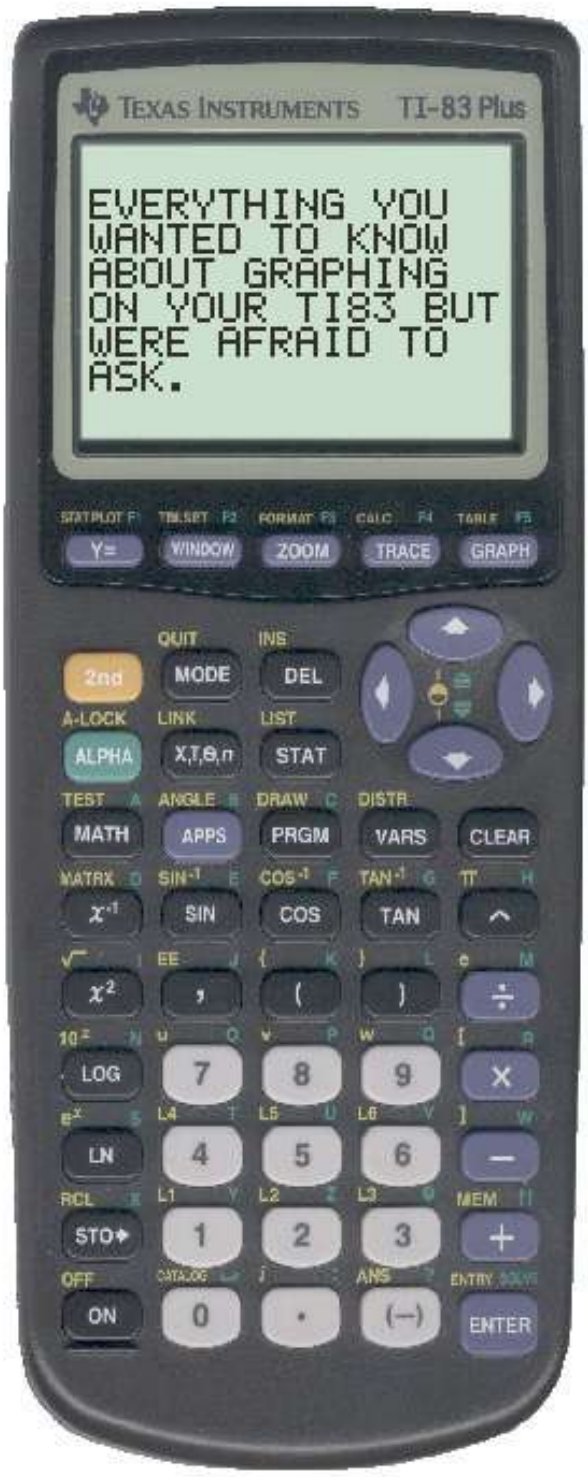
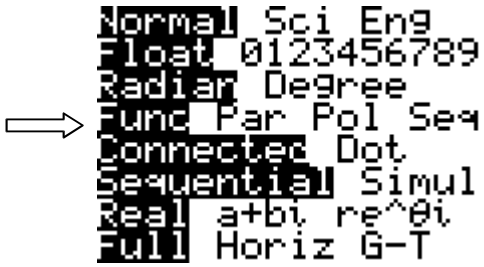


USING YOUR TI-83/84 GRAPHING CALCULATOR

Graphing Basics

The y= editor

- To enter a function into the calculator to be graphed, you must be in Function mode.



- Hit Y=
  There are ten storage locations for functions Y_1 through Y_{10}. You could graph 10 functions at one time, although I would not recommend that you do that!

- Use the X,T,Θ,n button for your **x variable** of your function.

- **To deselect** one of the functions, use your arrow keys to move the cursor to the equal sign of the function you would like to deselect and hit ENTER. The equation will remain in the y= editor but will not show up on your graph.

- Once you have an equation entered and selected, you can hit GRAPH to see the graph of this function. You often need to make adjustments to your graphing window to see a "better picture" of your function. (See Setting the Graphing Window below).

- To interrupt the plotting of a function, hit the ON button.

TRACE

- Use TRACE to move the cursor from one plotted point on the graph to the next using your ◄ and ► buttons.

- If you move to a point outside of the dimensions of your screen, the x and y coordinates will change appropriately and eventually the window screen will be readjusted.

- If you have more than one function graphed on the screen at one time, you can **move from one function to another** by using your ▲ and ▼ buttons.

Formatting the graph

- Hit 2nd ZOOM (FORMAT) You will see this screen:

  - **CoordOn** will show you the x and y coordinates of each point as you trace along your function.
  - **GridOn** will turn on the grid. It will show up as dots or lines. I prefer to leave the grid off.
  - **AxesOn** will turn on the x- and y-axes when you graph your function. It is almost always a good idea to leave these turned on.
  - **LabelOn** will label each axis as either x or y. This is not a feature that I generally choose.
  - **ExprOn** will display the function that is in use when the Trace cursor is active. I leave this one on all the time.

Setting the Graphing Window

- Hit the WINDOW button. In this screen, you can manually set the bounds of your window by setting the minimum and maximum value of each of your axes. You may also adjust the scale used on each axis (they do not have to be the same). For example, by setting the xscl to 5, a tic mark will appear every 5 units on your x-axis.
- The calculator has seven predefined window settings built in. The three that you will probably use most frequently when you first start using your graphing calculator are **Standard, Square** and **ZoomFit.**

- Hit the ZOOM button.
  - **6: Zstandard**: It sets the window variables so that the x and y axes go from –10 to 10, with a scale of 1.

  - **5: Zsquare**: It adjusts the window variables based on the current settings so that the graph is squared off. This is important for making *perpendicular lines* actually appear perpendicular and making *circles* actually look like circles.

  - **0: ZoomFit**: It recalculates the ymin and ymax to include the minimum and maximum values of y within the x range that is currently in use. This feature is often helpful to use as a starting point when your graph does not appear on your screen.

- Other window settings
    - **4: ZDecimal**: Replots the function(s) so that the change in x as you trace along the graph is 0.1.

    - **8: Zinteger**: You must choose ZOOM 8 and then hit ENTER. It will replot your function(s), setting the change in x to 1.

Zooming in or out on your graph

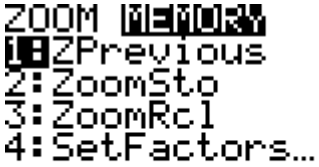
- **1: ZBox**: Allows you to define a new viewing window by drawing a rectangle around the portion of the screen you would like magnified.

- **2: Zoom In**: Magnifies the portion of the screen that surrounds the cursor. **QuickZoom: If you are in viewing the graph of your functions and are in Trace mode, you can hit ENTER and the portion of the screen surrounding the cursor will be magnified.

- **3: Zoom Out:** Zooms out around the area surrounding the cursor.

Saving your zoom settings

- ZOOM MEMORY



- **1: ZPrevious**: It will replot your function(s) using the window settings that were defined before your last ZOOM command.

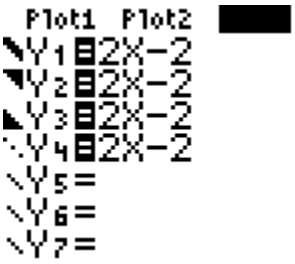
- **2**: **ZoomSto**: It will store the current window setting in memory

- **3**: **ZoomRcl**: It will replot your function(s) using the window settings that had been stored into memory.

- **4**:**SetFactors**: Allows you to define the level of magnification used in ZOOM In and ZOOM Out.

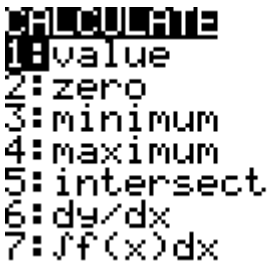
Graphing-Style

- You can change your graphing style from the default (Line style: connected) to other options by using your ◄ when in y= to move to the left of Y_1 (or Y_2, Y_3, etc.)
  - **Bold**: A thick line/curve is plotted
  - **Shade above:** For graphing inequalities
  - **Shade Below:** For graphing inequalities
  - **Dot:** Does not connect points on the graph.



THE INDISPENSABLE CALC MENU

- This is where the graphing calculator really shines! To get to the CALC menu, hit 2nd TRACE [CALC]. This is what you should see:



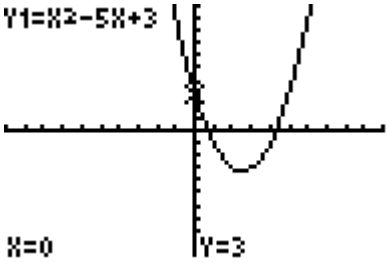
- For anyone studying functions, you should become very familiar with options 1 – 5. Choices 6 & 7 are used in calculus. Look at what the calculator can help you do when analyzing the graph of a function.

  - **1: value**: It will return the corresponding y value for whatever x value you enter as input.

    ** **Shortcut**: When viewing a function, hit TRACE, type the value of x you would like to input into the function, and then hit ENTER.

    This feature is great for finding the **y-intercept** of the graph of a function. **Enter a zero for the x-coordinate** and the Value operation will return the corresponding y-coordinate.

- This is what the screen looks like after using the value operation to find the y-intercept of $y = x^2 - 5x + 3$:



- **2:Zero**:
  Use this operation to find the real zeros of a given function. Graphically, this translates into finding the **x-intercept(s) of the graph** of a function. Because the graph of a function could have more than one x-intercept, you have to help the calculator *zero in* on the one you would like to find. You will have to repeat the operation to find additional zeros (x-intercepts).

  When viewing the graph of the function,
  - Hit 2nd TRACE [CALC] and choose 2: Zero

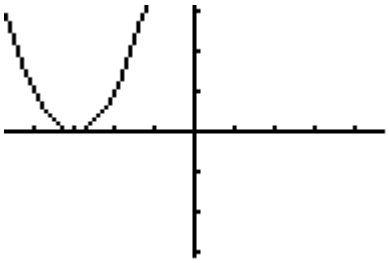
  - `Left Bound?`
    You will be asked to enter a left bound for your x-intercept. You want to move your cursor using ◄ or ► keys until it is at a point on the graph such that the **x-value is less than that of the x-intercept** or **enter a value for x** that is less than that of the x-intercept. Hit ENTER. .

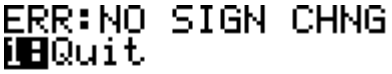
  - `Right Bound?`
    You will be asked to enter a right bound for your x-intercept. You want to move your cursor using ◄ or ► keys until it is at a point on the graph such that the **x-value is greater than that of the x-intercept** or **enter a value for x** that is greater than that of the x-intercept. Hit ENTER. . .

  - `Guess?`
    You will be asked to enter a guess. Move your cursor to a point that is fairly close to the actual x-intercept (or type in a numerical value for your guess). Hit ENTER.

****Warning: To find an x-intercept, the calculator looks for a change in sign from positive to negative (or vice-versa) in the y-value as the graph crosses the x-axis. Therefore, it cannot find x-intercepts at points where the function is *tangent* to the x-axis (the graph touches the x-axis at that point but does not pass through it).**

In the example below, the function $y = (x+3)^2$ does have an x-intercept at $x = -3$, but the calculator will not be able to find it using the Zero operation.





- **3: minimum** and **4: maximum**:
  Returns the relative minimum or maximum of a function within a specified interval. You will again be asked to **enter a left bound, a right bound, and a guess.**

- **5: intersect**:
  It will find the coordinates of the point where two lines/curves intersect. This is the operation you want to use to find the solution to a system of equations. It will ask you to answer three questions:

  - **First curve?**
    The equation of the function that is currently chosen will appear in the top-left corner of your viewing window. Use your ▲ or ▼ keys to select a different function, if necessary. (It will always start with the smallest Y_n). Hit ENTER.

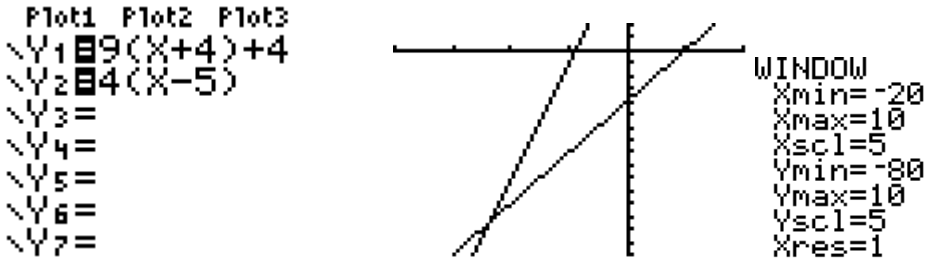
  - **Second curve?**
    Use your ▲ or ▼ keys to select a different function, if necessary. Hit ENTER.

  - **Guess?**
    Move your cursor to a point that is fairly close to the actual point of intersection that you would like to find (or type in a numerical value for the x-coordinate of your guess). Hit ENTER.

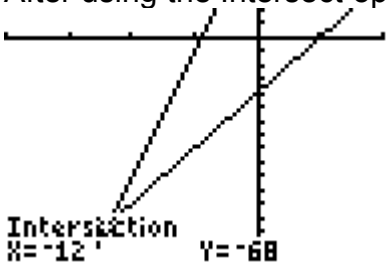
The Intersect operation can be used to solve equations graphically. For example, if I wanted to check my solution to the equation

$$9(x+4)+4=4(x-5),$$

I would enter the left side of the equation into Y_1 and the right side of the equation into Y_2. I would graph both equations and find the point of intersection. The x value at that point would be my solution to the original equation.



After using the Intersect operation, I get this screen:



Therefore, the solution to the equation is $x=-12$ which should match the solution you found when you solved it algebraically.

Now admit it; that was COOL!

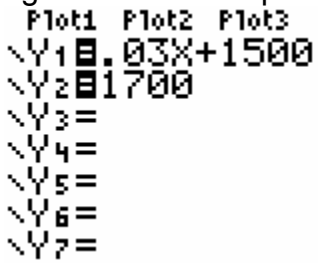
Let's look at one more example of using the intersect feature to solve an equation, this time in slow motion.

Example 2:
The salary for a sales representative is $1500 per month plus a commission of total monthly sales. Mathematically, the relationship can be expressed as
S = 0.03M + 1500**, where S represents the monthly salary and M represents the total monthly sales.**
Use your graph to estimate the total monthly sales needed for a salary of $1700. (Use CALC 5: intersect).
The equation that we need to solve is .03*m* + 1500 = 1700. This equation can be solved algebraically without much difficulty.

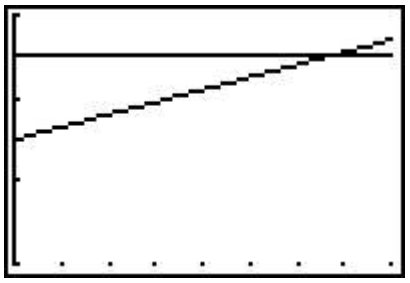
$$.03m + 1500 = 1700$$
$$.03m = 200$$
$$m = \frac{200}{.03}$$
$$m \approx 6666.67$$

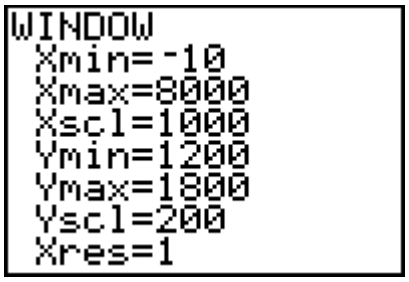
To solve it graphically, we will make use of the **Intersect feature**. This function will find the intersection of two lines/curves. So we will need to enter two functions into our y= editor.

1. The first step is to enter the left-hand side of the equation into y1 and the right side of the equation into y2. Your screen should look like this:



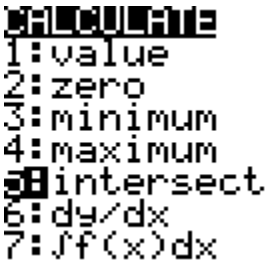
2. Now we will find the intersection of these two lines. First make sure that you can see the intersection point in your viewing window. Adjust your window if necessary.



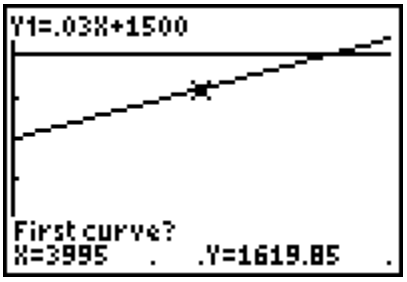


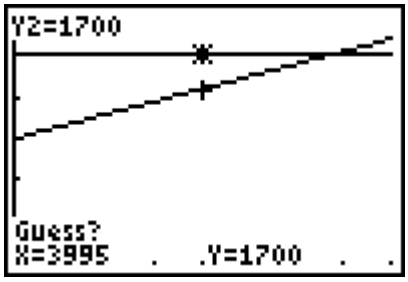
3. I am ready to use the calculator to find the intersection point.

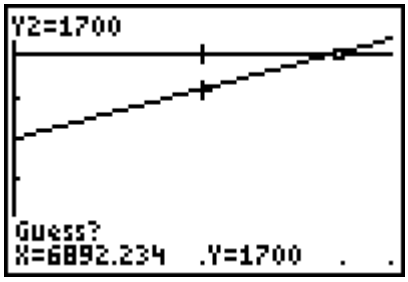
   Hit 2nd TRACE [CALC] and choose **5: intersect**



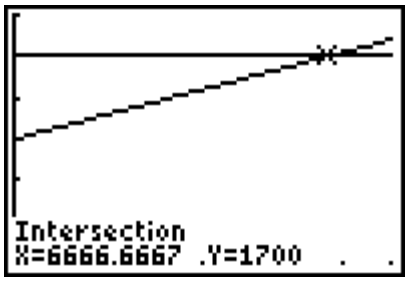
   You will have to enter the **Fist curve, Second curve, and Guess**. See screens below.







The calculator will return the **x and y coordinates of the point of intersection**.



The *x* value, *x* = 6666.67 is the solution to the original equation.

Important note regarding the intersect feature:
After selecting Intersect from the CALC menu, you must hit enter THREE times ("First curve", "Second curve", "Guess") to find the intersection point. If the screen does not say "Intersection" at the bottom then you probably do NOT have the coordinates of the intersection point.

For additional help on using your TI graphing calculator, you may want to visit the following site http://www.esc4.net/math/Calculator/intro.htm