0.2 Graphing Basics and Polynomial Functions

0.2.1 Basic Ideas for Graphing

Application problems, functions and equations may use variables other than x and y; however, the calculator requires the use of x, y. Thus, carefully rename the variables, if necessary, so you are using x and y.

The technique for graphing an equation involves the following steps.
Each of these will be discussed in the following examples. Choose the directions for your particular calculator and work through each example, actually performing each step and comparing your results with the picture given.

- Solve the equation by hand for y, if necessary.
- In graphing mode, enter the expression for y.
- Select a good viewing window and graph the function.
- Make adjustments to the viewing window as needed to avoid lots of unused "whitespace" on the graph.

Before we continue, let's discuss the window settings and their meanings. We must enter the following:

- `xmin` and `xmax` are the *leftmost* and *rightmost* values to use on the $x-$axis.
  If we enter `xmin=`-5 and `xmax=3`, we are saying to use $x-$values between -5 and 3 inclusive for the graph. We indicate this on paper using $[-5, 3]$.
- `xscl` refers to the units to use on the $x-$axis. If `xscl=1`, then each interval on the $x-$axis is 1 unit. If `xscl=5`, then each interval on the $x-$axis is 5 units.
- `ymin` and `ymax` are the *smallest* and *largest* values to use on the $y-$axis.
  If we enter `ymin=`-8 and `ymax=5`, we are saying to use $y-$values between -8 and 5 inclusive for the graph. We indicate this on paper using $[-8, 5]$.
- `yscl` refers to the units to use on the $y-$axis. If `yscl=1`, then each interval on the $y-$axis is 1 unit. If `yscl=5`, then each interval on the $y-$axis is 5 units.
- `xres` refers to the pixel resolution. You may want to try various settings for `xres` and see the difference.

When writing our information on paper, we indicate the viewing window by stating $[-5, 3]$ by $[-8, 5]$, showing the x-values first. (Notice, we use closed intervals for x- and y-values, not open intervals.) The `xscl` and `yscl` are assumed to be 1 unless otherwise stated.

0.2.2 Polynomial Functions

To graph a polynomial function, we will work through the following steps for each calculator:

- Solve by hand for y, if necessary.

  Polynomials are probably the simplest functions to graph on the calculator. Suppose we have $5x^2 + 4x - 2y = 1$. In order to graph this, we must first solve for y. Do this with paper and pencil now.

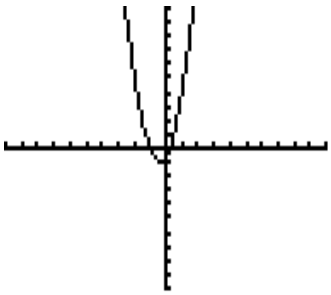
  Did you get $y = \frac{5}{2}x^2 + 2x - \frac{1}{2}$?

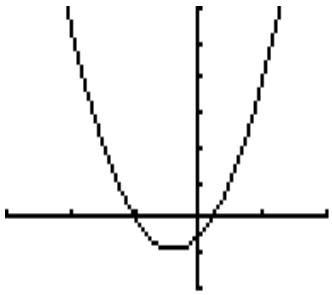
- In graphing mode, enter the expression for y.

- Select a viewing window and graph the function.

- Adjust the window as needed.

  For example, if we choose a viewing window of $[-10, 10]$ by $[-10, 10]$ for this polynomial, we get the graph on the left which shows lots of unused "whitespace" on the negative $y-$axis, and left and right on the $x-$axis. A better window would be $[-3, 2]$ by $[-2, 6]$ which is shown on the right.





A word of caution: The *negative* sign is not the same as the *subtraction* sign. The *negative* sign is between the decimal point and the Enter key. The *subtraction* sign is the key above the + key. If we try to interchange the negative and subtraction signs, we get an error.

Try typing them one after the other so you can see the difference. This picture shows "2 subtract negative 3". Notice the clear difference in the two signs.

2-(-3)

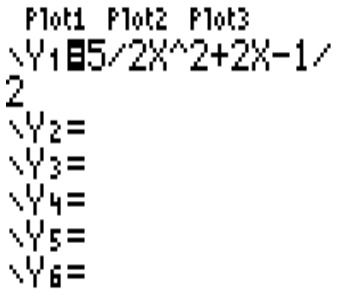
TI-83 (see page 13), TI-89 (see page 15), TI-86 (see page 18).

TI-83 Graphing Polynomial Functions

We want to graph $y = \frac{5}{2}x^2 + 2x - \frac{1}{2}$.

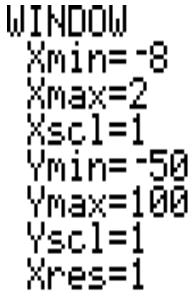
To start the graphing process, press [Y=]. If any functions are left over from a previous graph, put the cursor on each definition and press [Clear].

- Enter the formula for y as y_1, (do not type $y =$). The $x-$variable is entered using the key [X,T,θ,n]



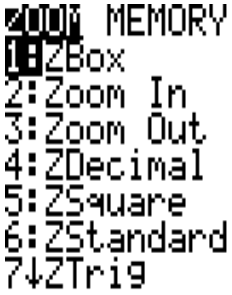
- Select a good viewing window and graph the function.

  To specify values for `xmin, xmax, xscl` and `ymin, ymax, yscl`, press [Window]. The values shown are left over from a previous graph (so your values will look different than the picture). The numbers here say we are going to display the graph of the function from $x = -8$ to $x = 2$ and from $y = -50$ to $y = 100$, or a window of $[-8, 2]$ by $[-50, 100]$.

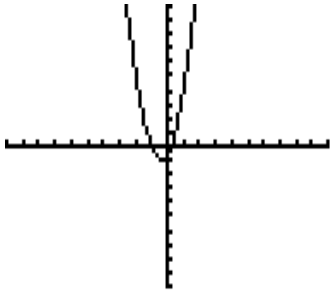


To change these values, we have some choices. We can use the *standard* window given by the calculator, $[-10, 10]$ by $[-10, 10]$, or we can enter values of our own.

Let's first look at the standard window. Press [Zoom] to see



Either use the arrow keys to move the cursor down to `6:ZStandard` and press [Enter], or just type 6. The graph displayed is:



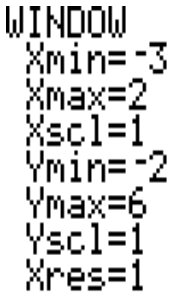
- Make adjustments to the viewing window as needed.

  Notice all the *whitespace* (the unused area) to the left and right on the $x-$axis, and on the negative $y-$axis on the graph. We can get a better picture of the graph by changing our window.

  Press [Window]. Notice it shows the $[-10, 10]$ by $[-10, 10]$ choices that we just used.

  Let's change the window settings to $[-3, 2]$ by $[-2, 6]$ to eliminate some of the unused whitespace on our graph.

  To change your window settings to match those shown, do the following.



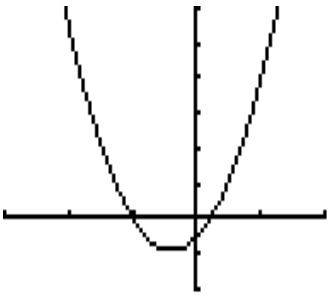
  With the cursor beside `Xmin=`, enter -3, and press [Enter].

  Enter `Xmax=2`, and press [Enter].

  Press [Enter] to accept `Xscl=1` as the desired value.

  Similarly, enter the `Ymin` and `Ymax` values.

  Press [Graph] to see the graph of $y = \frac{5}{2}x^2 + 2x - \frac{1}{2}$ displayed in a window $[-3, 2]$ by $[-2, 6]$.



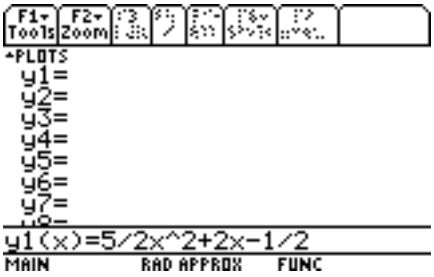
  This graph shows off the polynomial function better than the standard window.

TI-89 Graphing Polynomial Functions

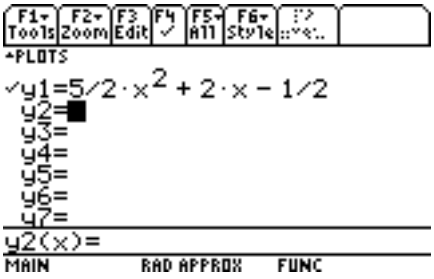
We want to graph $y = \frac{5}{2}x^2 + 2x - \frac{1}{2}$.

To start the graphing process, press the green ♦ key and then F1 Y=. If a function is left over from a previous graph, put the cursor on the function definition, and press Clear.

- Enter the formula for y as y_1, (do not type $y =$). The $x-$variable is entered using the key X directly under Home.



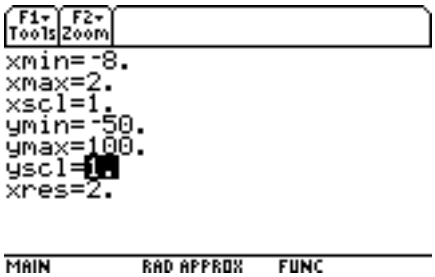
Press Enter to indicate we have finished the definition. Proofread to be sure it is typed correctly.



- Select a good viewing window and graph the function.

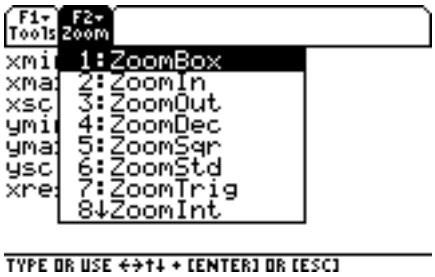
  To specify values for `xmin, xmax, xscl` and `ymin, ymax, yscl`, press ♦ and F2 Window.

  The values shown are left over from a previous graph (so your values will look different than the picture). The numbers here say we are going to display the graph of the function from $x = -8$ to $x = 2$ and from $y = -50$ to $y = 100$, or a window of $[-8, 2]$ by $[-50, 100]$.

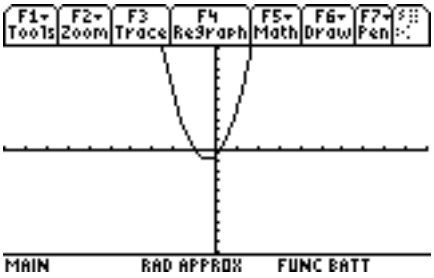


To change these values, we have some choices. We can use the *standard* window given by the calculator, $[-10, 10]$ by $[-10, 10]$, or we can enter values of our own.

Let's first look at the standard window. Notice the menu across the top of the window. Press F2 Zoom to see



Either use the arrow keys to move the cursor down to `6:ZoomStd` and press Enter, or just type 6. The graph displayed is:



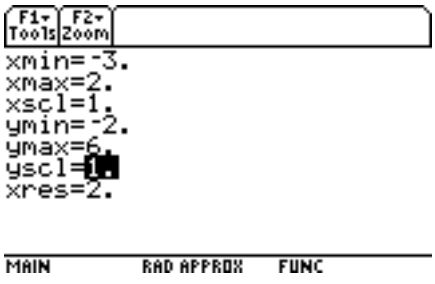
- Make adjustments to the viewing window as needed.

  Notice all the *whitespace* (the unused area) to the left and right on the $x-$axis, and on the negative $y-$axis on the graph. We can get a better picture of the graph by changing our window.

  Press ♦ and F2 Window. Notice it shows the $[-10, 10]$ by $[-10, 10]$ choices that we just used.

  Let's change the window settings to $[-3, 2]$ by $[-2, 6]$ to eliminate some of the unused whitespace on our graph.

  To change your window settings to match those shown, do the following.



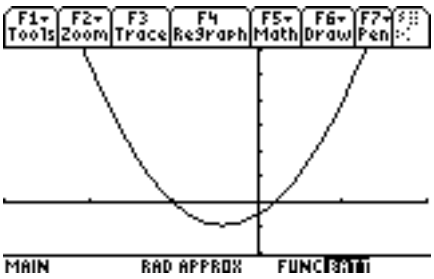
  With the cursor beside `xmin=`, enter -3, and press Enter.

  Enter `xmax=2`, and press Enter.

  Press Enter to accept `xscl=1` as the desired value.

  Enter the `ymin` and `ymax` values.

Press ♦ and F3 Graph to see the graph of $y = \frac{5}{2}x^2 + 2x - \frac{1}{2}$ displayed in a window $[-3, 2]$ by $[-2, 6]$.



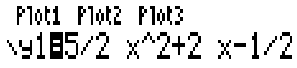
This graph shows off the polynomial function better than the standard window.

TI-86 Graphing Polynomial Functions

We want to graph $y = \frac{5}{2}x^2 + 2x - \frac{1}{2}$.

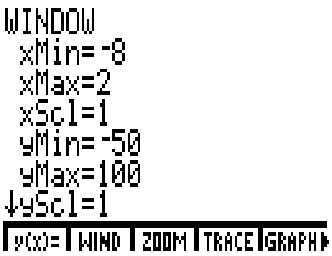
To start the graphing process, press [Graph], then [F1 y(x)=]. If functions are left over from a previous graph, put the cursor on each function definition and press [Clear].

- Enter the formula for y as y_1 (do not type $y =$). The $x-$variable is entered using the key [x-Var].



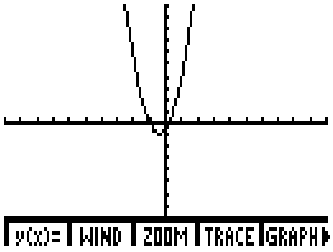
- Select a good viewing window and graph the function.

  To specify values for `xmin, xmax, xscl` and `ymin, ymax, yscl`, press [2nd] and [F2 Wind]. The values shown are left over from a previous graph (so your values will look different than the picture). The numbers here say we are going to display the graph of the function from $x = -8$ to $x = 2$ and from $y = -50$ to $y = 100$, or a window of $[-8, 2]$ by $[-50, 100]$. The down arrow on `yScl` indicates there is another setting. It is the `xRes` setting whose default is 1.



  To change these values, we have some choices. We can use the *standard* window given by the calculator, $[-10, 10]$ by $[-10, 10]$, or we can enter values of our own.

  Let's first look at the standard window. Press [F3 Zoom], then [F4 Zstd] to select `Zoom Standard`. The graph is immediately drawn with the standard window $[-10, 10]$ by $[-10, 10]$.



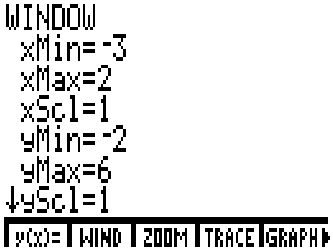
- Make adjustments to the viewing window as needed.

  Notice all the *whitespace* (the unused area) to the left and right on the $x-$axis, and on the negative $y-$axis on the graph. We can get a better picture of the graph by changing our window.

Press F2 Wind. Notice it shows the $[-10, 10]$ by $[-10, 10]$ choices that we just used.

Let's change the window settings to $[-3, 2]$ by $[-2, 6]$ to eliminate some of the unused whitespace on our graph.

To change your window settings to match those shown, do the following.



With the cursor beside `xMin=`, enter -3, and press Enter.

Enter `xMax=2`, and press Enter.

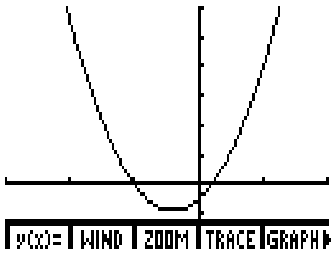
Press Enter to accept `xScl=1` as the desired value.

Similarly, enter the `yMin` and `yMax` values.

Press F5 Graph to see the graph of

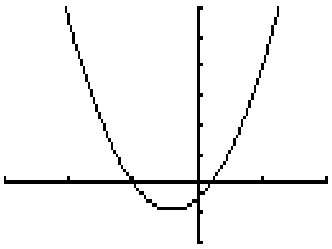
$$y = \frac{5}{2}x^2 + 2x - \frac{1}{2}$$

displayed in a window $[-3, 2]$ by $[-2, 6]$.



To eliminate the menu across the bottom of the window, press Clear.

To get the menu again, press Graph.



This graph shows off the polynomial function better than the standard window.