This guide contains all the functions of the calculator that we will be using this semester. We will learn how to do these in class when we need to, but this is a reference for you to look back to in order to remember how to use the calculator. The very first thing that you should do is familiarize yourself with the placement of all the buttons on the calculator. Read through the basics section below and try to do some simple calculations.

The Basics.

- Notice the parentheses keys, (and), directly above the number keys, these are important to group quantities together and you can get the wrong answer without them. Try typing in 9 3 + 5 and 9 (3 + 5) to notice the difference between what the calculator is computing. Use the ENTER key whenever you have finished inputing information to get the answer.
- The rightmost column has all the arithmetic symbols. Notice towards the top there is a \wedge key. This allows us to raise a quantity to a power. Thus, 2^3 is typed into the calculator as $2 \wedge 3$.
- In the bottom right corner we have the (-) key which is a negative sign, this is not to be confused with the minus sign in the righthand column which is used for subtraction. If you try subtraction with the (-) key the calculator will give an error and will not be able to compute anything.
- If you make a mistake typing something in, either move the cursor to the wrong entry and hit DEL to remove it or hit CLEAR to delete the entire line.
- If you have already typed something in and want to insert a number or operation in the middle of it you can use the INS button which is found above the DEL button. So you should move the cursor to the position where you would like to insert something and then hit 2ND followed DEL.
- To exit a graph or menu hit 2ND, then MODE to QUIT.
- A variable is entered using the X, T, θ, n key.
- The topmost row of buttons are used for graphing and tables and will be considered in detail next.

Creating a Table of Values.

There are a few quick steps that we will use in order to create a table of values for some particular function.

- Hit the Y = button and enter any equation for which you wish to have values generated. You may enter as many equations as you like, but we will only be able to view two at a time.
- Hit the buttons 2ND, then WINDOW. This will bring up a screen to setup your table. First enter the value at which you would like the table to start (TblStart=). Next tell the calculator what increments the entries should increase by (Δ Tbl=). For example, if you want input values of 5, 10, 15, 20... then you should tell the calculator to increase by 5. Also, be sure that the bottom of the screen has AUTO highlighted in both places. This will use the equations that were previously typed in.
- Hit the buttons 2ND, then GRAPH. This will allow you to view your table. You can use the arrow keys to scroll up an down and see other values. Additionally, if you scroll to the right you will see values for any other functions that were entered in the order in which you entered them.



Graphing a Function.

- Hit the Y = button and enter the equation to be graphed. You can graph several equations at once, by entering each one on a separate line.
- Next we must set up the viewing window. Hit the WINDOW button. Here you will have to enter the largest and smallest values for each axis to create a viewing window on the calculator. The values Xmin and Xmax are the leftmost and rightmost values you will see, while Ymin and Ymax are the bottom and top values of the screen. Additionally, you will have to set a scale, this represents how many units there will be along the axis before the calculator draws a tick mark. A good general rule is to take the total distance along each axis, divide by ten and use that as your scale. If the x values go from -15 to 25, that is total of 40 units, so that Xscl should be set to 4. Specific details for choosing the values to set a window are below. (Note: Xres=1 should not be changed.)
- Finally you can look at the graph by hitting the GRAPH button. If you do not see parts of the graph that you want to see, hit the WINDOW button again and reset your window. You can move along your graph by hitting the TRACE button, this will bring up a cursor on the graph. Hit the left and right arrow keys to move along the curve. While using the TRACE feature if you type a number and hit ENTER, the calculator will tell you the corresponding output value. If you have graphed more than one function, then hitting the up or down arrow will allow you to switch which curve the cursor is on.



Hints For Choosing Window Values.

- If you do not have any specific information about what part of the graph you want to look at start off the standard window. Hit the ZOOM button and choose 6:ZStandard. This will go ten units in every direction from the origin. If you do not see what you need on the graph you should have some idea now about how to reset the window by looking at the picture you have.
- If you have a practical domain and a practical range, then use these values for the window values. Remember when setting the scale to take the total distance along each axis and divide by ten.
- If you were given a table of values (or have created one on your calculator) you can use the table to get an idea of which values to use.

• You will need to use your knowledge of the function you are graphing and its behavior, as well as visual evidence from what you may have already graphed and information from the original problem to choose an appropriate window.

Using the Calculate Menu.

• If you have graphed two functions and wish to find their intersection point, first hit 2ND, then TRACE to enter the calculate menu. Next, choose 5:intersect. The calculator will bring you to the graph with a cursor on the first function. You must move the cursor as close to the intersection point as possible on the first curve, then hit ENTER. The cursor now switches to the second curve, again move to as close as possible to the intersection point and hit ENTER. Finally, give the calculator a guess of the intersection point and hit ENTER again. The calculator will now display the intersection point at the bottom of the screen. Remember, when moving the cursor, the left and right arrows move along the graph and the up and down arrows switch between graphs. Be sure that you do not go to the intersection point twice on the same function or the calculator will give back an error.



• To find the x intercept of a graph, go to the calculate menu by hitting 2ND, then TRACE. Now choose 2:zero. The calculator will bring you to the graph with a cursor on the graph. It will ask you to choose a value to the left of the intercept, so move the cursor there then hit ENTER. Next, it asks for a value to the right of the intercept, again move the cursor there and hit ENTER. Finally, it will ask for a guess, move the cursor as close as possible to the intercept and hit ENTER a last time. The calculator will now display the intercept at the bottom of the screen. Remember, when moving the cursor, the

left and right arrows move along the graph and the up and down arrows switch between graphs. Be sure that when you choose the values to the left and right of the intercept, one is above the x axis and one is below the x axis or the calculator will give back an error.



• When we need to find the maximum or minimum of a function go to the calculate menu by hitting 2ND then TRACE. Next, choose either 3:minimum or 4:maximum depending on which you wish to find (the procedure for each of these is the same). The calculator will bring you to the graph with a cursor on the graph. It will ask you to choose a value to the left of the maximum or minimum, so move the cursor there then hit ENTER. Next, it asks for a value to the right of the maximum or minimum again move the cursor there and hit ENTER. Finally, it will ask for a guess, move the cursor as close as possible to the maximum or minimum and hit ENTER a last time. The calculator will now display the maximum or minimum at the bottom of the screen. Remember, when moving the cursor, the left and right arrows move along the graph and the up and down arrows switch between graphs.





Graphing a Piecewise Function.

• To graph a piecewise function we must enter each piece in parentheses directly next to its restriction also in parentheses. The pieces are then separated by the + symbol. Consider the following example.

$$f(x) = \begin{cases} -2x+8 & \text{for } x < 3\\ x-1 & \text{for } 3 \le x \le 5\\ -x+9 & \text{for } x > 5 \end{cases}$$

This should be typed in the calculator exactly as follows:

$$(-2x+8)(x<3) + (x-1)(x \ge 3)(x \le 5) + (-x+9)(x > 5)$$

• To find the inequality signs hit 2ND, then MATH to enter the TEST menu. Choose the inequality you need. Be very careful about parentheses, if you forget one of them the calculator will have trouble graphing. Also, notice that in the above example the compound inequality for the second piece has to be entered as two separate inequalities. The calculator does not understand the other notation.

