Making and Using Graphs

College Algebra

# Introduction

In the last section, we made tables for a function given by a formula. We will now make graphs from formulas.

# Making Graphs on Texas Instruments Calculators

Graphing a function on a graphing calculator is relatively easy. We will have to spend some time setting up the viewing window. This is because graphing calculators are setup for traditional algebra classes by default.

## Calculator Directions – Graphing a Function

To make a graph on a TI graphing calculator, do the following:

1. Rewrite the formula so that the independent variable is $x$ and the dependent variable is $y$.
2. Press the Y= button on the calculator and type the formula for Y1.
3. Press the WINDOW button to set the viewing window.
4. Press the GRAPH button to display the graph.

Most of our work will go into finding the window settings.

(A quick aside: I realize that graphing calculators are considered old-fashioned now that programs like DEMOS exist. The reason I still like them is because you must know math to make them work. This is a math class, not a calculator class.)

# Finding the Window Settings

The window settings determine how much of the graph we will see. You want to be able to focus on key features or give an overview of the function depending on your needs.

## Calculator Directions – Setting a Viewing Window

1. Determine the range of values for the horizontal axis. This will either be given to you in the problem, or you will have to infer it from the context.
2. Make a table of values for the graph. This table will give you an idea of the highest and lowest values of the dependent variable. You will have to use the range of values for the horizontal axis from step 1 to make the table.
3. Set the window variables. Press the “WINDOW” button and enter numbers for these variables:
	1. Xmin – The left-most value on the horizontal axis.
	2. Xmax – The right-most value on horizontal axis.
	3. Ymin – The bottom-most value on vertical axis.
	4. Ymax – The top-most value on vertical axis.

The variables Xscl and Yscl are not critical. They can make the graph look pretty by setting the spacing in the tick marks on the axes.

# Examples of Graphing a Function

## Example 1

For the first example, graph the function $f(x)=\sqrt{x}-\frac{x}{20}$ for $x$ between 0 and 10.

## Solution

The calculator steps are below. Please follow along with your calculator.

| Calculator Steps | TI-84 Plus CE | TI-83 Plus |
| --- | --- | --- |
| Press “Y=” and enter the function formula. | The Y= screen of a TI-84 Plus CE. The function is entered in Y1. | The Y= screen of a TI-83 Plus. The function is entered in Y1. |
| “2ND" → “WINDOW” to get to “TBLSET”For x between 0 and 10, use: TblSart=0ΔTbl = 2. | The Table Setup menu for a TI-84 Plus CE. The TblStart is 0 and the Delta Tbl is 2. | The Table Setup menu for a TI-83 Plus. The TblStart is 0 and the Delta Tbl is 2. |
| “2ND" → “GRAPH” to get to “TABLE”For this function, the lowest y value is 0 and largest is 2.66. | The table of values for the function on a TI-84 Plus CE. The lowest function value is 0 and the largest is 2.66. | The table of values for the function on a TI-83 Plus. The lowest function value is 0 and the largest is 2.66. |
| “WINDOW”From the directions, use 0 for Xmin and 10 for Xmax.From the table, use 0 for Ymin and 2.8 for Ymax. You do not have to be precise with the y-values. | The Window menu on a TI-84 Plus CE. The variables are: Xmin = 0 Xmax = 10 Ymin = 0 Ymax = 2.8 | The Window menu on a TI-83 Plus. The variables are: Xmin = 0 Xmax = 10 Ymin = 0 Ymax = 2.8 |
| “Graph”The graph is displayed. If you have any gaps, revise the window settings. | The graph of the function on a TI-84 Plus CE. The graph is increasing and concave down. | The graph of the function on a TI-83 Plus. The graph is increasing and concave down. |

## Example 2

Graph the function $f\left(x\right)=-0.22x^{2}+21.3x+20$ for $x$ between 0 and 100.

| Calculator Steps | TI-84 Plus CE | TI-83 Plus |
| --- | --- | --- |
| Press “Y=” and enter the function formula. | The Y= screen of a TI-84 Plus CE. The function is entered in Y1. | The Y= screen of a TI-83 Plus. The function is entered in Y1. |
| “2ND" → “WINDOW” to get to “TBLSET”For x between 0 and 100, use: TblSart=0ΔTbl = 10. | The Table Setup menu for a TI-84 Plus CE. The TblStart is 0 and the Delta Tbl is 10. | The Table Setup menu for a TI-83 Plus. The TblStart is 0 and the Delta Tbl is 10. |
| “2ND" → “GRAPH” to get to “TABLE”For this function, the lowest y value is -50 and largest is 535. | The table of values for the function on a TI-84 Plus CE. The lowest function value is -50 and the largest is 535. | The table of values for the function on a TI-83 Plus. The lowest function value is -50 and the largest is 535. |
| “WINDOW”From the directions, use 0 for Xmin and 100 for Xmax.From the table, use -60 for Ymin and 550 for Ymax. You do not have to be precise with the y-values. | The Window menu on a TI-84 Plus CE. The variables are: Xmin = 0 Xmax = 100 Ymin = -60 Ymax = 550 | The Window menu on a TI-83 Plus. The variables are: Xmin = 0 Xmax = 100 Ymin = -60 Ymax = 550 |
| “Graph”The graph is displayed. If you have any gaps, revise the window settings. | The graph of the function on a TI-84 Plus CE. The graph is a parabola that opens downward. The vertex is close to the middle in the x range. | The graph of the function on a TI-83 Plus. The graph is a parabola that opens downward. The vertex is close to the middle in the x range. |

# Tracing On a Graph

Once you have a graph, you can answer many questions about the function. You will need exact function values to get the information to answer these questions. The trace feature on your calculator will allow you to access specific function values.

## Calculator Directions – Using the Trace Function

* To use the buttons to trace a graph, press the “TRACE” button. Press the left and right buttons to move the cursor along the graph. The x-coordinate and y-coordinates are displayed on the bottom.
* To evaluate the function for a specific x-value, type “TRACE” and then the value for $x$.

## Examples

Some examples of tracing a graph are shown below using the graphs from Example 2.

| Calculator Steps | TI-84 Plus CE | TI-83 Plus |
| --- | --- | --- |
| Press “TRACE” and press the right arrow a few times. | The graph of the function on a TI-84 Plus CE. The graph is a parabola that opens downward. The cursor is at x=71.21212 and y=421.16162. | The graph of the function on a TI-83 Plus. The graph is a parabola that opens downward. The cursor is at x=71.27660 and y=420.51381. |
| Press “TRACE” and type 40. | The graph of the function on a TI-84 Plus CE. The graph is a parabola that opens downward. The value x=40 is highlighted on the bottom. | The graph of the function on a TI-83 Plus. The graph is a parabola that opens downward. The value x=40 is highlighted on the bottom. |
| Then type “ENTER”.The cursor moves to a x-coordinate of 40. The y-coordinate of 520 is the function value. | The graph of the function on a TI-84 Plus CE. The graph is a parabola that opens downward. The cursor is at x=40 and y=520. | The graph of the function on a TI-83 Plus. The graph is a parabola that opens downward. The cursor is at x=40 and y=520. |