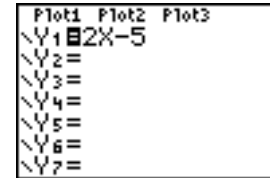


TI-83 Graphing Functions & Relations

To graph a function:

1. The equation must be written in functional notation in explicit (or “y equals”) form. (Y is the dependent variable and X is the independent variable.) For instance, we may need to graph the linear function given by $y = 2x - 5$.

2. Hit the $\boxed{Y=}$ key, and then enter the right side of your equation into Y_1 . (If Plot1, Plot2, or Plot3 is highlighted like the $\boxed{\text{■}}$ sign in this image, you may want to de-select the Plot by arrowing up to it and hitting $\boxed{\text{ENTER}}$, then arrow down to Y_1 . Otherwise, you will likely see the scatter plot along with your graph, or you may receive an error message.)



3. To view a table with values that your equation produces, enter $\boxed{2^{\text{nd}}}\boxed{\text{TABLE}}$. To change the starting value in the table (TblStart”) or the increment between X values in the table (“ Δ Tbl”), enter $\boxed{2^{\text{nd}}}\boxed{\text{TBLSET}}$. Generally, we keep the “AUTO AUTO” options selected in order to get an automatic table of X and corresponding Y values. (By the way, the “ASK AUTO” mode gives you the freedom to input independent variable values, and then the calculator will automatically supply the dependent variable solution. In this mode, the calculator ignores the “TblStart” and “ Δ Tbl” values.) The current setup will produce a table with 0 at the “top” and $\Delta X = 1$, as shown. Note: You can “scroll” up and down in the “X” column as far as you’d like.

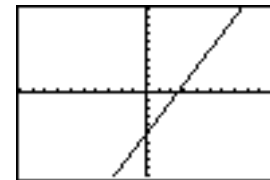


X	Y1
0	-5
1	-3
2	-1
3	1
4	3
5	5

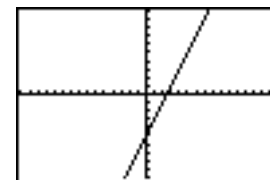
X=0

4. After entering a function into Y_1 , to graph a function, you have several options. You may enter $\boxed{\text{WINDOW}}$, adjust the window (max, min values, and scales for each axis), and then hit $\boxed{\text{GRAPH}}$; or, you may choose one of the ZOOM options. We describe the two most common ZOOM options, along with the resulting graph for our linear function.

$\boxed{\text{ZOOM}}\boxed{6}$ (ZStandard) gives a standard window with X values ranging from -10 to 10 and Y values ranging from -10 to 10.



$\boxed{\text{ZOOM}}\boxed{5}$ (ZSquare) gives a rectangular window in the same proportion as the actual display screen. This window depends on previous values; if we start with the standard values and then hit $\boxed{\text{ZOOM}}\boxed{5}$, we would have X values typically ranging from around -15 to 15 and Y values ranging from -10 to 10.



These are the very same line graphed using different window settings; the Square window most resembles graph paper.

There are several other “ZOOM” options from which to choose, including ZBox, Zoom In, Zoom Out, and ZoomFit, and these options are “user friendly”.

TI-83 Graphing Functions & Relations

Examples:

Graph the following functions.

- (1) $y = -\frac{3}{4}x + 5$ (2) $y = 2^x$
 (3) $y = x^2 - 2x + 3$ (4) $y = x^3$
 (5) $y = \frac{1}{x}$ (6) $y = |x + 3|$

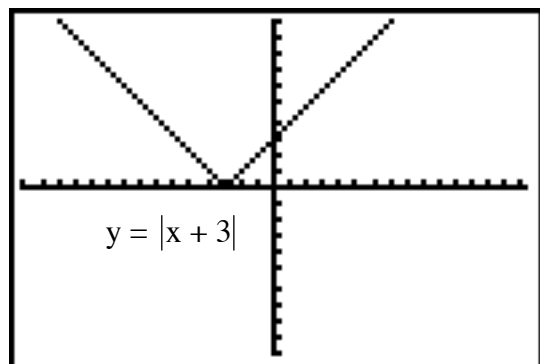
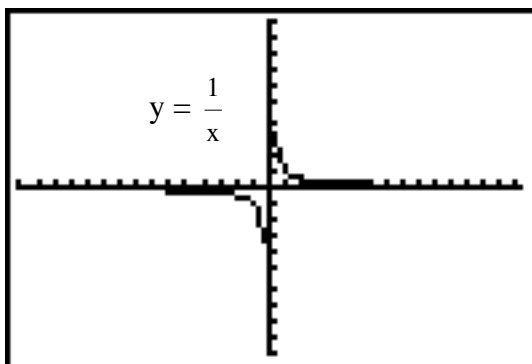
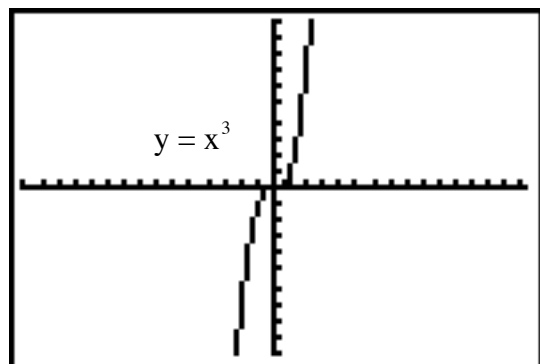
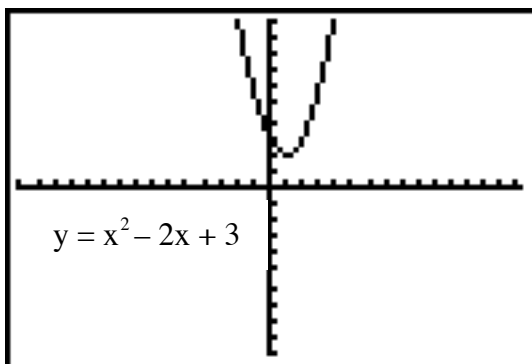
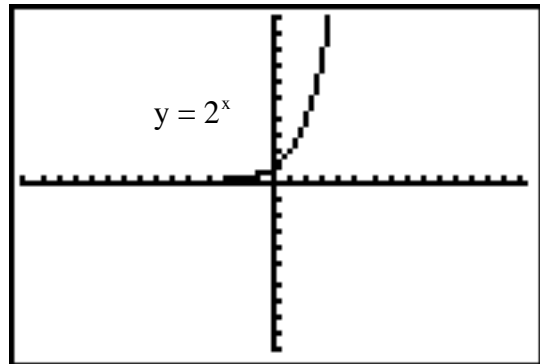
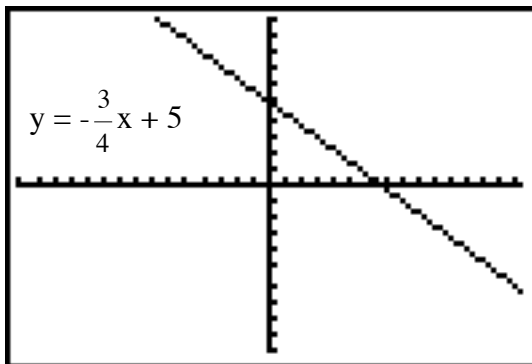
```

Plot1 Plot2 Plot3
\Y1 [-3/4X+5
\Y2 [2^X
\Y3 [X^2-2X+3
\Y4 [X^3
\Y5 [1/X
\Y6 [abs(X+3)
\Y7 [=
    
```

Solutions:

We show the function display for these 6 functions above. Note: The “abs” command is in the **MATH** function key under “NUM”.

The graphs of the functions given in #1-6 are shown below. In each case, we’re using the “ZSquare” window from the **ZOOM** menu.



TI-83 Graphing Functions & Relations

To graph a circle:

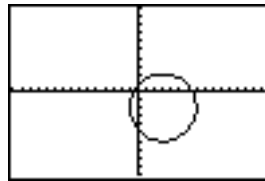
A circle can be graphed by specifying its center (h, k) and radius, r.

Hit $\boxed{2^{nd}} \boxed{DRAW} \boxed{9}$: Circle(. Then enter the coordinates of the center and the radius, separated by commas, with a closing parenthesis.

Depending on your window settings, the graph may not look like a circle. To make the graph look like a circle, choose the $\boxed{ZOOM} \boxed{5}$ option before asking for the circle:

$\boxed{ZOOM} \boxed{5} \boxed{2^{nd}} \boxed{QUIT} \boxed{2^{nd}} \boxed{DRAW} \boxed{9} \dots$

In general, the circular relation given by $(x - h)^2 + (y - k)^2 = r^2$ has center (h, k) and radius r. The circular relation given by $(x - 3)^2 + (y + 2)^2 = 16$ has center (3, -2) and radius 4. Its graph is accomplished with the Circle(3,-2,4) command and should look something like this:



To evaluate a function for a given x value:

Any function stored in the $\boxed{Y=}$ list can also be evaluated in the computation screen. For example, if $Y_1 = -\frac{3}{4}x + 5$, you can evaluate the function at $x = -4$ using the following sequence.

While in the computation screen, hit \boxed{VARS} , then arrow right to Y-VARS, \boxed{ENTER} (on Function), then \boxed{ENTER} (on Y_1), then type $\boxed{(} \boxed{-} \boxed{4} \boxed{)}$, then \boxed{ENTER} . The calculator would produce the answer 8, as shown.

$Y_1(-4)$	8
-----------	---

Another way is to go to $\boxed{2^{nd}} \boxed{TBLSET}$. Select the “ASK” (Independent variable) and “AUTO” (Dependent variable) options. When you go back into $\boxed{2^{nd}} \boxed{TABLE}$, the table is blank. You input any X-value, and the calculator will compute the corresponding Y value using the formula.

X	Y ₁
-4	8

A third way is to go to $\boxed{2^{nd}} \boxed{TBLSET}$. Select the “AUTO” (Independent variable) and “AUTO” (Dependent variable) options. As we saw before, this creates an automatic table of values. If we let TblStart=-4 and $\Delta Tbl = 1$, we would see the following table.

X	Y ₁
-4	8
-3	7.25
-2	6.5
-1	5.75
0	5
1	4.25
2	3.5

TI-83 Graphing Functions & Relations

Examples:

(7) If $y = f(x) = -3x^2 - 4x + 1$, find

- (a) $f(-3)$ (b) $f(0)$ (c) $f(2.5)$

Solutions: Using $Y_1 = -3x^2 - 4x + 1$ and the computation screen, the calculator produces these values.

- (a) -14 (b) 1 (c) -27.75

$Y_1(-3)$	-14
$Y_1(0)$	1
$Y_1(2.5)$	-27.75

(8) If $y = f(x) = 3x^3 - 2x^2 - 4x + 1$, find y when x is

- (a) -2 (b) 0 (c) 5.3

Solutions: Using $Y_1 = 3x^3 - 2x^2 - 4x + 1$ and “ASK AUTO” mode, the calculator gives us these values. Notice the complete answer for $f(5.3)$ at the bottom of the table.

- (a) -23 (b) 1 (c) 370.251

X	Y ₁
-2	-23
0	1
5.3	370.251

To find maximum and minimum values (extrema) and zeros:

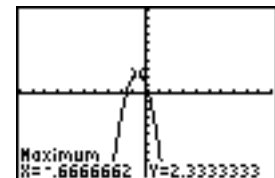
Once a function is graphed, options in the CALC menu (under **TRACE**) can be used to locate maximum and minimum values and real zeros (x-intercepts) of the function.

For instance, consider the quadratic function given by $Y_1 = -3x^2 - 4x + 1$.

To find the maximum of the function, have the calculator graph the function in the viewing window. Then hit **2nd** **CALC** **4**: maximum.

The calculator prompts you for a left bound. Enter an x-value to the left of the maximum (or TRACE to the left of the maximum), and then hit **ENTER**. The calculator then asks for a right bound. Enter an x-value to the right of the maximum (or TRACE to the right of the maximum), and then hit **ENTER**.

The calculator next asks for a guess. Enter an x-value near the maximum, and hit **ENTER**. The coordinates for the approximate maximum are given.



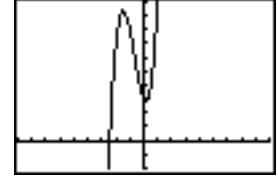
Using -1 and 0 as left and right bounds for the given quadratic function, the maximum value given by the calculator is 2.3333333 , and it occurs when x is -0.6666662 . [Here, the calculator is off a bit; the exact maximum point, or vertex, can be proven with algebra or calculus to be $(-0.\bar{6}, 2.\bar{3})$.]

TI-83 Graphing Functions & Relations

To find the minimum (local minimum), use option $\boxed{3}$: minimum in the CALC menu.

To find the zeros (x-intercepts) of a function, use option $\boxed{2}$: zero in the CALC menu.

For practice, use the calculator to find some of these features of the graph of the cubic function given by $y = 3x^3 + 6x^2 - 2x + 3$. This function has x-intercept $(-2.440952, 0)$, relative minimum $(0.14982956, 2.8451248)$, and relative maximum $(-1.483162, 9.3770974)$. These approximations depend on the choice of lower and upper bounds, but are very close approximations.



To find a point of intersection of two graphs:

Both functions must be entered into $\boxed{Y=}$ (perhaps Y_1 and Y_2). With the graphs in the viewing window, hit $\boxed{2^{nd}} \boxed{CALC} \boxed{5}$: intersect.

Press the up or down arrow until the cursor is on the first graph, then hit \boxed{ENTER} . Press the up or down arrow until the cursor is on the second graph, then hit \boxed{ENTER} . Move the cursor near the point of intersection for your “guess”, then hit \boxed{ENTER} .

The x- and y- coordinates of the point of intersection are then given. This is typically very precise.

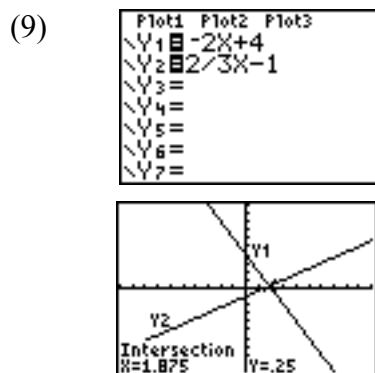
Examples:

Find the point(s) of intersection for each of the given systems:

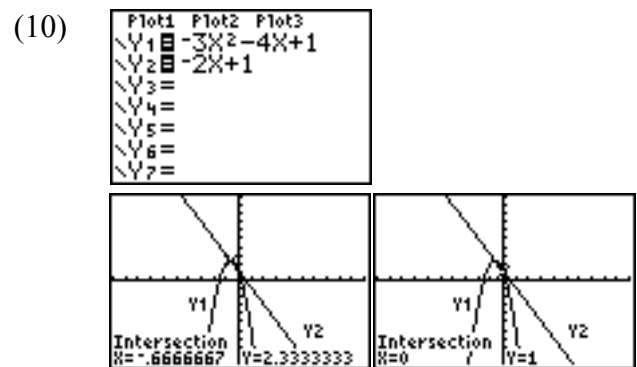
(9) $y = -2x + 4$
 $y = \frac{2}{3}x - 1$

(10) $y = -3x^2 - 4x + 1$
 $y = -2x + 1$

Solutions:



The solution is $\{(1.875, 0.25)\}$.



The two points of intersection are $(0, 1)$ and $(-0.\bar{6}, 2.\bar{3})$.