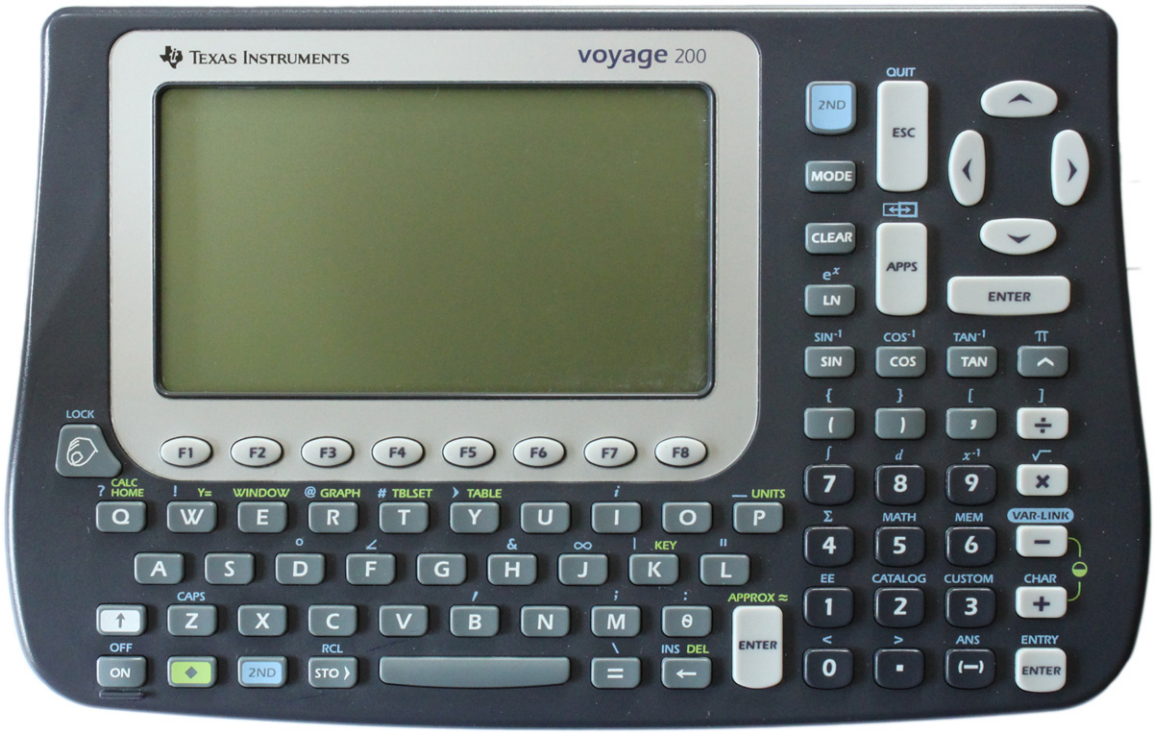
# Introductory Handbook for the TI Voyage 200



# Contents

# Chapter 1

# The Layout of Your Calculator

## 1.1 Functions Keys

Immediately beneath your calculator's screen is the following:


These buttons, F1 through F8 , are your function keys. As with regular computers, function keys all you access to additional features of the different applications you will use. How these are used in the various applications will be explained in the appropriate sections of the handbook.

## 1.2 Blue 2nd and Green Diamond

At the bottom left of your calculator, you have the following:


The two buttons ◆ and 2ND are some of the most important buttons on your calculator.

Almost everything on your calculator is color-coded. To be able to use items or commands that are blue or green, you must first press the corresponding button: ◆ or 2ND .

Find the R button under F3 .


Above R , you have "@" in blue and "GRAPH" in green.
If you wanted to use the "@" command, you would need to first press 2ND and then R .
If you wanted to use the "GRAPH" command, you would press ◆ and then R .

## 1.3 Arrow Keys

At the top right of your calculator, you have the following arrow keys:

These will allow you to move up, down, left, or right in graphs, menus, etc.

## 1.4 Delete and Clear

The  button, located on the bottom of the keyboard and to the right of the spacebar, will delete one space to the left of the cursor.
The 

button, located to the right of the screen, will clear an the entire line, function, or other entry that you have highlighted.

## 1.5 Other Important Buttons

The  button acts as your ”shift” button when using any of the letter keys.

The 

button will act like ”esc” button on a computer. It will exit out of a menu without saving any changes or choosing any options.

The 

button will cancel an operation that is in progress: it will stop graphing mid-graph, stop calculating mid-calculation, etc.

# Chapter 2

# The Most Basic Basics

## 2.1 Turning the Calculator On and Off

To turn on your calculator, press ON located in the lower left corner.

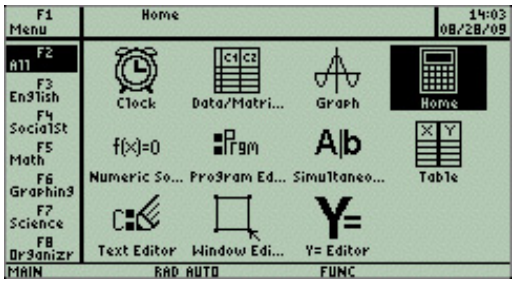
To turn off your calculator, press 2ND and then ON since "OFF" is above ON in blue.
Note: Your calculator will turn itself off after a few minutes of inactivity to save power.

## 2.2 Adjusting the Screen Contrast

To make the screen darker, hold down ◆ and press + .
To make the screen lighter, hold down ◆ and press − .

## 2.3 The App Screen

When you turn your calculator on, you'll have a screen that looks something like this:




This is the App Screen. From this screen, you can access the Flash applications that you have on your calculator. You can scroll up or down with the up/down arrow keys to see the other applications that came preinstalled or that you have downloaded. To return to the App Screen at any time, use the calculator's "QUIT" function. To do so, press 2ND followed by ESC .

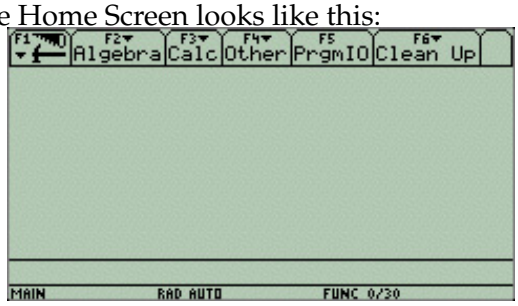
## 2.4 The Home Screen

The Home Screen that is highlighted in the picture in section 2.3 is where you will do all of the calculations that you normally think of doing on a calculator, such as adding, subtracting, etc. To get to the Home screen either:

a. press ENTER while "Home" is highlighted in the App Screen, or

b. press the ◆ Q, since "CALC HOME" is in green above Q.

The Home Screen looks like this:




## 2.5 Pretty Print

One of the nicest things about the TI-89 calculator is the fact that it uses Pretty Print. Pretty print is the option to display symbolic mathematics in the format that you would normally use when writing mathematics. On most other calculators, $x^4 - 7x^2 + 1$ would look like "$x \wedge 4 - 7x \wedge 2 + 1$." On the TI-89 Titanium, $x^4 - 7x^2 + 1$ will look like "$x^4 - 7x^2 + 1$."

## 2.6 The Catalog

The calculator has a limited amount of space on the keypad and cannot have a button for every operation or command that it can carry out. All of the preprogrammed commands are stored in the calculators catalog. Find the word "CATALOG" above the 2 button in blue. To access the catalog, press 2ND 2. This will allow you to see an alphabetical list of all the commands the calculator has. To make use of any command, you can scroll up or down with the up/down arrow keys to move the triangle next to the command that you want to use. Once the triangle is pointing at the command, press ENTER and the command will be brought to the application you were using.

You can also jump to any letter by pressing the key that corresponds to the appropriate letter.

**Example:**
You want to get to the **rand(** command in the catalog, but you're currently at **abs(**. Press R and you will jump to the beginning of the Rs in the catalog. Then use the up/down arrows to scroll down to **rand(**.

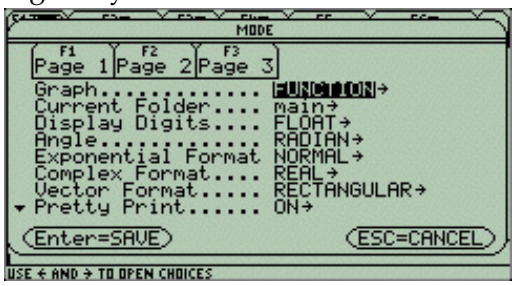
# Chapter 3

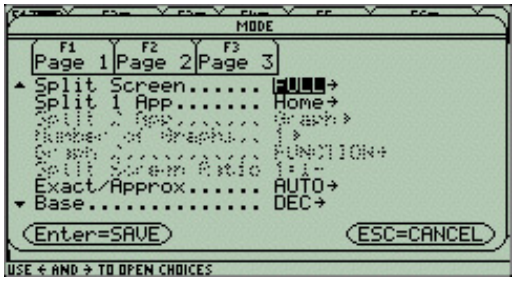
# The Settings

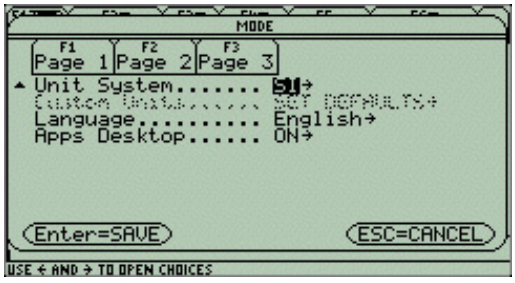
## 3.1 The MODE Button

Before you do anything else, you want to make sure the settings on the calculator are what you will want for most of the mathematics courses you'll take. Keep in mind you might use different settings in certain classes, but your instructor will inform you when these settings need to be changed.

Press MODE, located under 2ND to the right of the screen, to access the settings. There are 3 pages of settings and you can use F1, F2, and F3 to view each page. Within a page, use the arrows to scroll up or down between the options. The following are the settings I use on my calculator, for the three respective pages. I would recommend that you use the same settings for most classes. Again, your instructor will indicate when you need to vary from these settings for your class.



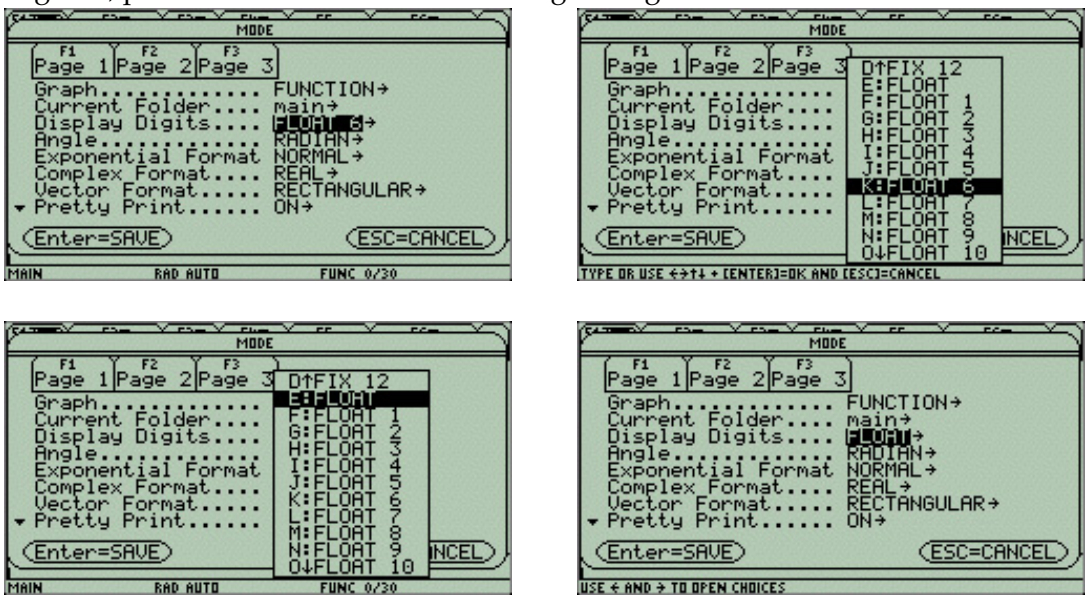

Some options are grayed out, as they are not options you can change.

## 3.2 Changing a Setting

Press F1 to view the first page of settings.

If your calculator is brand new, your "Display Digits" option is probably set to "FLOAT6."

You want to change that from "FLOAT6" to "FLOAT." To do so, scroll down with the up/down arrows to the "Display Digits" setting. Press the right arrow to see the other options available for the "Display Digits." Use the up/down arrows to scroll up to "FLOAT." Once you have FLOAT highlighted, press ENTER once to make the change and go back to the MODE window.




Repeat the same process for all other settings you want to change.

**IMPORTANT:**
To actually save all of the changes you have made, you **must** press ENTER a second time.

Note:
When you press ENTER the second time, you will be brought back to the application or screen you were using prior to pressing MODE .

# Chapter 4

# Performing Calculations

Go to your Home Screen by pressing [◆] [Q].

## 4.1 Clearing the Home Screen

If you have anything in your Home Screen, you'll want to clear it out now. To do this, access the Tools menu, [F1]. Option 8 is "Clear Home." There are two options for using this command.

a. Scroll down with the arrows keys until Clear Home is highlighted and then press [ENTER].

b. Press [8] to select the 8th command. (This is a handy short cut.)

You can do this anytime you want to clear everything out of the Home Screen.

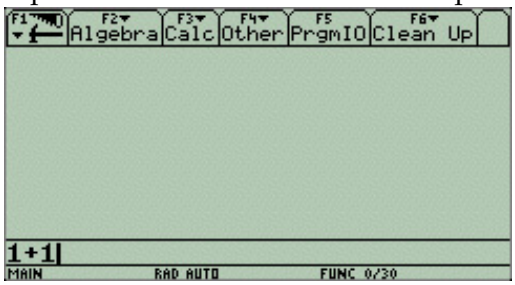
## 4.2 Addition, Subtraction, Multiplication, Division

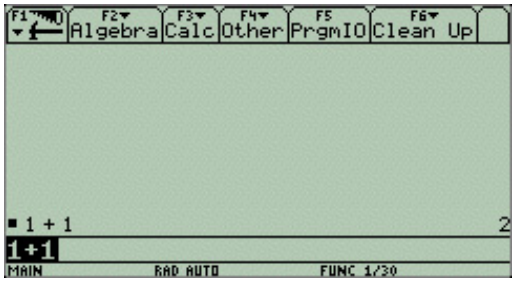
In the Home Screen, you enter your calculations on the bottom line, the Command Line.

**Example:**

To add $1 + 1$, type [1] [+] [1]. This will appear in the Command Line.

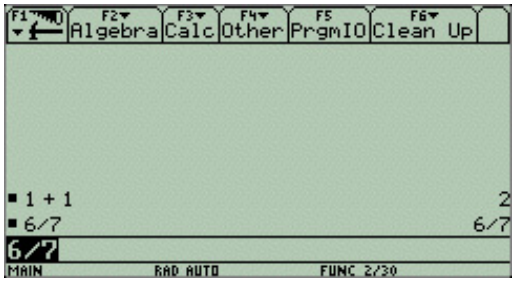
Now press [ENTER] to have the calculator perform the calculation.




What you typed in will appear on the left and the result will appear on the right.

**Example:**
To divide 6 by 7, type [6] [÷] [7] [ENTER]




With the division, notice it told you that 6 divided by 7 is 6/7. This is because the calculator will give you the exact value if you do not use any decimals in what you type in to the calculation. If you had entered something with a decimal point, the calculator would give you an approximate value. A later section will explain how to obtain an approximation if you need it.

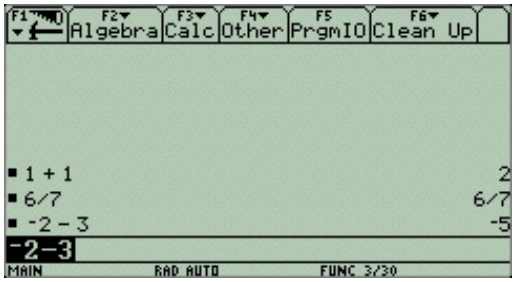
## 4.3 $x$ vs $\times$

Find [X] and [×] buttons on your calculator.
[X] is between [Z] and [C]. This is the button for the letter or variable $x$.
[×] is in the right column with the [+], [−], and [÷] buttons. This is the button for multiplication.

## 4.4 Negative Numbers vs. Subtraction

The calculator has one key for subtraction, [−], and a different key for negative numbers, [(−)]. These two buttons are not interchangeable. If you use the wrong button, the calculator will either give you an error message or will perform a different calculation than what you had intended to calculate.

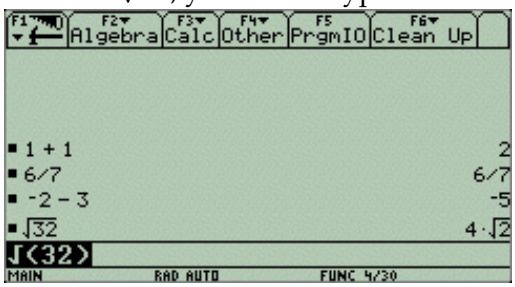
**Example:**
To calculate $-2-3$, you would type [(−)] [2] [−] [3] [ENTER].



## 4.5 Square Roots

Above [×], you will find the $\sqrt{\ }$ symbol in blue. Press [2ND] [×] to use the square root.

**Example:**
To calculate $\sqrt{32}$, you would type [2ND] [×] [3] [2] [)] [ENTER].




With the square root, you should notice a few things:

a. When you press [2ND] [×], it gave you the radical and the opening parenthesis. You needed to provide the closing parenthesis after the 32. If you do not insert the closing parenthesis, the calculator will give you a error message.

b. As with the 6/7, this calculation also gave you the simplified exact value, $4\sqrt{2}$, and not an approximation, about $5.65685425$.

## 4.6 Exponents

To use exponents, you need to use the [^] key to indicate you have an exponent. If you are using fractional exponents, make sure you put parentheses around the exponent.

**Example:**
To calculate $3^5$, you would type [3] [^] [5] [ENTER].

**Example:**
To calculate $8^{1/3}$, you would type [8] [^] [(] [1] [÷] [3] [)] [ENTER].

## 4.7 Cube Roots and Other Radicals

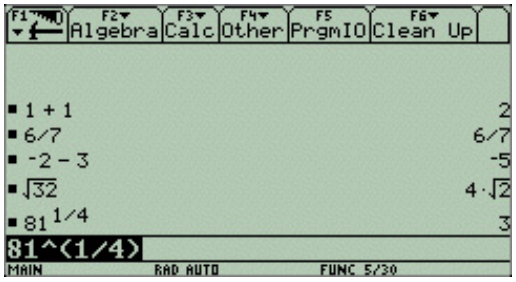
The calculator does not have a button for any roots other than the square root. To calculate the $n^{th}$ root of a number, you have two options.

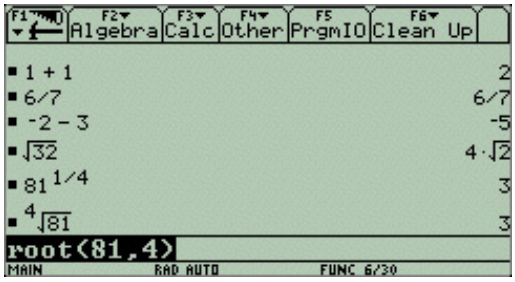
a. Use the fact that $\sqrt[n]{x} = x^{1/n}$ and enter the radical as a fractional exponent.

   **Example:**
   To calculate $\sqrt[4]{81}$, remember that $\sqrt[4]{81} = 81^{1/4}$.
   Type [8] [1] [^] [(] [1] [÷] [4] [)] [ENTER].

b. If calculator's operating system is 3.10 or higher, you can go to the catalog and find the **root(** command. The root command uses the format $root(radicand, index)$. After selecting **root(** from the catalog, you need to enter in the radicand, followed by a comma, followed by the index, and then a closing parenthesis.

   **Example:**
   To calculate $\sqrt[4]{81}$, you need the command line to read $root(81, 4)$.
   Select **root(** from the catalog and then type [8] [1] [,] [4] [)] [ENTER].



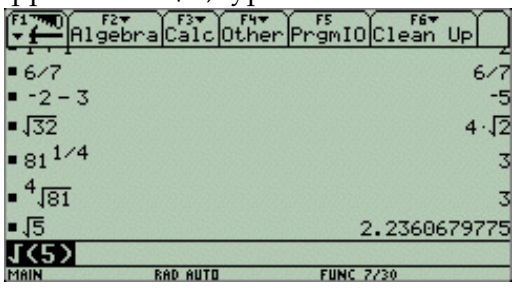




Notice with the **root(** command and pretty print, the radical is displayed as $\sqrt[4]{81}$.

## 4.8 Exact vs. Approximate Results (a.k.a. $\sqrt{5}$ vs. $2.2360679775$)

Look above [ENTER] to see the "≈" symbol in green. If you want to obtain an approximate or decimal value, press [◆] [ENTER] instead of [ENTER]. This will tell the calculator to approximate the result.

**Example:**
To approximate $\sqrt{5}$, type [2ND] [×] [5] [)] [◆] [ENTER].



## 4.9 Absolute Values

The calculator does not have a key for the absolute value. There are two ways to use the absolute value command.

a. Find the command **abs(** in the calculator's catalog.
Press 2ND 2 and scroll to **abs(**. To chose this command, use the arrow keys to move the little black triangle so that it points at **abs(** and then press ENTER .

**Example:**
To calculate $|-4|$, select **abs(** from the catalog and type (−) 4 ) ENTER .

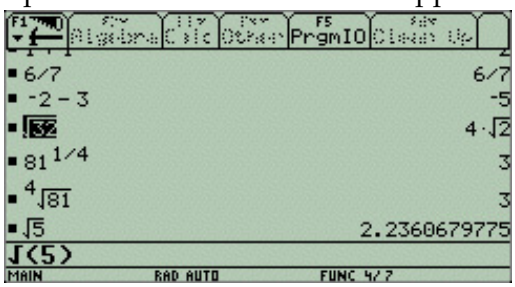
b. Type out **abs(** by hand.
To do so, use the letter keys to spell "ABS" and then press ( . Then continue with the rest as in part a.: (−) 4 ) ENTER

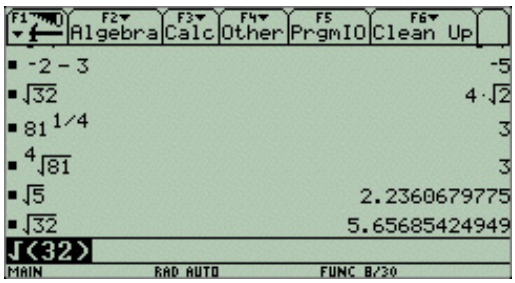
## 4.10 Home Screen History Area: 1/30, 2/30, 3/30, ...

Look back at the last three screen shots in this handbook. In the bottom right corner, you should see numbers like 5/30, 6/30, and 7/30. Your calculator is set to save the last 30 commands and results (or history pairs) that you executed, with the most recent on the bottom and the least recent at the top of the list. The "$x$/30" is an indication that you have $x$ history pairs in the history area, out of 30 possible. If you have 30 pairs in the history area and perform another calculation, it will bump the least recent pair out of memory and replace it with the most recent.

You can use the up/down arrows to scroll up in the memory to see what history pairs you have in memory and bring items from the history area down to the command line. You can also change how many pairs can be saved in the history area. See the next chapter, under **9: Format** option in the **F1:** menu, for more information.

**Example:**
Recalculate the expression from the fourth line up, find the approximate value. Use the up arrow until the expression is highlighted, press ENTER to bring that expression to the command line, and then press ◆ ENTER to obtain the approximate value.



# Chapter 5

# Home Screen F-Menus

Go to your Home Screen by pressing  .
Clear your Home Screen by pressing  .

As was mentioned before, the Home Screen is where you will perform most of your calculations. But it is important to recognize that you can do much more than just addition, subtraction, multiplication, and division here. Along the top of your screen, you should notice tabs, like you have in almost all computer applications. Each tab gives you access to a drop-down menu of commands. To access any of those menus, use the function keys directly below the screen. You can scroll up or down within a menu and you can scroll left or right between menus.

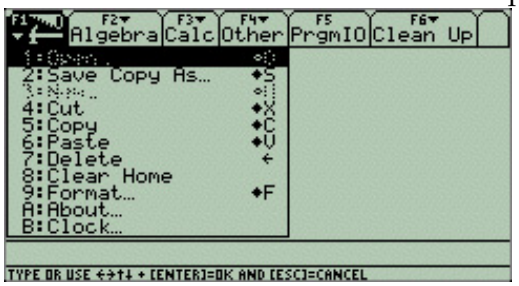
In this chapter, we'll look at the options under each menu and explain a few of the most commonly used ones in detail.

To select an option under one of these menus, either use the arrow keys to scroll up or down and press  , or press the number/letter key identifying the option.

To exit the menus without selecting anything, press  .

## 5.1 F1: Tools

Press F1 for the **Tools menu** and scroll up and down to see all of the options.




This menu has some of the "Edit" menu options you have Microsoft Word, as well as some others. Notice that next to the 8 is an ↓. This indicates that if you use the down arrow, you can scroll down further for more options.

### 5.1.1 8: Clear Home

"Clear Home" will delete all history pairs from the entire Home Screen history area.

### 5.1.2 9: Format

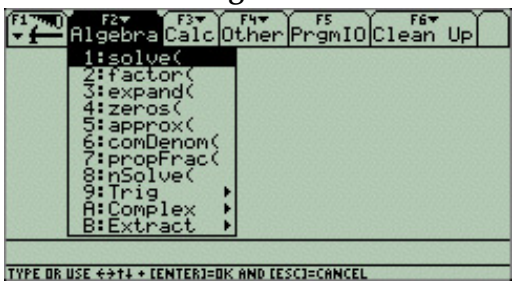
"Format" allows you to change number of history pairs in the home screen from the default value of 30 to your choice of 10, 20, 30, ..., 90, or 99 history pairs.

### 5.1.3 A: About

"About" will show you details about your calculator's operating system (OS), hardware version, and product ID. Depending on your hardware version, you may be able to update your operating system. To update your operating system, please contact your instructor. When you are done looking at this information, you can press either ENTER or ESC to exit the "About" window.

## 5.2 F2: Algebra

Press F2 for the **Algebra menu** and scroll up and down to see all of the options.



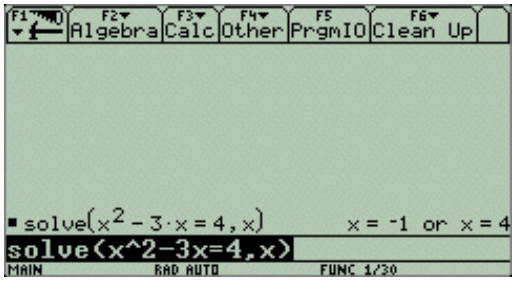

This menu has many algebra-related commands and will be helpful in any mathematics course.

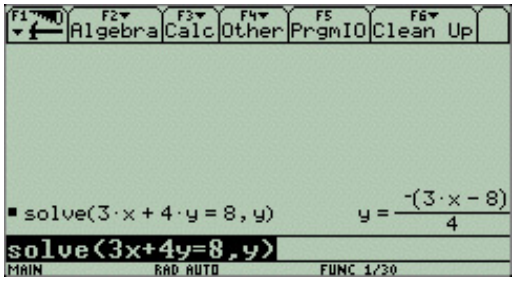
### 5.2.1 1: solve(

"solve(" will solve an equation and uses the format $solve(equation, variable)$ .
You must tell it for which variable it needs to solve. Do not forget the closing parenthesis ")".

**Example:**
Solve $x^2 - 3x = 4$. You need to enter $solve(x^2 - 3x = 4, x)$.
Type F2 1 , then X ^ 2 − 3 X = 4 , X ) ENTER .

**Example:**
Solve $3x + 4y = 8$ for $y$. You need to enter $solve(3x + 4y = 8, y)$.
Type F2 1 , then 3 X + 4 Y = 8 , Y ) ENTER .



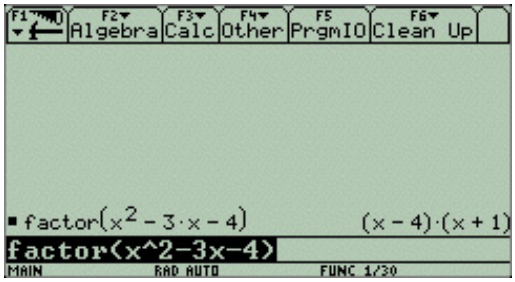



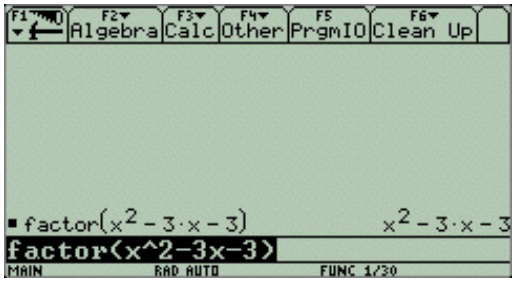
### 5.2.2 2: factor(

"factor(" will factor an expression for you and uses the format $factor(expression)$.
If you enter in a prime polynomial, the result will simply be the expression you entered.

**Example:**
Factor $x^2 - 3x - 4$. You need to enter $factor(x^2 - 3x - 4)$.
Type [F2] [2] , then [X] [^] [2] [−] [3] [X] [−] [4] [)] [ENTER] .

**Example:**
Factor $x^2 - 3x - 3$. You need to enter $factor(x^2 - 3x - 3)$.
Type [F2] [2] , then [X] [^] [2] [−] [3] [X] [−] [3] [)] [ENTER] .

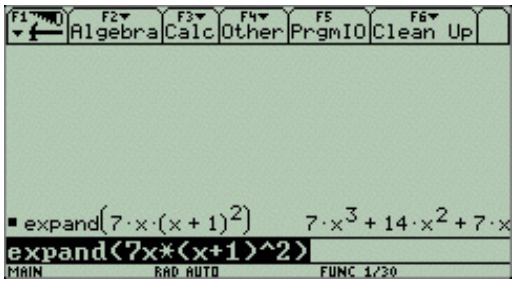



### 5.2.3 3: expand(

"expand(" will expand an expression and uses the format $expand(expression)$.

**Example:**
Expand $7x(x+1)^2$. You need to enter $expand(7x \times (x+1) \wedge 2)$.
Type [F2] [3] , then [7] [X] [×] [(] [X] [+] [1] [)] [^] [2] [)] [ENTER] .




Between the $7x$ and $(x+1)^2$, you must insert the multiplication, [×] .
If you do not include [×] , then you will receive and error message.
Do not confuse the letter $x$, [X] , with the multiplication symbol, [×] .

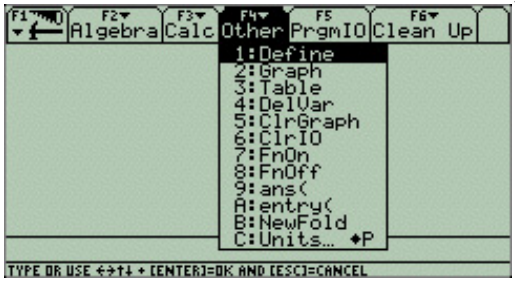
## 5.3 F3: Calculus

Press F3 for the **Calculus menu** and scroll up and down to see all of the options.

This menu has many calculus-related commands and will be helpful in MTH 251 and higher. These options are outside the intended scope of this handbook. Please see your instructor of assistance with this menu.

## 5.4 F4: Other

Press F4 for the **Other menu** and scroll up and down to see all of the options.

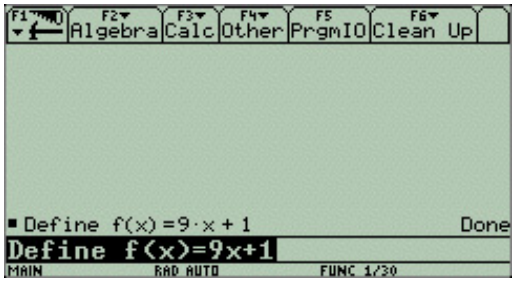




### 5.4.1 1: Define

"Define" allows you to define a function.

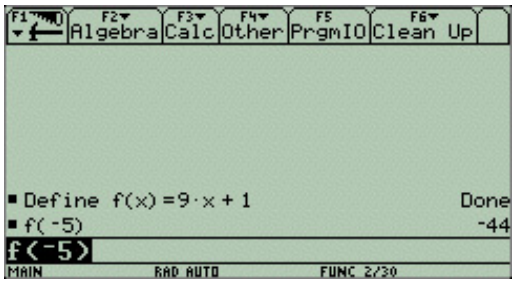
**Example:**
Define $f(x) = 9x + 1$ so that you can evaluate it and solve equations using it.
Enter $Define f(x) = 9x + 1$. You'll find the letter "f" in white above | , on the left side of the calculator.
Type F4 1 , then F ( X ) = 9 X + 1 ENTER




With $f$ now defined, you can evaluate expressions or solve equation that involve $f$.

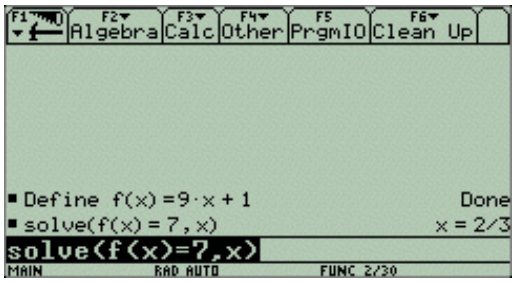
**Example:**
Evaluate $f(-5)$, using $f(x) = 9x + 1$ from above.
$f$ has already been defined, otherwise you would do that now.

To evaluate $f(-5)$, you need to enter "$f(-5)$".
Type F ( (–) 5 ) ENTER .




**Example:**
Solve $f(x) = 7$, using $f(x) = 9x + 1$ from above.
$f$ has already been defined, otherwise you would do that now.

To solve $f(x) = 7$, you need to enter $solve(f(x) = 7, x)$.
Type F2 1 , then F ( X ) = 7 , X ) ENTER



## 5.5 F5: ProgamIO

Press F5 for the **ProgramIO menu**.

This menu is outside the scope of this handbook.

## 5.6 F6: Clean Up

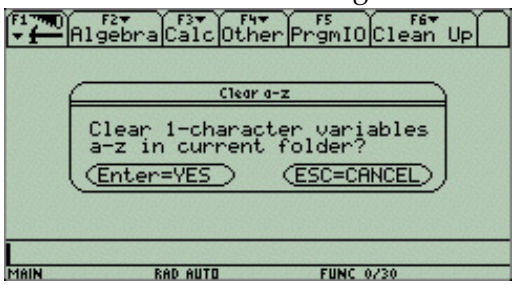
Press F6 for the **Clean Up menu**.


### 5.6.1 1: Clear a-z...

"Clear a-z..." will delete all saved single-variable values. This means that function definitions, values, etc. that were saved using a single letter will be cleared out.

Note: This can be very helpful if your calculations are coming out strange.

Because you might be deleting important information, the calculator will want you to confirm you meant to clear those variables. Press ENTER a second time to confirm you want to do this or press ESC to not delete the single-variable values.



# Chapter 6

# Graphing Equations/Functions

Above the three letter keys, W , E , and R ,


you'll see the following words in green: **Y=**, **WINDOW**, and **GRAPH**.
These are the three things you needs to graph functions and each options represents a step in the process of graphing functions. Since **Y=**, **WINDOW**, and **GRAPH** are in green, you will need to press  before being able to use any of the three.

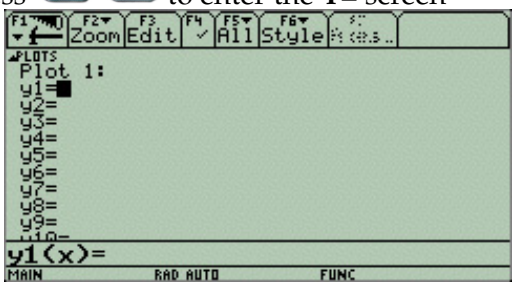
There are three steps when graphing a function:

i. entering in the function you want to graph,
ii. making sure your viewing window is what you want, and
iii. graphing the equation.

Each step is explained below.

## 6.1 Entering in Functions

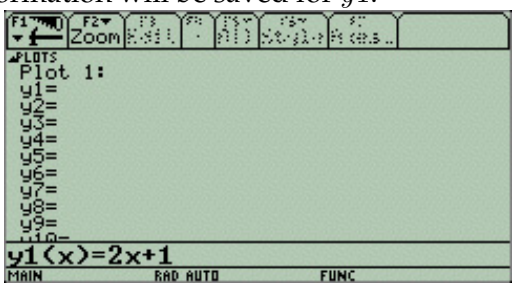
Press  W to enter the **Y=** screen

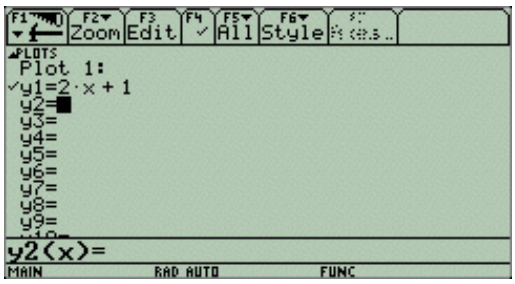



This window serves the same purpose for both graphing and using tables. This is where you enter in the function or functions you want to graph. $y1$, $y2$, ..., $y99$ represent the different functions that you would want to graph. Your calculator has the ability to remember and/or graph 99 different functions at a time.

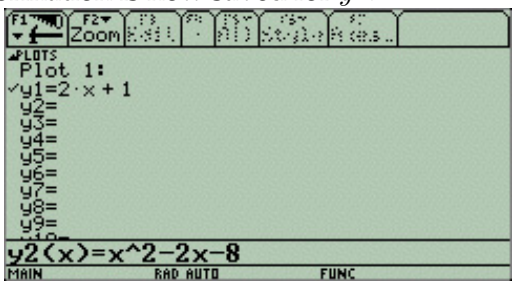
To enter in a function to graph, type the function in the command line.

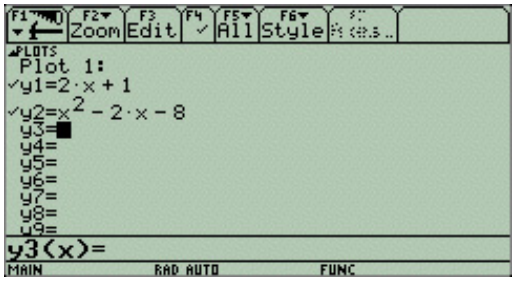
**Example:**
You want to graph $y = 2x + 1$. Enter that in for $y1$ by using the arrows to move the cursor next to $y1$. Then type [2] [X] [+] [1] in to the command line. When you press [ENTER], that information will be saved for $y1$.




**Example:**
You also want to graph $y = x^2 - 2x - 8$. Enter that in for $y2$ by using the arrows to move the cursor next to $y2$. Then type [X] [^] [2] [−] [2] [X] [−] [8] [ENTER] in to the command line. That information is now saved for $y2$.



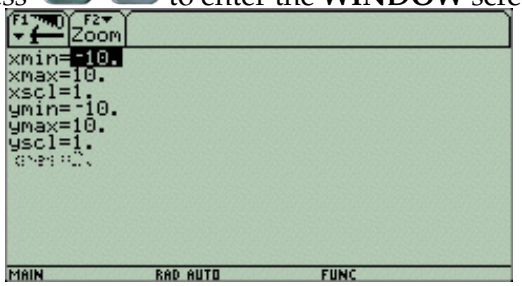

If you look at both $y1$ and $y2$, you will see a check mark next to each. This indicates that $y1$ and $y2$ will both be graphed. It is possible to have functions saved but not graphed. The way to do this is to uncheck the function. Look at the [F4] menu at the top of the screen. This option will check or uncheck an function. You must first highlight a function by scrolling up or down, and then press [F4].

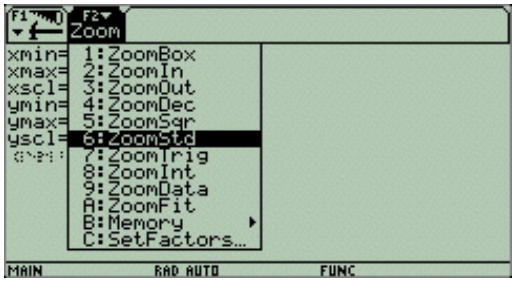
The **F6 Style** menu will change the style of line graphed. You can experiment with this later.

Make sure both functions you entered have checks and continue to the next step.

## 6.2 Checking Window Settings

Press [◆] [E] to enter the **WINDOW** screen.



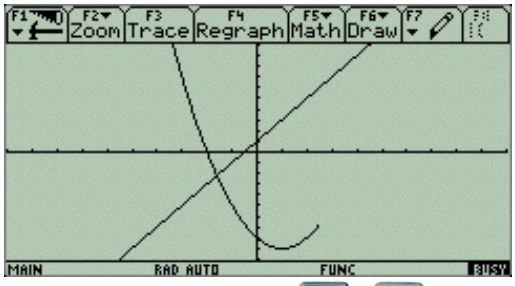

The standard viewing window is $[-10, 10]$ for both the $x$ and $y$ axes. If the viewing window is different, you can manually reset it to the standard viewing window but scrolling up and down with the arrow keys and entering $-10$ or $10$ as appropriate. Make sure you use [(−)] to enter in negative values.

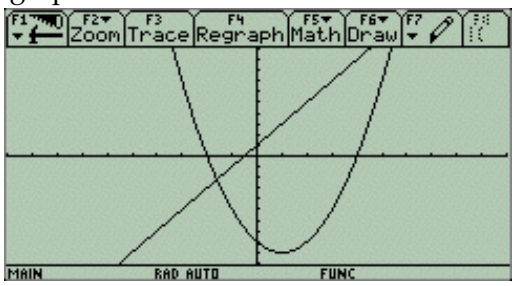
The **xscl** and **yscl** settings are used to set the scale, or tick marks, on the respective axes. For the standard viewing window, both values are $1$.

Another option to reset the window values to the standard viewing window is to use the **Zoom** menu, [F2] . If you use the sixth option **6: ZoomSTD**, the calculator will automatically reset all the window settings to the standard viewing window and also start graphing the function(s).

## 6.3 Graphing the Equation

Press [◆] [R] to enter the **GRAPH** screen and graph the functions.



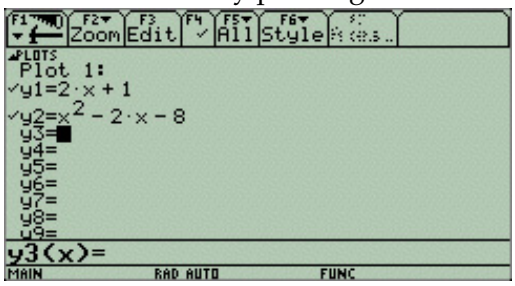

As soon as you pressed [◆] [R] , the calculator will start to graph the equations. Look in the bottom right corner of the left screen shot and you should see BUSY . While the calculator is in the process of graphing, it will show that is it busy. Once it is done, the BUSY message will go away.

If you press [ENTER] while the calculator is BUSY , it will pause the graphing.

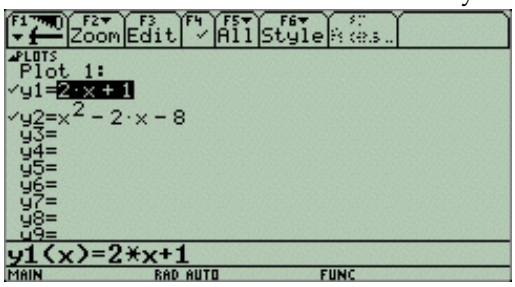
If you press [ON] while the calculator is BUSY , it will cancel the graphing.

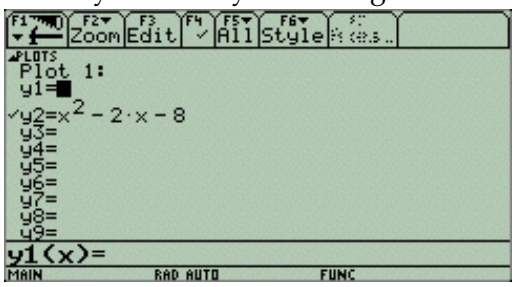
## 6.4 Clearing Previous Functions From the Y= Screen

Go to the **Y=** screen by pressing [◆] [W] .




Clear any saved functions by using the up/down arrows to highlight a function and then press [CLEAR] to delete the function from memory. Do this for any function you no longer need.

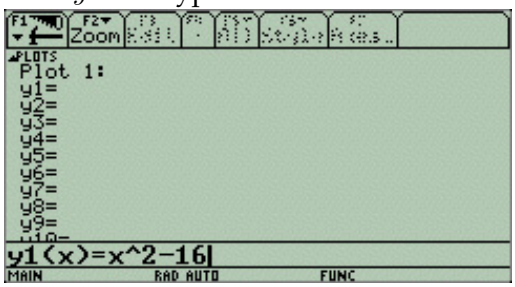


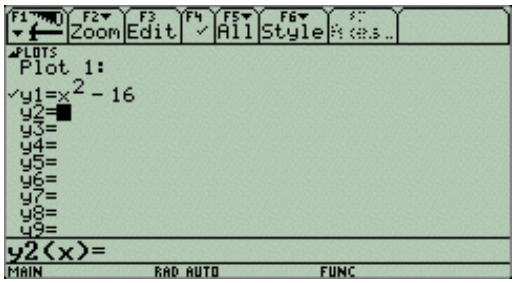




## 6.5 Changing the Window Settings

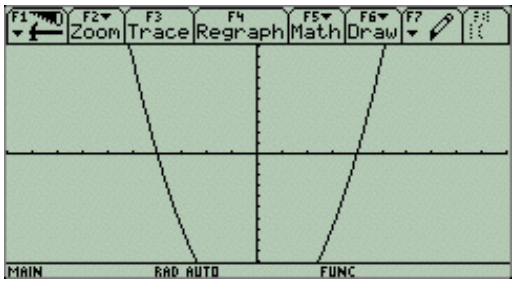
Go to the **Y=** menu, [◆] [W] .

**Example:**
Save the function $y = x^2 - 16$ for $y1$ and then graph it.
Move to $y1$ and type [X] [^] [2] [−] [1] [6] [ENTER] .

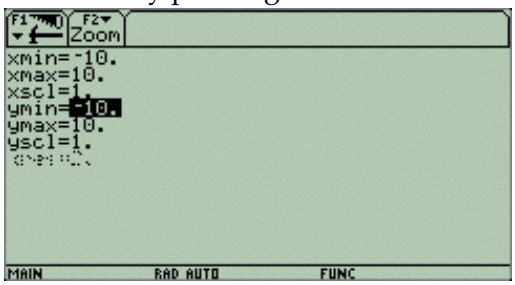


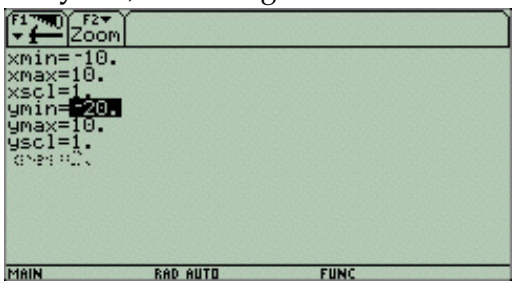




Check the viewing window ( [◆] [E] ) and graph the function ( [◆] [R] ).

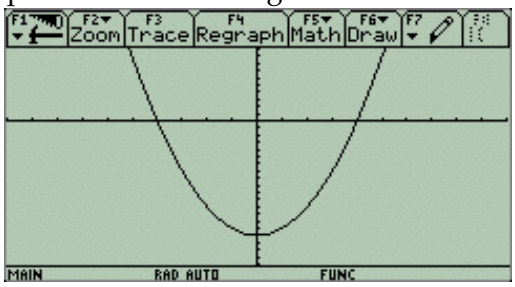



The problem with this window is that you cannot see part of the graph. What you need to do is to adjust the viewing window to go down further on the vertical axis. Go back to the **WINDOW** screen by pressing  . Scroll down to **ymin**, and change it to $-20$.




Graph the function using the new window settings,  , and you will see the entire graph.




**Notes:**

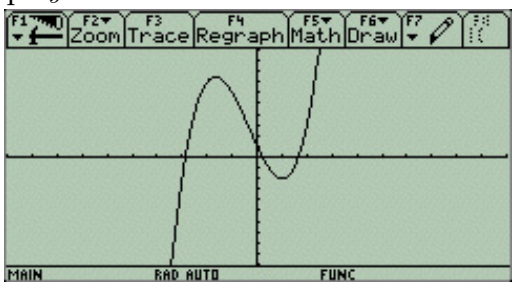
i. With the new dimensions on the vertical axis, the tick marks are very close. You could adjust this by changing the **yscl** setting in the **WINDOW** screen.

ii. These new viewing window settings have been saved and will used the next time you graph a function, unless you remember to change them.

## 6.6 F-Menus While Graphing

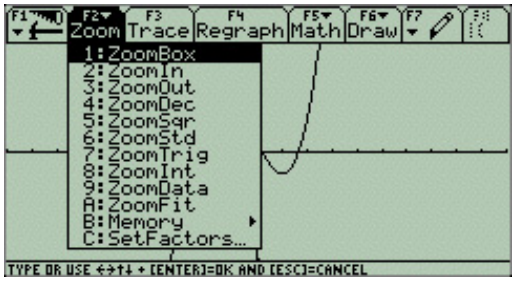
Some, but not all, of the available F-Menu commands in the **GRAPH** screen will be explained.

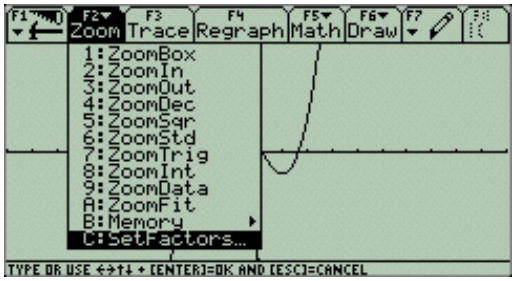
Graph $y1 = x^3 + x^2 - 5x + 1$ in the standard viewing window.




All explanations will be done with this function as the example and viewed on the standard viewing window.

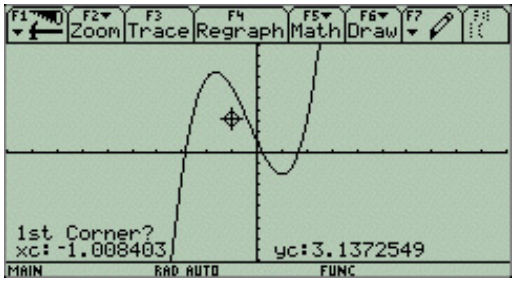
### 6.6.1 F2: Zoom

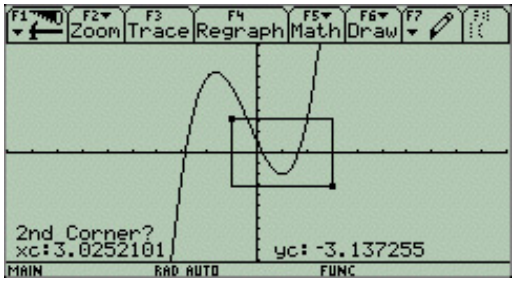



This is exactly the same **Zoom** menu that you have when you are in the **WINDOW** screen. After each option is explained, I will assume that you regraph the function on the standard viewing window.

**1: ZoomBox**

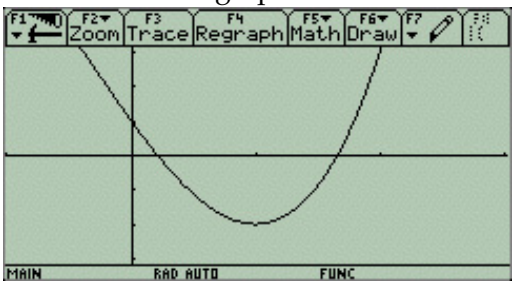


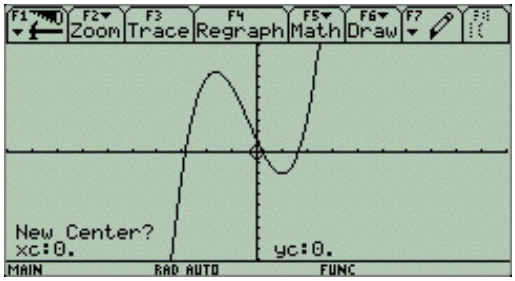

**ZoomBox** allows you create a small box on your graph and then enlargers that box to fill the entire window.

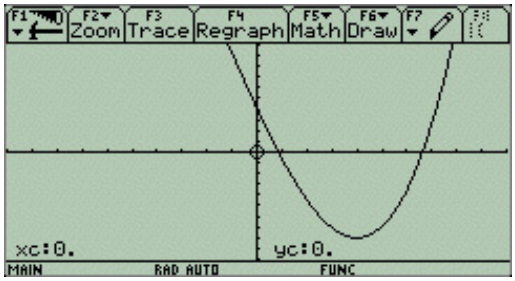
You need to specify the location of the first corner of the box is by moving the cursor with the arrow keys to the location of the first corner and then press ENTER. Then you need to specify the

location of the second corner, also by moving the cursor with the arrow keys. As you move the cursor for the second corner, you will see a box being drawn on the graph. This is the box you'll zoom in on. When you have the second corner placed at your desired location, press ENTER again. The calculator will regraph the function on this smaller window.




**2: ZoomIn**



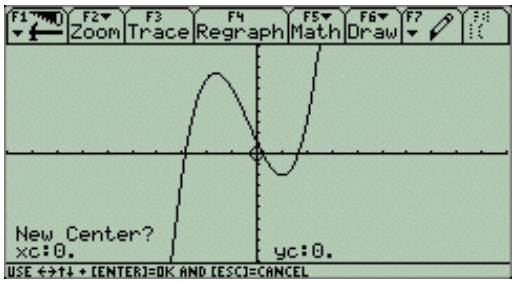



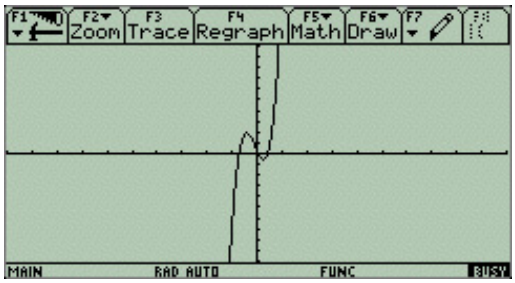

**ZoomIn** allows you to recenter the graph and zoom in by the amount specified in **C: SetFactors...** (see **C: SetFactors...** below). The default is that you will zoom in to 1/4 of the x-axis, 1/4 of the y-axis, and your scales will become 1/4 of their previous distance.

When you choose this option, you will need to decide where the new center of your graph will be. You can move the cursor using the arrow keys and then press ENTER when you have found where your new center will be.

Note: You will not likely be able to pick integer coordinates for the new center.

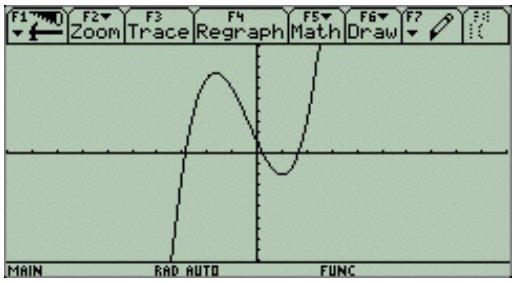
**3: ZoomOut**



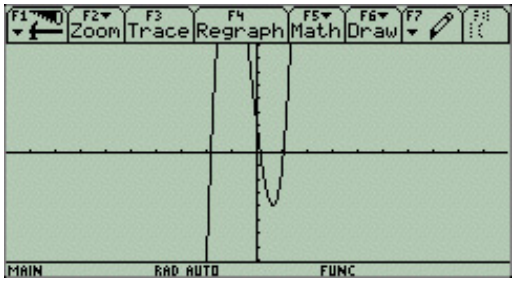

**ZoomOut** allows you to recenter the graph and zoom out by the factor specified in **SetFactors...**. This is simply the counterpart to ZoomIn and the directions are the same.

**6: ZoomSTD**



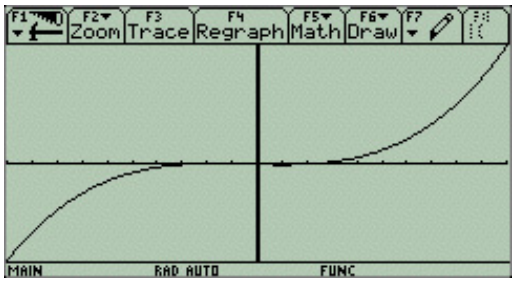

**ZoomSTD** will automatically reset all the window settings to the standard viewing window and regraph the function(s).

**7: ZoomTrig**




**ZoomTrig** will reset the window settings to a predefined [-3.3$\pi$, 3.3$\pi$] on the $x$-axis, and [-4, 4] on the $y$-axis.
This can be helpful for a quick look at the graph of a trigonometric function.

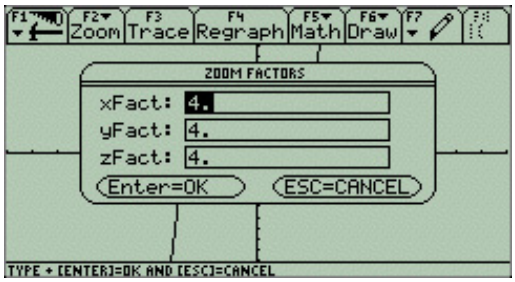
**A: ZoomFit**




**ZoomFit** will keep your **xmin** and **xmax** values the same and the calculator will adjust the **ymin** and **ymax** to include the full range of $y$-values for your $x$-values.

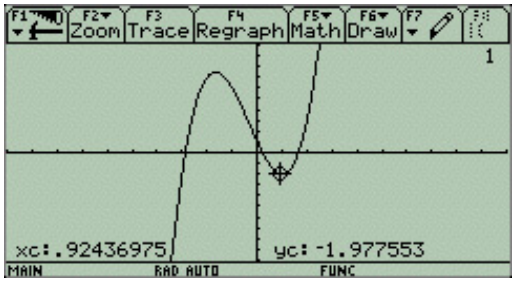
This can be helpful at times, but it can also include such large values that you lose any of the fine details of your graph.

**C: SetFactors...**




**SetFactors...** allows you to set the zooming factor for **ZoomIn** and **ZoomOut**.
It includes **xFact** and **yFact** settings for 2-dimension and **zFact** for 3-dimensional graphs.

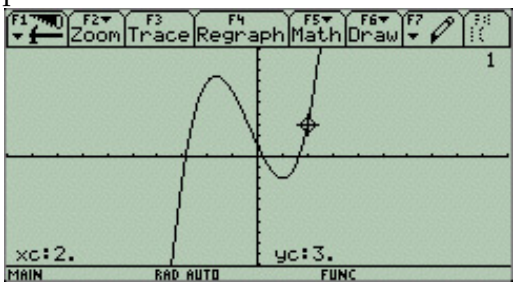
### 6.6.2 F3: Trace



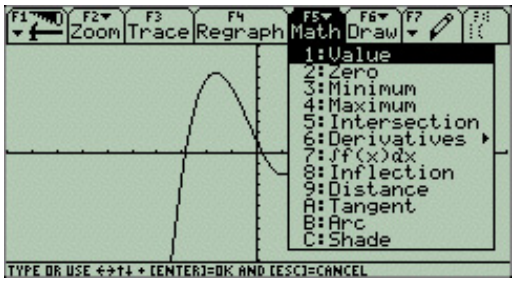

**Trace** allows you to use the cursor to trace your graph using the left/right arrow keys. It displays the coordinates of the cursor's location.

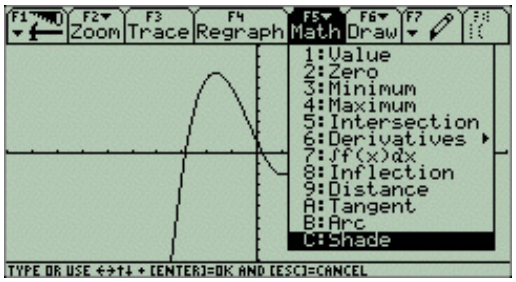
If you want an integer $x$-coordinate, you can press that value and then ENTER and the cursor will jump to that coordinate. (You cannot specify a $y$-value.)

**Example:**
Trace to the point that has an $x$-coordinate of 2. Press F3 to trace and then 2 ENTER to jump to that point.

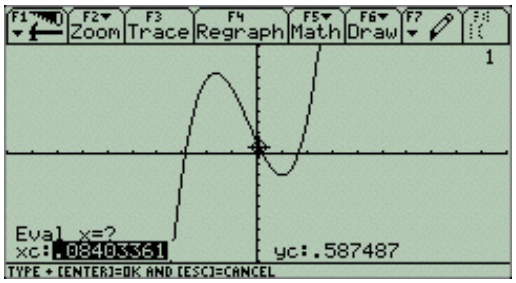


### 6.6.3 F5: Math



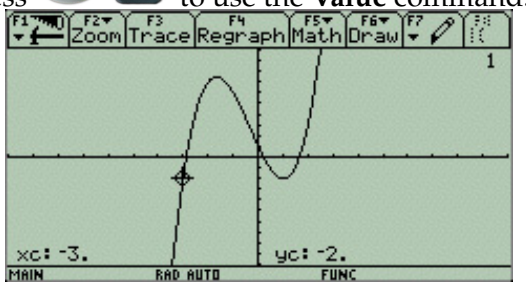




**1: Value**

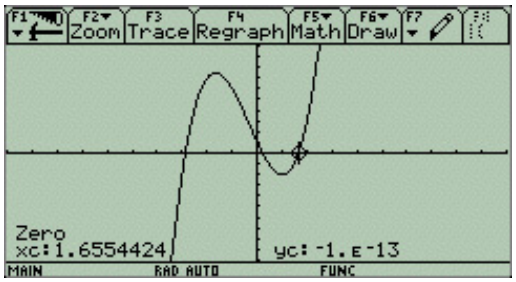



**Value** will allow you to calculate a $y$-value when you enter in an $x$-value and it will visually move the cursor to this $(x, y)$ coordinate. In some ways this is similar to what you can do with the **Trace** feature.

**Example:**
Find the $y$-value when the $x$-value is $-3$.
Press F5 1 to use the **Value** command. Press (−) 3 ENTER .

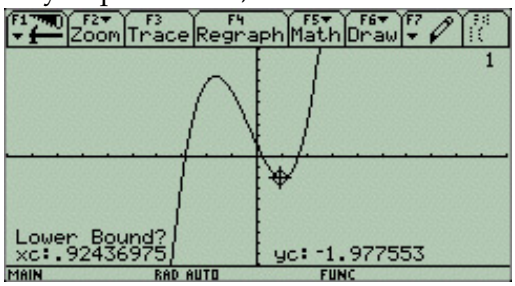


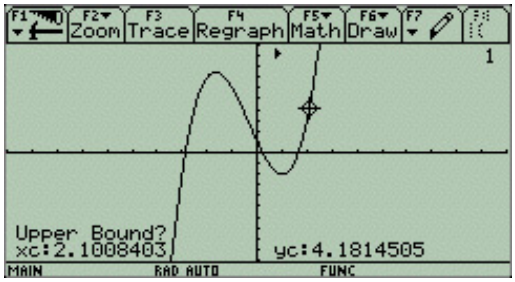
**2: Zero**



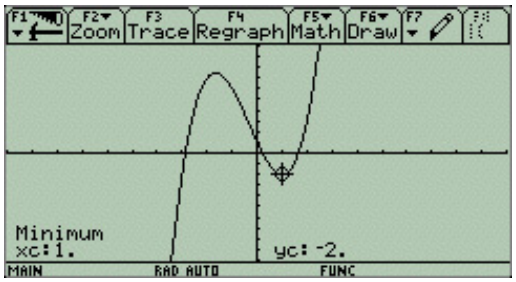

**Zero** will identify the zeros (a.k.a. the $x$-coordinate of an $x$-intercept) of your function. To use this command, the calculator will ask for a **lower bound** and **upper bound**, which tells the calculator which $x$-values to look between. If more than one zero is found, the least (left-most) zero will be identified.

**Example:**
There is a zero between 1 and 2. Estimate that zero.
Press F5 2 to use the **Zero** command. You must tell the calculator to look between 1 and 2. For the lower bound, use the arrow keys to move the cursor near an $x$-value of 1 and then press ENTER. Notice that there is now a triangle towards the top of the screen marking your lower bound. For the upper bound, use the arrow keys to move the cursor to the right, near an $x$-value of 2. When you press ENTER, the calculator will find an estimate of the zero.



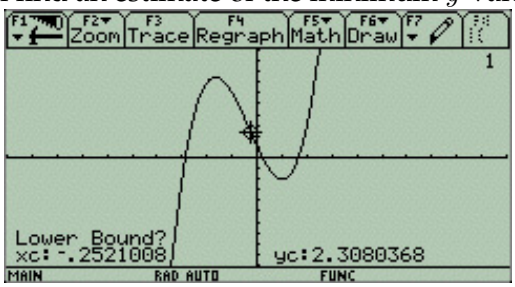



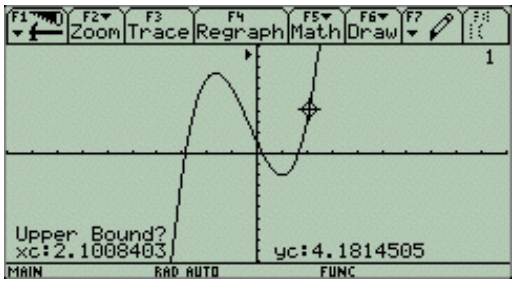
**3: Minimum**



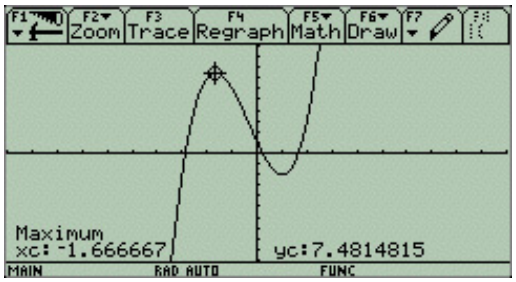

**Minimum** will find the minimum $y$-value between your identified **lower bound** and **upper bound** and it will visually move the cursor to this $(x, y)$ coordinate.

**Example:**
Find the minimum $y$-value between the $x$-values of 0 and 2.
Press F5 3 to use the **Minimum** command. For the lower bound, use the arrow keys to move the cursor near an $x$-value of 0 and then press ENTER. Notice that there is now a triangle towards the top of the screen marking your lower bound. For the upper bound, use the arrow keys to move the cursor to the right, near an $x$-value of 2. When you press ENTER, the calculator will find an estimate of the minimum $y$-value.



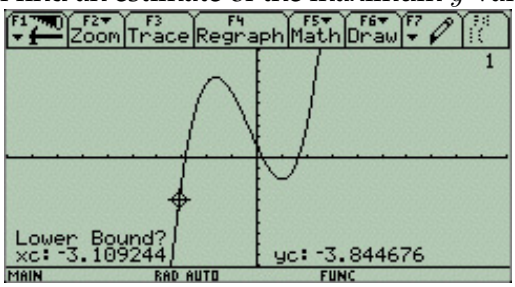



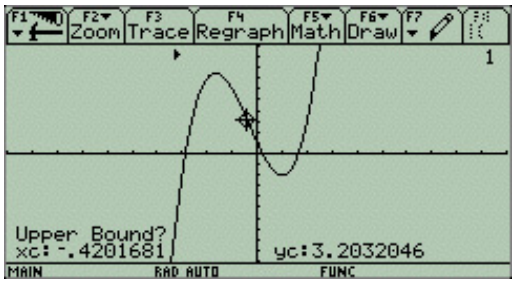
**4: Maximum**



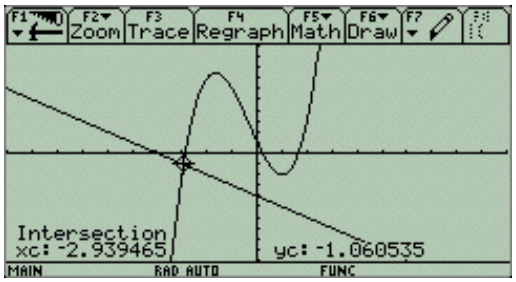

**Maximum** is the counter-part for the **Minimum** command. **Maximum** will find the maximum $y$-value between your identified **lower bound** and **upper bound** and it will visually move the cursor to this $(x, y)$ coordinate.

**Example:**
Find the maximum $y$-value between the $x$-values of -3 and 0.
Press F5 4 to use the **Maximum** command. For the lower bound, use the arrow keys to move the cursor near an $x$-value of -3 and then press ENTER. Notice that there is now a triangle towards the top of the screen marking your lower bound. For the upper bound, use the arrow keys to move the cursor to the right, near an $x$-value of 0. When you press ENTER, the calculator will find an estimate of the maximum $y$-value.



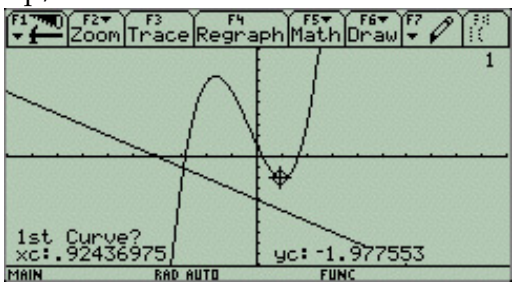



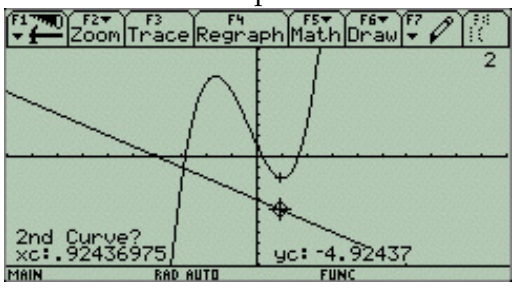
**5: Intersection**



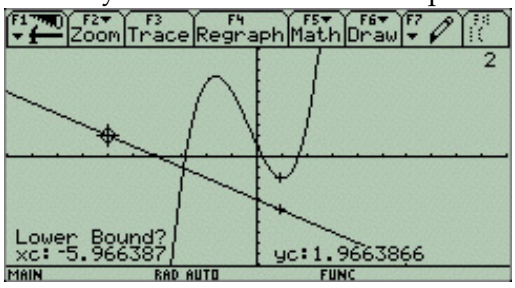

**Intersection** will allow you to determine where two different functions intersect, between your identified **lower bound** and **upper bound** and it will visually move the cursor to this $(x, y)$ coordinate. In addition to identifying the **lower bound** and **upper bound**, you will need to identify which two functions you want to consider. (Keep in mind that you could have 99 different functions graphed at once and the calculator wouldn't know which two you wanted to consider.)

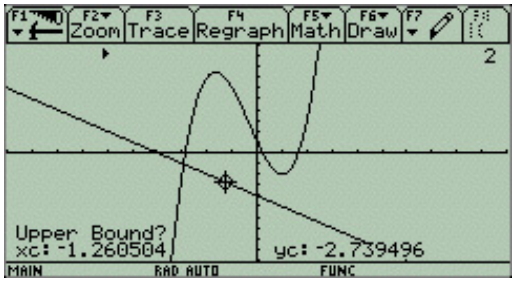
**Example:**
Find the intersection point between $y1 = x^3 + x^2 - 5x + 1$ and $y2 = -x - 4$.
First, go back to the **Y=** menu ( F1 ), enter in $y2 = -x - 4$ ( (−) X − 4 ENTER ), and then graph both functions ( F3 ).
Press F5 5 to use the **Intersection** command. Identify the **1st Curve** by using the up/down arrows until the cursor is on the first function and press ENTER . Identify the **2nd Curve** by using the up/down arrows until the cursor is on the second function and press ENTER .




Now identify your **lower bound** and **upper bound** using the left/right arrows. Make sure the point of intersection that you are looking at falls between your **lower bound** and **upper bound**. Once the intersection point is calculated, the calculator will show both the $x$ and $y$-coordinates and visually move the cursor to this point.



# Chapter 7

# Using the Table

Above the three letter keys, W , T , and Y ,


you'll see the following words in green: **Y=**, **TBLSET**, and **TABLE**.
These are the three things you needs to graph functions and each options represents a step in the process of graphing functions. Since **Y=**, **WINDOW**, and **GRAPH** are in green, you will need to press before being able to use any of the three.

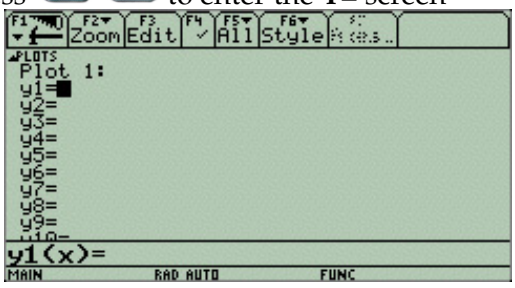
There are three steps when graphing a function:

i. entering in the function(s) you want to view in a table,
ii. making sure your table setup is what you want, and
iii. using the table.

Each step is explained below.

## 7.1 Entering in Equations

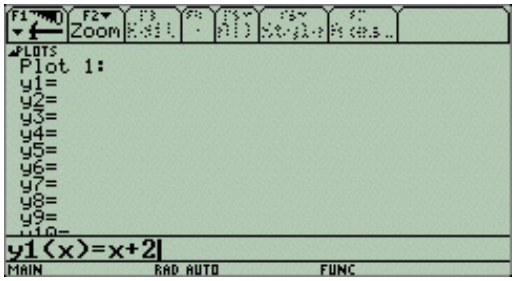
Press W to enter the **Y=** screen

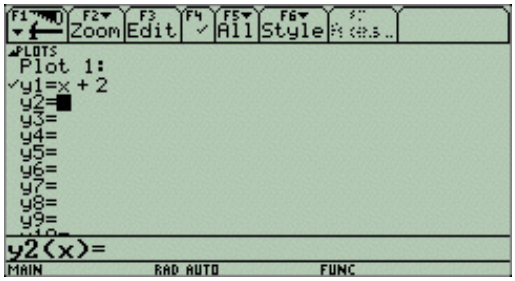



This window serves the same purpose for both graphing and using tables. This is where you enter in the function or functions you want to see in the table. $y1$, $y2$, ..., $y99$ represent the different functions that you would want to use in a table.

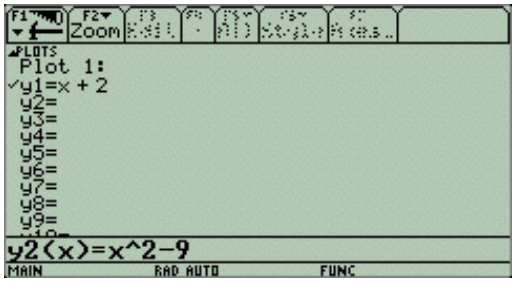
To enter in a function to use in the table, type the function in the command line.

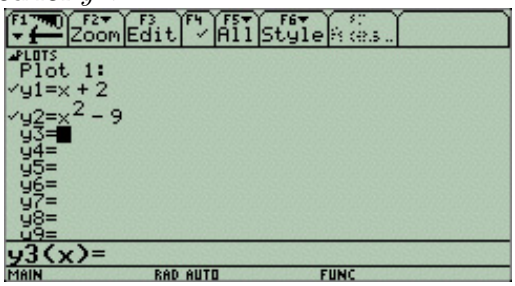
**Example:**
Enter $y = x + 2$ for $y1$.
Use the arrows to move the cursor next to $y1$ and then type [X] [+] [2] in to the command line. Press [ENTER] to save that information for $y1$.




**Example:**
Enter $y = x^2 - 9$ for $y2$.
Using the arrows to move the cursor next to $y2$ and then type [X] [^] [2] [−] [9] [ENTER] in the command line. That information is now saved for $y2$.



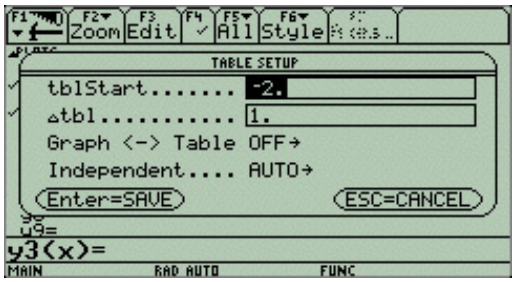




If you look at both $y1$ and $y2$, you will see a check mark next to each. This indicates that $y1$ and $y2$ will both be included in the table. It is possible to have functions saved but not used in the table. The way to do this is to uncheck the function. Look at the [F4] menu at the top of the screen. This option will check or uncheck an function. You must first highlight a function by scrolling up or down, and then press [F4] .

Make sure both functions you entered have checks and contnue to the next step.

## 7.2 The Table Settings

Press [◆] [T] to enter the **TBLSET** screen.




There are four potential settings that you can adjust. The bottom setting, **Independent**, is the most important.

**Independent: Auto or Ask**
If this is set to **Auto** , your table will be automatically generated using the other three settings.
If this is set to **Ask** , you will need to enter in each $x$-value one at a time for the table to have any information.

If you're using **Auto**, you will need to adjust the following settings:

**tblStart**
This value will be the first $x$-value used in your table.

**$\Delta$tbl**
This value is the distance between each $x$-value in the table.

**Graph $<->$ Table**
There are two options, either **ON** or **OFF**.
You will typically want this option to be set to **OFF**.

Make sure you press [ENTER] twice to save any changes you've made. When you do this, you'll be taken back to the window you previously were using.

**Example:**
Set the **TBLSET** settings to the following:

**tblStart**: $-2$

**$\Delta$tbl**: $1$

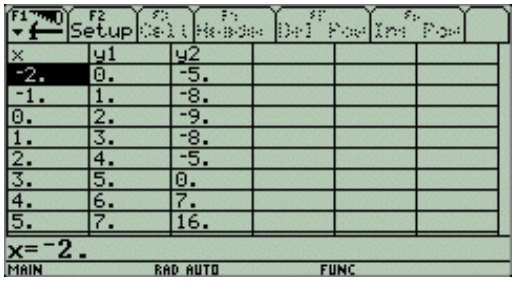
**Graph**: OFF

**Independent**: AUTO

Press [ENTER] twice to make sure the changes are saved. You will be taken back to the **Y=** screen.

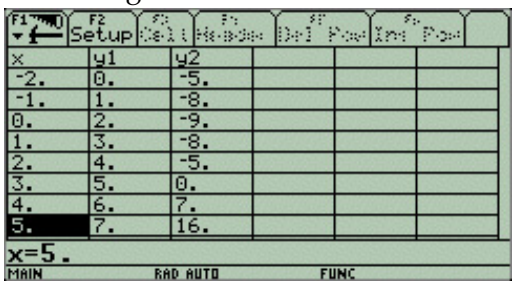
## 7.3 Using the Table

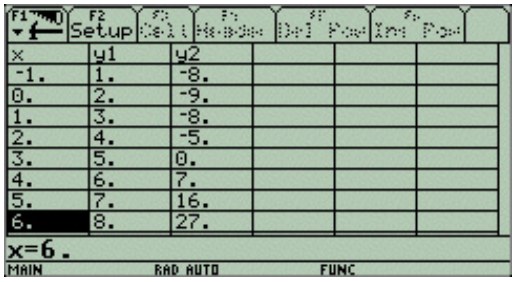
Using the equations from the first section of this chapter and the settings from the second section, press [◆] [Y] to view the table.




The first column contains the $x$-values that have come from the **Independent: AUTO** settings.
The second column contains the corresponding $y$-values for the function saved as $y1$.
The third column contains the corresponding $y$-values for the function saved as $y2$.

You can use your left/right arrow keys to move between columns and your up/down arrow keys to move up the table or down the table. If you are on the bottom of the screen and you move down, the calculator will show you the next $x$-value and corresponding $y$-values following you **AUTO** settings.




Note: By using the up/down arrows to see additional values, you will be adjusting the values in the **TBLSET** screen.