

INTRODUCTION TO THE TI-83/84 GRAPHING CALCULATOR

Sue Kellicut
Mathematics Professor
Seminole Community College
2006

Introduction

This guide to the TI-83 and TI-84 calculators is designed for those students who have never owned a graphing calculator. It is a summary of the material found in the manuals that accompany these calculators. Please consult the manuals for more details.

Basic Concepts

1. Getting Started

Please note that there are options above each key on the calculator as well as on each key.

On the TI-84 the options in a blue are accessed by first pressing the blue key marked 2nd. This key is located at the top of the left-hand column on the keypad. On the TI-83 the options in yellow are accessed by first pressing the yellow key marked 2nd. This key is located at the top of the left-hand column on the keypad. To access the options in green on both calculators, you must first hit the green key marked ALPHA. This key is right below the 2nd key. Toggle indicators are on the upper right-hand of the keypad.

To turn the calculator on, press the ON button at the bottom of the left-hand column on the keypad. You should see a blinking rectangle, or cursor, on the screen. If you do not see the cursor, you may need to change the brightness of the screen. To darken the screen, hit 2nd and toggle \uparrow . To lighten the screen, hit 2nd \downarrow . Do not hold the 2nd button. If the screen is very light or very dark, repeat the sequence 2nd \uparrow or 2nd \downarrow until the screen is readable. As you do this, the cursor will appear in the upper right corner of the screen with a number from 1 to 9. A 1 indicates fresh, new batteries and a 9 means that the batteries are very weak. Keep the screen brightness at the lowest level that is comfortable for you to see.

Batteries last a long time in these calculators. To change the batteries, remove the door on the back of the calculator. Remove and replace the four AAA batteries one at a time. This will save any information which is stored in your calculator. The round watch-style battery rarely needs replacement.

To turn the calculator off, hit the 2nd key, then the ON key.

2. Mode

When you hit the MODE button, a series of options is shown. Normally, you will want to have the first option in each row selected. Use the toggle keys to darken the first option in each row if that has not been selected. Once that option is dark, hit the ENTER key to maintain that setting.

3. Subtraction and Negation

Please note that negation (-) and subtraction – are separate keys. The subtraction key is located with the other operation keys on the right of the calculator. The negation button (-) is located with the decimal key at the bottom of the calculator. Subtraction is an operation and is used when another number or variable begins the expression. Negation must be used to begin an expression.

Example: $-4 - (-7)$ *Press:* (-)3 – (-)7 ENTER

The answer 4 should appear on your calculator screen.

Example: $8 - 5$ *Press:* 8 – 5 ENTER

The answer 3 should appear on your calculator screen.

4. Clearing the Screen

To erase the current line of text, hit CLEAR. To erase the entire screen, hit CLEAR CLEAR.

5. Returning to the Home Screen

To exit out of any menu and return to the home screen, press 2nd MODE.

6. Arithmetic Operations

The numbers and operations should be entered into the calculator as written, then the ENTER key should be pressed. The calculator is programmed to apply the correct order of operations.

Example: $12 + 6 \times 4$ *Press:* 12 + 6 x 4 ENTER

The answer 36 should appear on your calculator screen.

Notice that the calculator did the order of operations correctly by performing multiplication before addition. If you want to do addition first, you must use a set of parentheses to indicate your wishes.

Example: $(12 + 6) \times 4$ *Press:* $(12 + 6) \times 4$ ENTER

The answer 72 should appear on your calculator screen.

To raise a quantity to an exponent, use the ^ key, which is located on the right side of the calculator below the CLEAR button.

Example: 4^3 *Press:* $4 \wedge 3$ ENTER

The answer 64 should appear on your calculator screen.

If the base of an expression with an exponent is negative, parentheses must be used to indicate that the negative is also affected by the exponent.

Example: $(-2)^3$ *Press:* $((-2) \wedge 3)$

If fractions are used as coefficients or as exponents, parentheses must be used to indicate this.

Example: $\frac{1}{2}x^3 + 3x^{\frac{1}{2}}$ *Press:* $(1 \div 2) \times \wedge 3 + 3 \times \wedge (1 \div 2)$

If you want to square a quantity, you may either use the ^ key or the x^2 key which is the fifth button on the left side of the keyboard.

Example: 5^2 *Press:* $5 \wedge 2$ ENTER
OR
Press: $5 x^2$ ENTER

The answer 25 should appear on your calculator screen.

To find the square root of the number, you need to use the function that is above the x^2 key.

Example: $\sqrt{36}$ *Press:* $2^{\text{nd}} x^2 36$ ENTER

The answer 6 should appear on your calculator screen.

When finding other roots, it is much easier to convert the root into a fractional exponent. Remember that $\sqrt[3]{x} = x^{\left(\frac{1}{3}\right)}$, $\sqrt[4]{x} = x^{\left(\frac{1}{4}\right)}$, etc.

Example: $\sqrt[3]{10}$ *Press:* 10 ^ (1 ÷ 3) ENTER

The answer 2.15443469 should appear on your screen.

When entering a mathematical expression with one or more sets of parentheses, use only parentheses. Do not use the brackets [and] which are accessed with the 2nd key. Be sure to have an equal number of left and right parentheses in your expression.

Example: $8 + 6[5 - 2(7 + 4)^2]$ *Press:* 8 + 6 (5 - 2 (7 + 4) x²) ENTER

The answer -1414 should appear on your screen.

7. Scientific Notation

Sometimes the TI-83 and TI-84 calculators give answers in scientific notation.

Example: $(.06)^3$ *Press:* (.06) ^ 3

The answer 2.16E-4 should appear on your screen. This is the calculator's method of indicating the number 2.16×10^{-4} .

8. Editing

To delete an entry, move the cursor to the character you want to erase, then press the DEL key which is located in the top row next to the toggle keys. To insert a character or characters, move the cursor to the character directly after the location where you want the insertion to occur. Then hit 2nd DEL and type in your selection.

To edit an expression after it has been entered, hit 2nd ENTER. The expression will then appear again on the screen and can be edited.

MENUS

The TI-83 and TI-84 graphing calculators are able to perform complicated, multi-step procedures through the use of menus. The menus that you will be using the most often are explained below.

9. Math Menu

When you press the MATH key, which is located on the left side of the keypad, you will see four choices at the top of the screen with the MATH option highlighted. Seven functions are listed with an arrow by the seventh option. This

arrow indicates that more options are available. If you scroll down to option 7, another option appears. If you scroll two more times you will see two more options. If you scroll again you will see that you are back to the beginning.

Example: $\sqrt[3]{512}$ *Press:* MATH 4 ENTER 512) ENTER

The answer 6 should appear on your screen.

To access the NUM (number) option, move the cursor to the right using the toggle keys. You will see seven more options with an arrow by number 7. If you scroll down you will see two more options listed.

Example: $|4.5 - 8.9|$ *Press:* MATH →ENTER 4.5 – 8.9) ENTER

The answer 4.4 should appear on your screen.

The other two options, CPX and PRB are for complex numbers and probability. You will probably not need these categories in beginning classes.

10. Angle Menu

To access the angle menu, press 2nd MATRX. Note that there is only one group of options for this menu.

GRAPHING

The graph button is used to access the graphing menu. A graphing calculator graphs functions, not equations. To graph an equation, it must be in the form $y = f(x)$.

11. Graphing Equations

Before beginning, set your graph window to the standard viewing window by selecting that option. Press the ZOOM key, then scroll down to option 6 and press ENTER. Your viewing window will now include x values from -10 to 10 and y values from -10 to 10.

To graph a function, press Y=. Enter the desired equation using the variable key (marked as **X,T,θ,n** on your keyboard) key to enter variable. Press GRAPH.

Example: Graph $y = 3x + 1$ *Press:* Y= 3 **X,T,θ,n** + 1

You should see the graph of a line with slope 3 and y-intercept 1.

If you now return to the Y= screen, you will notice that the equal sign next to the equation you entered is highlighted. Only those functions with a highlighted equal sign will be graphed. To de-activate a function, move the cursor to the equal sign and press ENTER. The function will not be graphed. If you want to re-activate the function, move the cursor to the equal sign and press ENTER.

12. Window Settings

You may select any viewing window you wish. We previously selected the standard viewing window. Press the WINDOW button, located next to the Y= button, to see range of the current window. The standard viewing window shows $X_{\min} = -10$, $X_{\max} = 10$, $X_{\text{scl}} = 1$, $Y_{\min} = -10$, $Y_{\max} = 10$, $Y_{\text{scl}} = 1$, $X_{\text{res}} = 1$. This means the portion of the coordinate plane that will be displayed on the calculator is $-10 \leq x \leq 10$ and $-10 \leq y \leq 10$. The $X_{\text{scl}} = 1$ and $Y_{\text{scl}} = 1$ gives the scale used on the axes. Each mark on these axes is worth 1 unit.

Example: Set the calculator to view the graph when $-5 \leq x \leq 20$ and $-20 \leq y \leq 50$ with a scale of 10 on each axis.

Press: (-) 5 ENTER 20 ENTER 10 ENTER (-) 20 ENTER 50 ENTER (-)10 ENTER

You should now see the graph of $y = 3x + 1$ in the new window.

13. Zoom Menu

The zoom menu offers a quick way to change the viewing window. Zoom Decimal (option 4), Zoom Square (option 5), and Zoom Integer (option 8) all change the values for the window to $-4.7 \leq x \leq 4.7$ and $-3.1 \leq y \leq 3.1$.

Example: Graph $y = 3x + 1$ in the Zoom Decimal viewing window.

Press: 4 ENTER

14. TRACE Feature

Return the calculator to the Standard Viewing Window using ZOOM 6. Press the TRACE button located under the view screen. You should see the cursor on the y axis and $x = 0$, $y = 1$ displayed on the bottom of the screen. Use the left and right toggle buttons to move the cursor along the graph. Note the changing values for x and y displayed at the bottom of the screen.

If you wish to find a specific point on the graph, just enter that number and press ENTER. The x value you entered and its correct y value for the equation should appear at the bottom of the screen.

Example: Find the y value for $y = 3x + 1$ when x is 5.

Press: 5 ENTER

You should see $x = 5$ and $y = 16$ on the bottom of the screen.

15. Calculate Menu

Once a function has been entered using $Y=$, calculations can be done using 2nd TRACE. You can use this menu to find a particular value for the function that has been entered in $Y=$ by pressing VALUE (option 1). Option 2 can be used to find the roots or x-intercepts of the function; option 3 finds the minimum point of a function in a given interval; option 4 finds the maximum value of a function in a given interval; and option 5 find the point where two graphs intersect. (Options 6 and 7 are used in calculus courses.)

To find the root or zero or x-intercept for a function, you must first graph the function. After the graph is displayed, press 2nd TRACE 2. The calculator will now ask you a series of questions to enable it to find the correct zero when two or more exist. The first question will be 'Left Bound?' Move the cursor to the left of the x-intercept and press ENTER. The calculator will then ask for the Right Bound. Move the cursor to the right of the x-intercept and press ENTER. When you see 'Guess?', press ENTER. The zero will be displayed at the bottom. If several zeros exist, the procedure must be repeated for each one.

To find the minimum or maximum value for a function, you must first graph the function. After the graph is displayed, you will need to select either option 3 or 4. The calculator will go through the same series of questions that were used to locate a zero.

To find the intersection point of two graphs, you must first graph the functions. After the graph is displayed, select option 5. When you see the question 'First Curve', move the cursor close to the intersection point you are trying to find and press ENTER. You will then see 'Second Curve?'. Press ENTER and ENTER again for the Guess? Question. The coordinates of the intersection point will be displayed. If there is more than one intersection point, repeat the procedure.

16. Table Feature

A table of x and y values representing ordered pairs that are solutions of an equation can be displayed on a graphing calculator. To create such a table, the function must first be entered on the $Y=$ screen. Then press 2nd WINDOW to set up your table. You can choose to supply the x values your self or you can set the graphing calculator to supply them. To have the calculator supply the x values, set "Indpnt" to "Auto" by positioning the cursor over "Auto" and pressing ENTER. "Depend" should also be set to "Auto".

When “Indpnt” is set to “Auto”, the calculator will supply values for x, beginning with the value specified as TblStart and continuing by adding the value of ΔTbl to the preceding x value.

Example: Set up a table for $y = 3x + 1$, beginning with -5 and increasing the x value by two for each entry.

Press: 2nd WINDOW ↓ (-)5 ↓ 2 Make sure that “auto” is highlighted for both “Indpnt” and “Depend”. Then press 2nd GRAPH.

If you are looking for a particular x value in the table, you must change the TBLSET screen from “Auto” to “Ask”. You do this by highlighting the “Ask” option on the “Indpnt” line. The highlighting for the “Depend” line should remain on “Auto”. Note: Because the calculator is set up to deal with functions, input is restricted to x values only. In other words, you cannot input a y value and request the related x value of a graph.

Example: For the function $y = 3x + 1$, find the value of y when $x = 2$

Press: 2nd WINDOW ↓ ↓ ↓ “Ask” 2nd GRAPH 2 ENTER

The calculator should display a y value of 7 in the table.