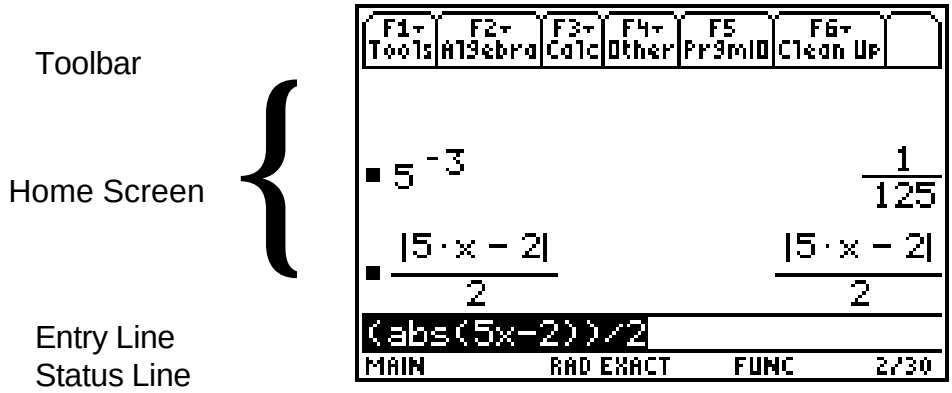
Getting Started with the TI-89

(revised January 5, 2003)

About the screen



Adjusting the screen contrast

Turn on the TI-89 by hitting **ON**, the lowest left key. A flashing black skinny rectangle, ▮, should appear on the left hand side of the Entry Line, near the bottom of the screen. If the box does not appear, press **CLEAR**. If the screen is too light to see the Toolbar or Status Line, hold down ◆ (diamond symbol inside a green border) and momentarily press + (plus key) to darken the screen. If the screen is too dark, hold down ◆ and momentarily press **(-)** (minus key) to lighten the screen. Keep repeating this process until the screen contrast is at a comfortable level.

Accessing the 2nd (yellow) commands

To access the yellow commands which are printed above the keys, press the yellow **2nd** key, and then press the desired key for the yellow operation. It does not work like a "shift" key; you do not need to hold it down. Once you press **2nd**, the Status Line displays a **2ND**. To undo this, press **2nd** again. You must press **2nd** each time prior to accessing a yellow command.

Accessing the purple letters

To access the purple letters and symbols which are printed above the keys, press the purple **alpha** key, and then press the desired key for the purple letter (it will print lower case) or symbol. It does not work like a "shift" key; you do not need to hold it down. Once you press **alpha** the Status Line displays an 'a'. Pressing a second time (or **2nd** **alpha**) it works like a typewriter, the Status Line will display a bolded 'a'. It locks in the purple mode so that you can do a series of letter or symbols without pressing **alpha** each time. To undo this, press **alpha** again, this will cancel the alpha-lock sequence and return the calculator to standard key operations.

The TI-89 also does upper case letters. Press [↑] and then the letter key. The Status Line will then display an arrow when the [↑] key is pressed. Pressing [↑] and [alpha] works like the caps lock on a typewriter, the Status Line will display a bolded "A". Pressing [2nd] [alpha], not [↑] again, cancels the upper case alpha-lock, pressing [alpha] cancels the alpha mode entirely and returns the calculator to standard key operations.

Accessing the green diamond (diamond) commands

To access the green commands press the [◆], and then the desired key for the green operation. It does not work like a "shift" key: you do not need to hold it down. Once you press [◆] the Status Line displays a [◆] . To undo this, press [◆] again. You must press [◆] each time prior to accessing a green command.

Editing

If you have not yet pressed [ENTER] (located in the lower right hand corner), you can correct a line by using the left and right blue cursor keys. After you have pressed [ENTER], you can recall the previous line by using the up and down blue cursor keys. The TI-89 retains as many as 30 of the previous entries. You can access those entries by continuing to scroll up.

Using a Menu

The TI-89 uses partial to full screen menus to access many additional operations. When you press a function key, [F1], [F2], … or a yellow or blue command key, that menu superimposes over the screen you are working on. For example, press [F1]. Notice how some of the screen is still visible. Use [▲] [▼] cursor keys to select an item, followed by [ENTER]; or you can simply press the number of the item you want to select. You will then be returned to the home screen, your previous screen.

To exit from a menu without executing a function, press [ESC].

Some menus have submenus, for example the Math menu, [2nd] [5]. You can observe more options by pushing the [▶] cursor, this will get you to the submenu, then [◀] or [ESC] will get you back to the original menu. Use the above directions to select an item in the submenu.

To exit a submenu without executing a function, press [ESC] [ESC] or QUIT ([2nd] [ESC]) and you will be brought back to the home screen.

Exploring the calculation features of the TI-89

To utilize this worksheet you need to have your toolbar set to its default mode. If the **F1** menu represents "Tools" then continue on. If it does not read tools then press **2nd** **HOME** to change back from a custom menu. Also, the "Complex Format" mode must be set to "REAL". To do this, press **MODE**, scroll down to "Complex Format", then press ▶ 1. Hit the **ENTER** key to save your changes.

Pressing **CLEAR** once will clear the entry line. To clear the home screen, press **F1** and select #8, "Clear Home".

The contents of your last calculation are stored in 'ans', which is **2nd** **(-)**, and displays ans (1), the next to last answer is stored in ans (2), the third to last in ans (3) and so on. You must use the cursor to go back and change the (1) to a (2) or (3) yourself.

Raising to powers

14^2 (Use the ^ key to enter exponents. Ex: 14 ^ 2 for 14^2) (answer is 196)
-11^2 (Use the **(-)** key for a negative not the minus key) (answer is -121)

23^3 (answer is 12167)

5^{-3} (answer is .008)
$256^{\frac{3}{4}}$ (Use parentheses around fractional exponents) (answer is 64)

Square roots

$\sqrt{576}$ ($\sqrt{}$ is above the multiplication sign) (answer is 24)

$\sqrt{3^2+4^2}$ ($\sqrt{}(3 \wedge 2 + 4 \wedge 2)$) (answer is 5)

Roots other than square roots – the TI-89 doesn't take cube or other roots.

$\sqrt[3]{-8^5}$ (The index is the reciprocal of the power it represents. Ex: $\sqrt[3]{x}$ is the same as $\times\wedge(1/3)$, therefore, find (-) 8 ^ (5/3); answer is –32)

$\sqrt[5]{(-243)}$ (find (-) 243 ^ (1/5); answer is -3)

Absolute values
$|-12+7|$ (The absolute value can be found in the Math, Number menu. To open this menu, press **2nd**, 5, 1. ▲ Choice **2: abs(** is the absolute value function) (answer is 5)

Changing answer from decimal to fraction

$\frac{3}{5}+\frac{2}{7}$ (To see the answer as a fraction, press [MODE]. Choose exact for a fraction; answer is 31/35.)

Trigonometry

1. The length s of the arc intercepted on a circle of radius r by a central angle of measure q radians is given by the formula $\mathbf{s} = \mathbf{r}\,q$. A circle has radius 18.2 centimeters. Find the length of the arc intercepted by $144°$.

   Press the **MODE** key and make sure your Angle setting is "Radians".
   Enter 18.2 x $144°$ (the degree symbol is found above [D], which is the key to the left of the 7 key). Notice that the calculator automatically converts degrees to radians! (answer is approximately 45.7 cm)

2. Find cos $135°23'38''$ (answer is -.711951151)

   Press **2nd** [Z] for cos. Enter 135 followed by the degree sign (which is located above the [D] key). Next enter 23 followed by the ' above the [=] key. Enter 38 followed by the " which is located above the **1** key. Close the parentheses with the [ )] key and press **ENTER** to find the answer).

Complex Mode

$\sqrt{-16}$ (If your Complex Format (in the MODE menu, **MODE**) is set to REAL, an ERROR box will come up. Press **ESC** to get back to the Home Screen and then change your Complex Format to RECTANGULAR in the MODE Menu. Try again in this new mode. Answer looks like $4.\cdot i$ which is interpreted as 4i.)

Catalog function

The CATALOG function will give you quick access to functions, operations, and variables. Press **CATALOG**, then press the first letter of the function for which you are searching (the **alpha** key is not needed.) The TI-89 will automatically place you at the first alphabetical listing for that letter. Pressing **ENTER** selects the function. For example, locate the gcd (greatest common divisor) function and press **ENTER**. Find the greatest common divisor of 23,894 and 8,243,118 by typing 23894,8243118). (The answer is 26) For Function names that begin with symbols, start at Z and scroll down the list until you find what you were looking for.

Exploring the Graphing Feature on the TI-89

Make sure your Graph mode is set to "FUNCTION" in the MODE menu.

1. Enter an Equation

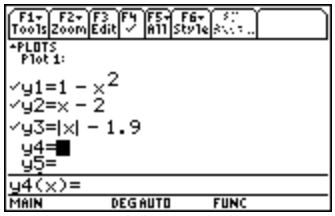
The five keys located below the screen access the graphing features of the TI-89.

Pressing **APPS** 2 will give us a menu to enter functions that we want to graph. Also, ◆ **F1** will bring us to this menu.

The ◆ **F2** key gives us the size of the coordinate plane that will appear on the screen.
The ◆ **F1** **F2** key gives us a menu of zoom choices.
The ◆ **F3** key is what we press to get the graph after we have defined a window.
The ◆ **F3** **F3** key locates specific values on the graph.

Press ◆ **F1**. Delete any functions you have using **CLEAR** and enter :

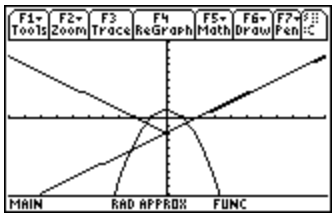
$1-x^2$ (Use the X key, which is in the first column of keys.) for y1,
$x-2$ for y2, and
$abs(x)-1.9$ for y3.



2. Graphing an Equation

Press **F2** **6** (Zoom Standard) to get the default window of 10 x 10.

Your screen should look like the following:

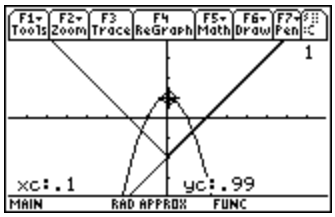


Press **F3**.

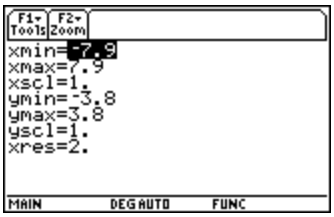
You should see a “spider” cursor, the values for X and Y displayed on the screen as xc and yc. A “1” is displayed in top right corner to denote y.

Press the right and left arrow keys to “move” along the parabola.
To jump to another curve, press the up or down arrow. The number in the upper right hand corner will change to correspond to the equation in the Y=menu. Practice moving along the different curves.

As you trace, you will notice that the x values are primarily long decimal numbers. The calculator draws a graph by figuring the value of each “pixel” on the screen. The difference between each pixel is often an awkward value. Press **F2** **4** (ZoomDecimal). Press **F3** and notice that the x values are now short decimal numbers.



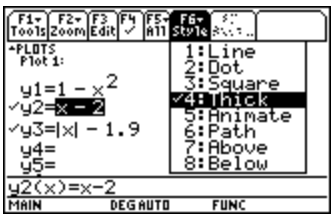
ZStandard was a 10 x 10 window. Press ◆ **F2** to view the values of the ZDecimal screen.



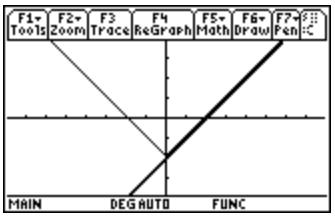
These values look odd, but they are multiples of the number of pixels contained on the TI-83 screen. Therefore, the values of x change in nice multiples of .1. This screen is called a “Friendly Screen” because the values you trace are more like you would choose if you were graphing by hand. ZoomINT is also a friendly screen. Why?

Press ◆ **F1** to return to the list of functions. We want to “turn off” the parabola ($y=1-x^2$) and look at just the second and third equations. Move your cursor to highlight the right side of y1 and press **F4**.

We can differentiate between the two curves by changing the drawing style on one of them from a thin line to a thick line. Move your cursor in front of Y2. Press **2nd** **F1** to see the different style choices. Choose 4: Thick.



Now press ◆ **F3** and the parabola should no longer be present.

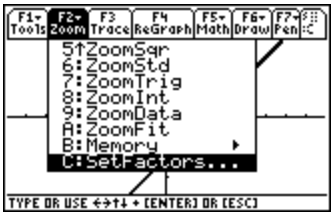


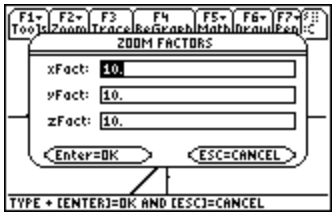
To examine the behavior of the two functions on the right side, we can use the **F2** feature.

To get a closer look at what is happening, we will magnify the graph on the right hand side, using the "zoom in" feature.

First, check what the extent of change will be when you use "zoom in".

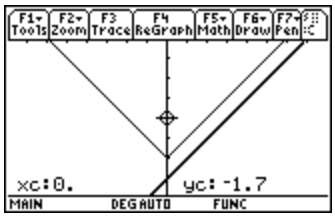
Press **F2** and then move your cursor down to C: Set Factors . . .





If your factors are not all 10, set them to 10. These factors define the magnification or reduction factor that will be used to zoom in or out around a point.

Press **F2** and select option 2, Zoom In. The graph will reappear, and the cursor will be blinking in the middle of the screen (at (0,0)). Move your cursor down to the point where the two graphs come together. This is the point at which we want to see the behavior. Now press **ENTER**.



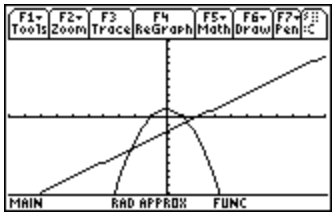
It is now easy to see that the two graphs do not touch. Press **F2** and select Zoom In again. Move your cursor to a point to zoom in on. Press **ENTER**.

Now try Zoom Out. Remember that when you call up Zoom In or Zoom Out, the calculator will first give you a chance to move the cursor to a new center. The zoom will not take affect until you press **ENTER**.

3. Use a graph to calculate values

Press ◆ F1. Turn on y1 by moving your cursor over the expression of y1 and press F4. Turn off y3 by moving your cursor over the right side of y3 and pressing F4.

Press F2 6 (ZoomStd) to get the default window of 10 x 10.
Your screen should look like the following:



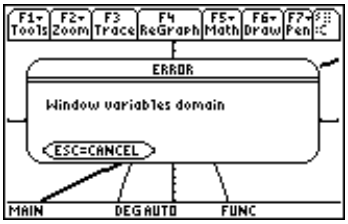
You know how to trace, but tracing gives you values selected by the calculator. Suppose you want to find the value of $y1=1-x^2$ when x=5.

Press F3 to start tracing.

Enter 5 and press ENTER. The calculator will return a value of –24 for yc.

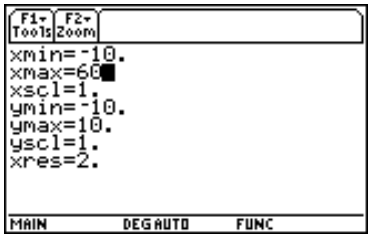
Use the down arrow to move to the line. Enter 5 and Press ENTER. The y value will change to 3. Enter –2.345. The calculator will respond with –4.345 for yc. If you move to the parabola and enter –2.345 and press enter, the y-value is –4.49903.

Enter 52. You should get the following:

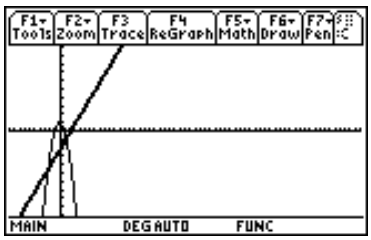


The value function only works if the value that you ask for is part of your window!

Press ENTER to exit the error screen and then press ◆ F2. Our window has x-values from –10 to 10. We want to enter the value of 52, so change the xmax (the maximum value that x can be) to 60 by moving your cursor down and typing 60 over the 10:



Press ◆ F3:



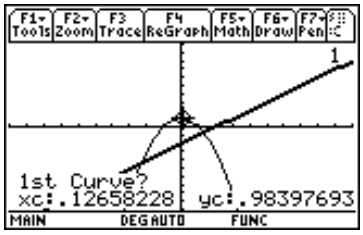
Now, Start trace F3 and enter 52. The calculator should tell you that Y=-2703.

4. Finding intersection points

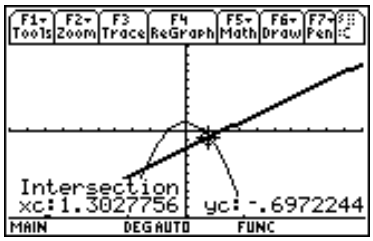
Press F2 6 (ZoomStd) to get the default window of 10 x 10.

Press F5 to find intersect. Press 5 to select intersect.

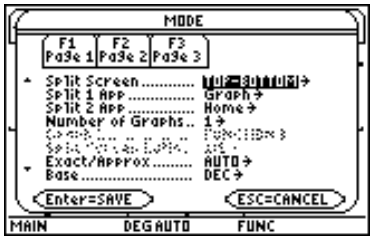
This function automatically locates intersection points.



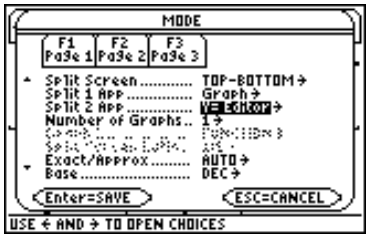
Notice the "First curve?" question on the screen. Your first curve is the parabola, so press **ENTER**. The cursor jumps to the line and the question "Second curve?" appears. Your second curve is the line, so press **ENTER**. Now it will ask you for lower bound and upper bound. Scroll Left and Right and press **ENTER** to select these. Your screen should show the intersection.



(**optional**) Press **MODE** and select option 2: TOP-BOTTOM from the Split Screen menu of choices.

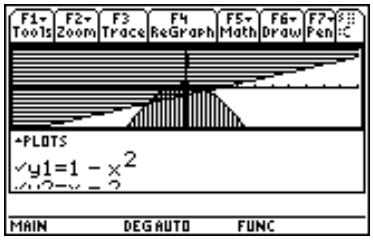


Press **ENTER** to exit. The top part of the screen will not be for graphing and the bottom part will be the home screen.



Must select **MODE**, Split 2 App 2: y=Editor to make the bottom screen . . . show the equations you used to graph. Move your cursor in front of y_1. Use **2nd** **APPS** to switch the active window if you need to. Press **2nd** **F1** to select "Below". Move your cursor in front of y_2.

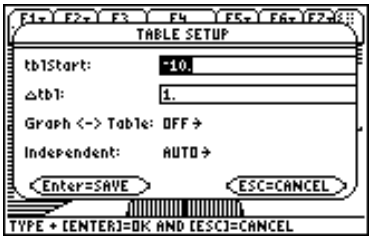
Press **2nd** **F1** to select "Above". Press ◆ **F3**.



You can access any function in the bottom part that you normally access from the home screen. Return to Full Screen by pressing **MODE**, then move your cursor over Split Screen and select 1: Full. Press **ENTER** to exit.

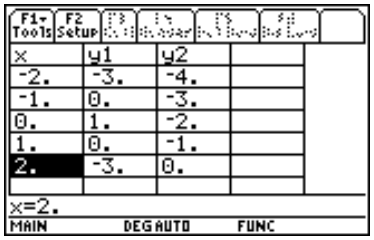
5. Calculate a Table of Values

Press ◆ **F4** to select the TblSet (Table Set) option.
Make your window match the following:



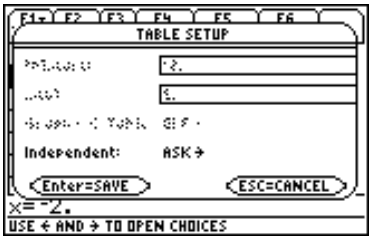
Press **ENTER**. Press ◆ **F5** to select the TABLE option. For each X, (in this case we are starting at –10 and increasing by 1), it displays the value of y1 ($1-x^2$, in this case) and y2 (x-2, in this case). Scroll through the values using the up and down cursor keys.
For what value of x is $y_1 = 0$?

For what value of x is $y_2 = 0$?

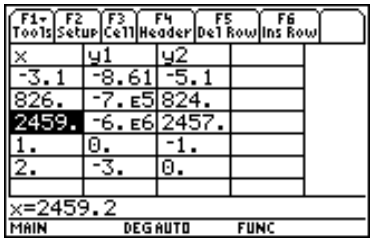


Suppose you want to know the values of y_2 for some specific values of x, say at –3.1, 826, and 2,459.2.

Return to the TblSet function by pressing ◆ **F4**. X is the independent variable, so select **Ask** across from Independent: by moving your cursor and pressing ▶ **2**.



Press ◆ **F5** to select the TABLE option. The TABLE still holds the old values, but you can enter new x-values over the old ones. Enter –3.1 **ENTER**, 826 **ENTER**, 2,459.2 **ENTER**, as three x-values. The y-values you get may be slightly different depending on what "Display Digits" is set to in the Mode menu.



The values for y_1 and y_2 will fill in automatically. Press ◆ **F4** and select "Auto" for Independent: then press **ENTER**.

This page has been added for printing purposes.