Pre-Calculus Graphing Calculator Handbook

I. Graphing Functions

A. [Y=] Button for Functions

This button is used to enter any function to be graphed.
You can enter up to 10 different functions at a time.

Use the [X,T,Θ,n] button to enter the variable x for the equation.
Use your up/down arrow buttons to move between functions and plots.
Use your right/left arrow button to move to the = sign to select or de-select graphs by highlighting or undoing the highlighting.
Use your right/left arrow button to move to the \ symbol to select the style of graph to be drawn. For example, regular line, thick line, shaded above, shaded below, circle trace with line, circle trace without line, dotted line.
To pause a graph while the function is being graphed, press ENTER.
To stop a graphing feature, press ON.

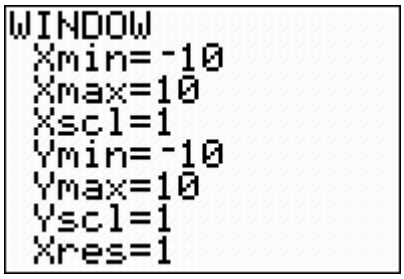
Graph: y = -2x + 5 while changing some graphing features.

Common errors:

Using the minus button [−] instead of the negative button [(−)], and vice versa.
Having a Plot1, Plot2, or Plot3 ON instead of OFF.
Not using parentheses appropriately.
Not having appropriate windows.

B. WINDOW Button for Functions

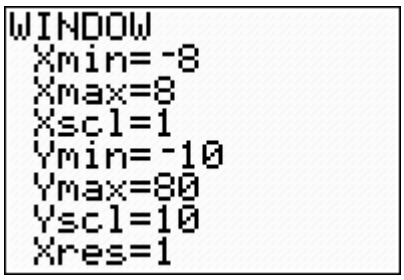
It will be vital for this class that you use appropriate windows when graphing.
The standard window for graphing is:



Xmin and Ymin mean the minimum value for the axes.
Xmax and Ymax is the maximum value.
Xscl and Yscl are the values of each tick mark on the axes. (TIP: If the scale is set too low the axis will be drawn very thick, which may hide information about the graph.)
Xres is the pixel resolution and should always be set at one.

Graph the functions $y = x^2 + 13$ on a standard window. What do you notice?

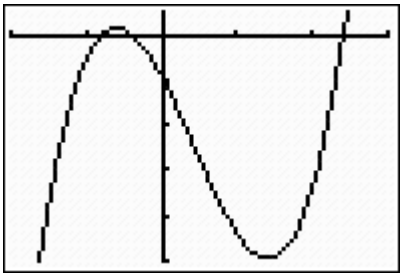
Change the window to the following:



What do you notice?

This new window is now an ideal window for a graph because it uses the full screen to show the important pieces of the graph. (Intercepts, turning points, symmetry, etc)

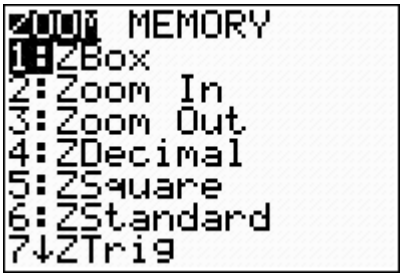
Graph $y = x^3 - 6x^2 - 64x - 96$ and find appropriate windows so your graph looks similar to the figure to the right:



The window used here was x:[-10, 15] xscl 5 and y:[-500, 50] yscl 100.

C. ZOOM Button

Several key features to notice:



1. ZSquare will adjust the window so the graph appears normal to the eye instead of looking oblong. A circle looks like a circle instead of an oval.
2. ZStandard sets the window to the standard setting discussed above.
3. The arrow at number 7 indicates there are more options.
4. Never use ZoomFit, as it will not give you accurate windows. The following example demonstrates how ZoomFit does not show you all you need to see on a graph.

Graph $y = 0.002x^3 - 0.01x^2$ on a standard window.
Now use the ZoomFit feature.
Now use the windows: X [-2,6] scl 1, Y [-0.05,0.05] scl 0.001
What do you notice about the three different window settings?
Which setting should be used for this graph on a test?

II. Table Functions

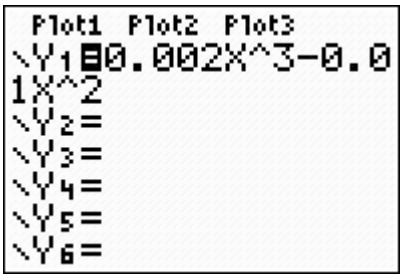
Various times throughout the year, you will be asked to complete a table.

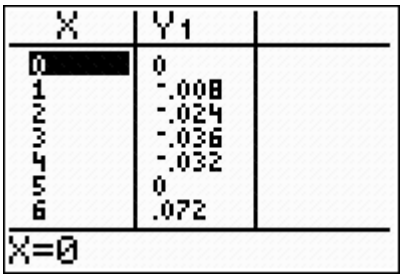
By entering the equation into the Y= screen, you can then access a table using the feature on the calculator by pressing 2nd GRAPH
(The table setup has nothing to do with the current "window" setup.)

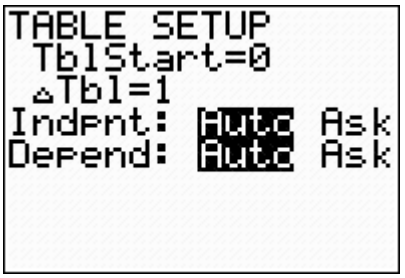
Creating a table

Use the equation from the previous example: $y = 0.002x^3 - 0.01x^2$.

1. Enter the equation into the Y= screen.
2. Display the table: (If your table does not look the same, read #4 and #5 to reset the table at 0)







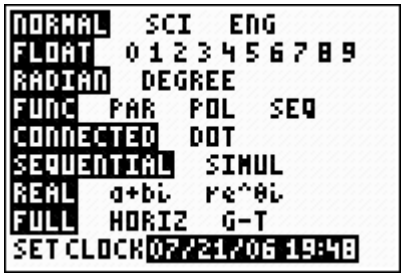
3. X and Y_1 columns appear (If you have more than one function, all will be listed by function number.)
4. Sometimes the table you are completing will need to start at a number other than zero. To change this, press 2nd WINDOW for the "Tbleset" button.
5. Change the starting number to -0.1 and ΔTbl to 0.01 to change the increments of the table.

> What is the value for Y, when X is 0.9?

When x = 0.3, y = -8E4 which is really -0.0008 in scientific notation. Also, when a value is shown as 4E-12, understand it really should be considered 0.

III. Mode Features

Use this button to change modes at any time:

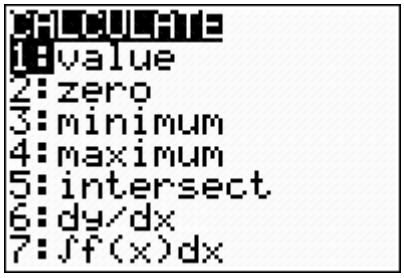


Most of the time, leave NORMAL, FLOAT, CONNECTED, and REAL set as they are. For now, either RADIANS or DEGREES is fine. Second semester we will investigate Parametric and Polar equations, but for now leave the calculator on FUNCTION. When graphing two or more functions at a time, you may change the calculator to SIMUL. This will graph all functions at the same time. SEQUENTIAL graphs one at a time. You may change the screen from FULL (full screen graph only) to G-T (half screen graph, half screen table). Once we enter the trig chapters you will become very familiar with radians and degrees. Some calculators do not have clocks to set.

IV. Calculate Features

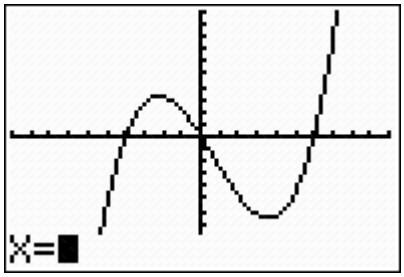
Located by pressing 2nd TRACE .

We will only use features 1 through 5.



Graph $y = 0.1x^3 - 0.2x^2 - 2.4x$ using a standard window. Use the directions below to find a value, the zeros, minimums, and maximums.

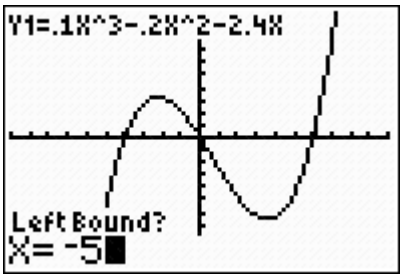
A. Value: Find the function's value at a given x value.



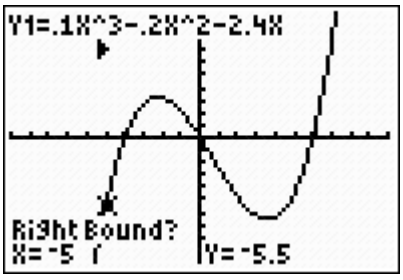
Press CALC and select #1. The calculator is prompting for an x-value. Enter the desired number and the calculator will compute f(x). You can do this for repeated values without pressing CALC again – just enter the next number.

Evaluate f(4), f(2.1) and f(-.5)

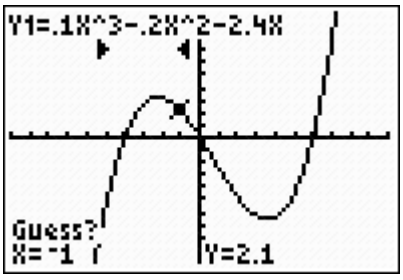
B. Zero: Finds where a graph intersects the x-axis.



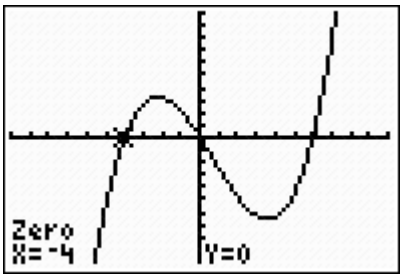
Press CALC and select #2 Zero. It will ask for the left bound. Use the right or left arrow buttons to place the cursor to the left of the x-intercept. Press ENTER. If you know where an appropriate left bound is on the graph, you can just enter the value instead of using the arrows to move the cursor.



An arrow will appear in the upper part of the screen.



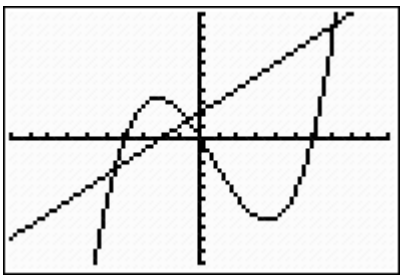
Next, use the right/left arrow button to move the cursor to the right of the x-intercept. Press ENTER. A second arrow will appear near the top of the screen.



Then, the calculator will ask you to guess. You can choose to ignore this option or enter your guess as to where the zero is on the function. Press ENTER for the answer. Do the same for the other two intercepts.

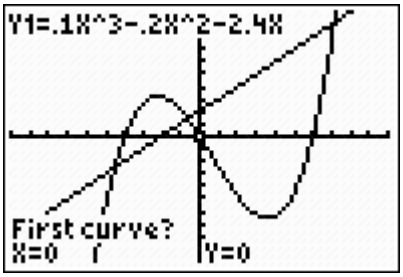
C. Minimum: Finds the relative minimum of a graph.
Follow the same procedure as above with left and right bounds to find the minimum, if one exists.

D. Maximum: Finds the relative maximum of a graph.
Follow the same procedure as above with left and right bounds to find the maximum, if one exists.



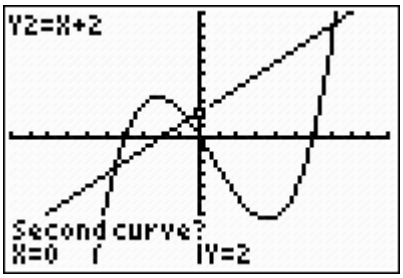
Graph y = x + 2 in Y_2 so that you have both graphs in the same window. Use the directions below to find the 3 points of intersection of the two graphs.

E. Intersect: Finds the point of intersection of two graphs.

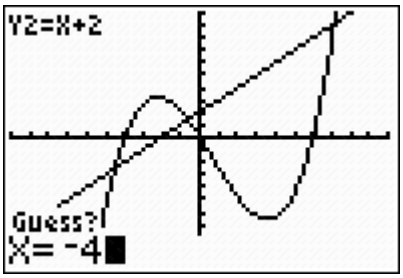


Two graphs must be in the graph screen. Select INTERSECT.

The calculator is going to ask which two graphs will be intersected. Press ENTER to select Y_1 and press ENTER again to select Y_2. The calculator defaults to select these graphs.

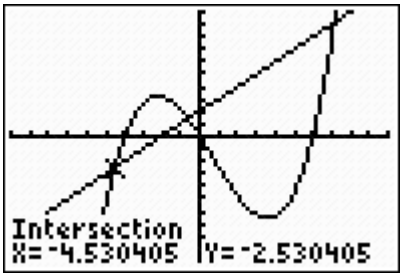


If you have more than two graphs you will need to use the up/down arrows to select the correct functions.



The functions of the selected graph appear at the top of the screen. Should you need to change between graphs, use the up/down arrows.

Ignore the guess (unless you would like to guess) and press enter for the answer.



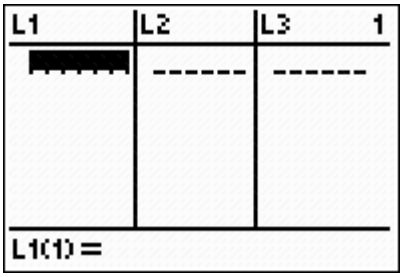
If you have more than one point of intersection, do the same process, just move the cursor in the beginning to the second point of intersection. Or you can guess near the other points of intersection.

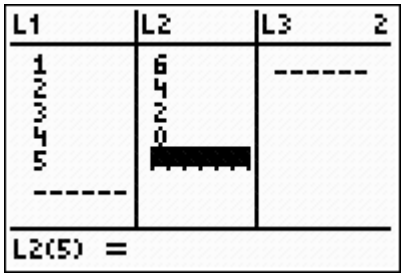
V. Lists

Use this feature to enter statistics for data analysis (making scatter plots, story problems, regression equations, etc.) There are two ways to enter data in a list.

A. Direct method:

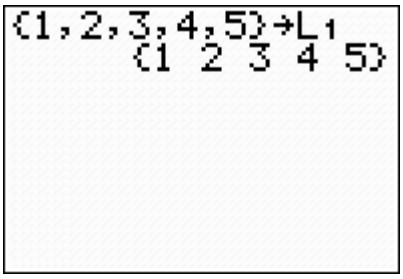
Press STAT ENTER to edit your lists. Type in the numbers for the lists as needed. Use the arrow keys to switch between lists. Usually the L_1 is for x-values and L_2 for y-values.





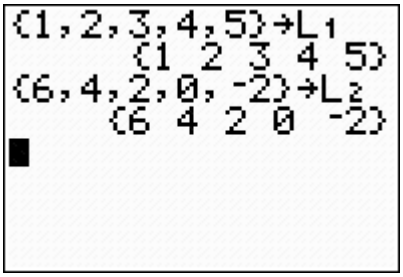
B. Using the STO▸ feature:

Type the entries to your list separated by commas and using { } set parenthesis. Then store each set into the list you choose.



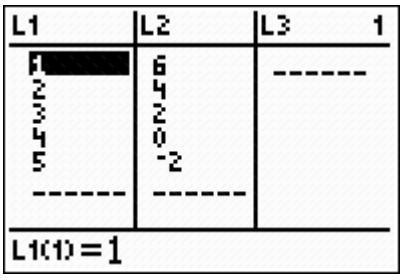
Here are the keystrokes for the screen to the left.

2nd (1 , 2 , 3
, 4 , 5 2nd) STO▸
2nd 1 ENTER

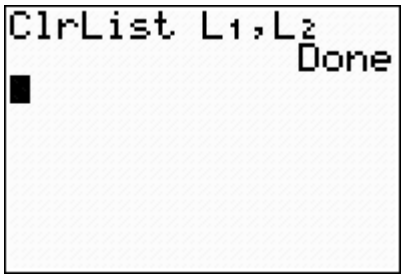


Do the same for the next set of values in L_2

2nd (6 , 4 , 2
, 0 , (−) 2 2nd)
STO▸ 2nd 2 ENTER

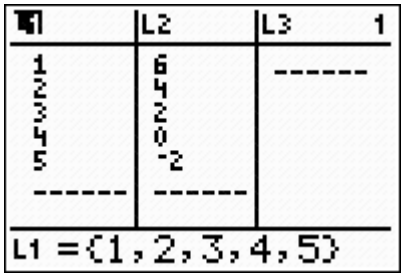


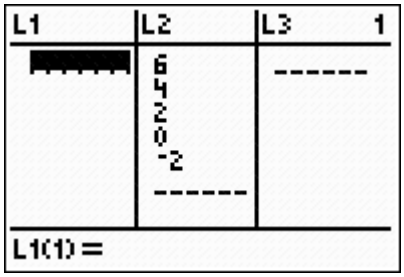
Then select STAT ENTER to see the lists entered.



C. Clear lists by either going to STAT and follow the keystrokes: STAT 4 2nd 1 , 2nd 2 ENTER CLEAR. You must select specific lists to be cleared, separated by commas.

Or go through the MEMORY by pressing 2nd + 4 ENTER. However, this will clear all lists. You can also clear a specific list by going into EDIT and moving the cursor to the top of the list and pressing clear, then enter. Use the following keystrokes for this: STAT ENTER ↑ CLEAR ENTER





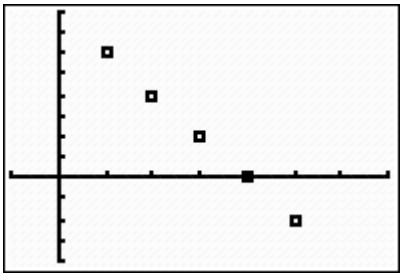
VI. Stat plots:

Use this feature to graph the data stored in your lists.

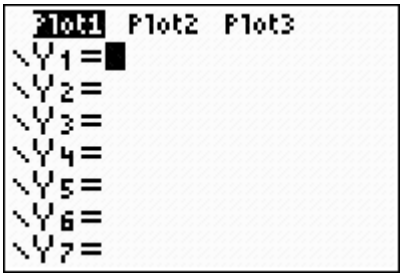
A. Turning STAT PLOT on:

Go to StatPlot by pressing 2nd Y=. Notice L_1 is defaulted to x-values and L_2 is defaulted to y-values. Select ON.

Use the lists from above and create a scatter plot using STAT PLOT. Change your windows so your graph looks like the one below.



B. You can also turn on STAT PLOT through the [Y=] screen. Arrow up and highlight PLOT1. You can also turn off the PLOTS in this manner. Remember to turn off your PLOTS if you have nothing in the lists, or you will not be able to graph.



VII. Miscellaneous Features

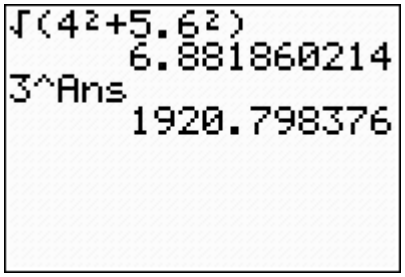
A. ENTRY found by [2nd] [ENTER].
Use this feature when you are doing multiple calculations that only require a simple edit.

Calculate $\sqrt{4^2 + 5.6^2}$ and then $\sqrt{3^2 + 5.6^2}$

Once the first problem is entered, use the entry feature to just edit the 4 to a 3. Hit ENTER and new problem is answered.

B. ANS found by [2nd] [(−)]
Use the answer button to insert the previously calculated problem into a new problem.

Calculate $3^{(\sqrt{4^2 + 5.6^2})}$



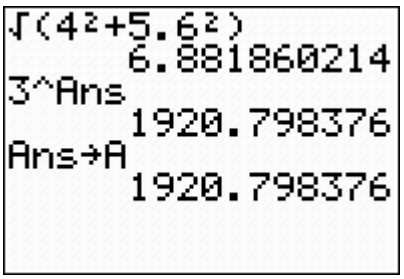
Use the following keystrokes to find your answer.
This feature is a very limited storing feature. It will always use the answer from the last calculated problem.

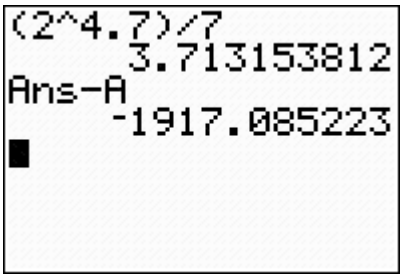
[2nd] [x^2] [4] [x^2] [+] [5] [.]
[6] [x^2] [)] [ENTER] [3] [^] [2nd]
[(−)] [ENTER]

C. STO▸ found directly above the ON.
Use this feature to store calculated numbers so you do not have a rounding error.

> Using the previous problem, 3^($\sqrt{4^2 + 5.6^2}$), store your answer into the variable A. Then compute (2^4.7)/7 – A.

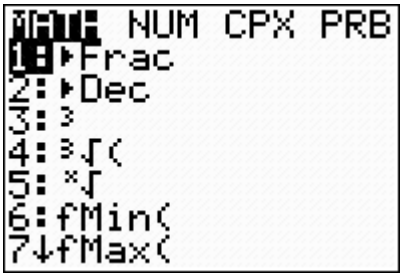
You should have used the following keystrokes:





This feature will be one key to your success. Many times students will round answers too soon in a problem. By using the STORE feature with variables, your answers can be more exact.

D. MATH Button:
Knowing what features are on this menu will be valuable.

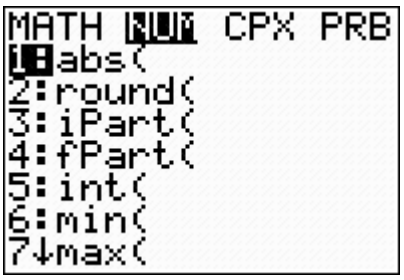


MATH Menu:
1) Changes a decimal to a fraction, if possible.
2) Changes a fraction into a decimal.
3) Cubes a number or variable.
4) Cube root of a number or variable.
5) N^{th} root of a number. First enter the index of the root, select number 5, press enter, enter the radicand.

D. MATH Button continued:

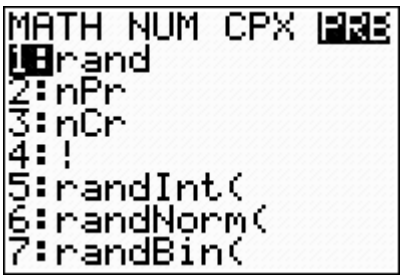
Find the $\sqrt[6]{64}$ using the $\sqrt[x]{}$ feature

Your calculator should display 2 as the answer. You should have used the following keystrokes: 6 MATH 5 6 4 ENTER



The NUM screen is where you will find the absolute value feature "abs("

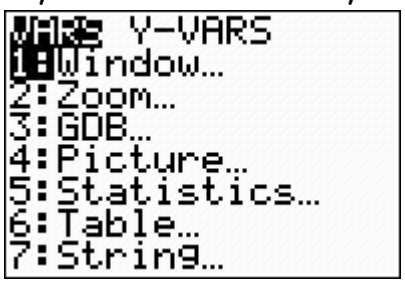
Evaluate $|-5+3|$ on the calculator

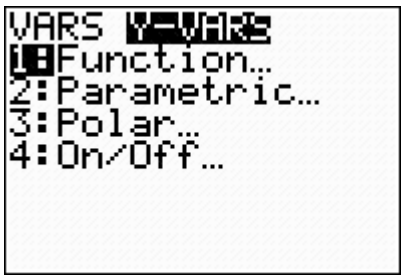


The PRB screen is where you find permutations, combinations and the factorial buttons.

Evaluate 7!

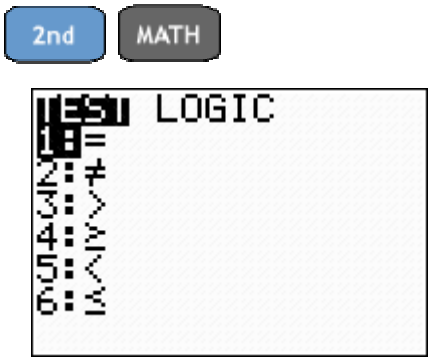
E. VARS ▸ 1 To find functions for use in other equations or functions. Also use these keystrokes to compute function notation, ie f(4) is $Y_1(4)$ entered on your calculator once you have a function entered in the Y= screen

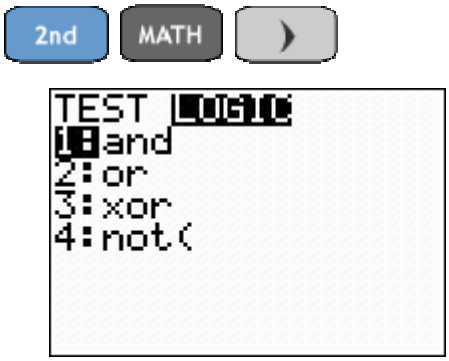




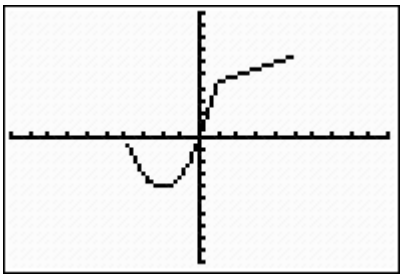
VIII. Piece-wise functions:

When graphing piece-wise functions you will need to use inequalities and compound inequality notations "and" and "or". These are located in the TEST menu. See the keystrokes and screens below.





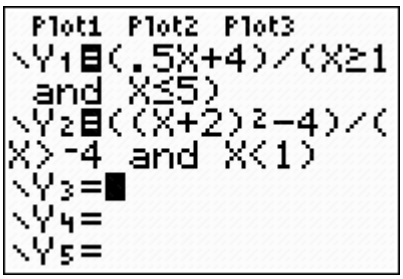
To graph a piece-wise function, you must limit the domain of each piece. To limit the domain of each piece, divide the function by the restrictions by using some of the above features.



For this graph, two functions are:

$Y_1 = 0{,}5x + 4 \ , \ 1 \leq x \leq 5$

$Y_2 = (x + 2)^2 - 4 \ , \ -4 < x < 1$



To enter these as piece-wise functions, you must divide the function by the restricted domain as seen to the right.

Write two equations to model the graph to the right. Enter the equations in your calculator to verify your answer is correct.