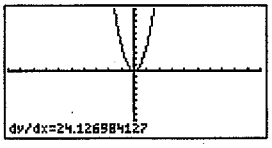
Example: To find the derivative of $y = 4x^2$ at $x = 3$, press [2nd] [÷] [F2] (nDer) [4] [X-VAR] [x^2] [,] [X-VAR] [,] [3] [)] [ENTER]



Alternate Option for the Numerical Derivative: You may also find 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 [MORE] [F1] (MATH). Press [F2] for "dy/dx". Use your right and left arrow keys to find the x-value for which you wish to find the derivative and press [ENTER].

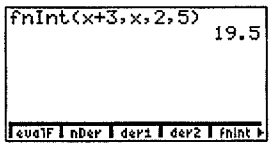




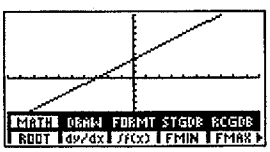


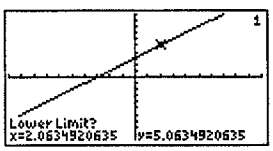
Approximating a Definite Integral: The TI calculator allows you to find a definite integral using the "fnInt" command. This command is located under the CALC menu (behind the [÷] key). Once you obtain the command, you must enter the function you are integrating, followed by the variable with which you are integrating, followed by the limits of integration. (Be sure to place commas between these items.)

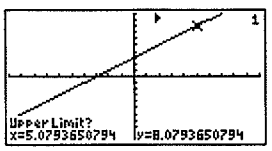
Example: To find $\int_2^5 (x+3)dx$, press [2nd] [÷] [F5] (fnInt) [X-VAR] [+] [3] [,] [X-VAR] [,] [2] [,] [5] [)] [ENTER].

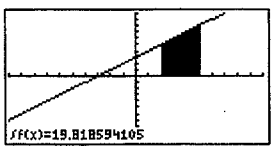


Alternate Option for the Definite Integral: You may also find the definite integral after you graph the function. To do so, first graph the function. (Try graphing $y = x + 3$ from the previous example.) Then, go into the MATH menu by pressing [MORE] [F1]. Press [F3] for "$\int f(x)$". Use your right and left arrow keys to find lower limit of the definite integral, press [ENTER], use the right arrow key to find the upper limit, and press [ENTER].



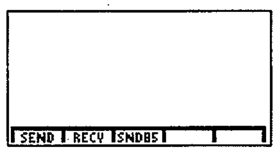






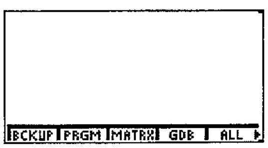
LINKING – TI 86

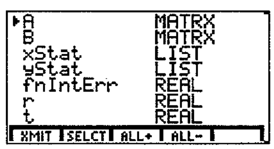
Linking: To send information from one calculator to another, you only need a linking cable. If you wish to send information to and from a computer, you need the linking software (available online from TI) and you need the calculator-serial port cable which is available for purchase form TI. These directions 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] [x-VAR] (LINK). That accesses the following menu.

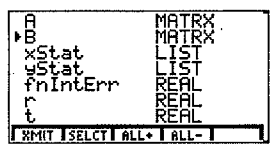


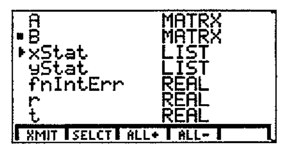
RECIEVE: On the receiving calculator, you first hit [2nd] [x-VAR] (LINK). Then you hit [F2] (RECV). It should start waiting for information to be sent.

SEND: On the sending calculator, from the menu shown above you pick [F1] (SEND). You then get the menu shown below left. Usually the most flexible way to proceed is to pick [F5] (All). 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 [F2](SELCT). If you move down another row, you can see that a little square is in front of B (above right). That means it has been selected, and it is ready for transfer. You may also select any others you wish to send. Then hit [F1] (XMIT) to transmit the information.