In addition to performing symbolic algebra, *Derive*^{TM} *6* is a powerful graphing tool. The purpose of this worksheet is to help you become familiar with some of Derive's graphing capabilities.

Getting Started:

Run *Derive 6* from any of the computer labs on campus. From the Window menu at the top of the screen, choose "New 2D-plot Window." Then choose "Tile Vertically" from the Window menu at the top of the screen. You should see something similar to Figure 1 below. The "active" window is whichever window has the highlighted border. Activate a window by clicking on its title bar. You can tell which is the algebra window and which is the plot window by looking at the title bars.

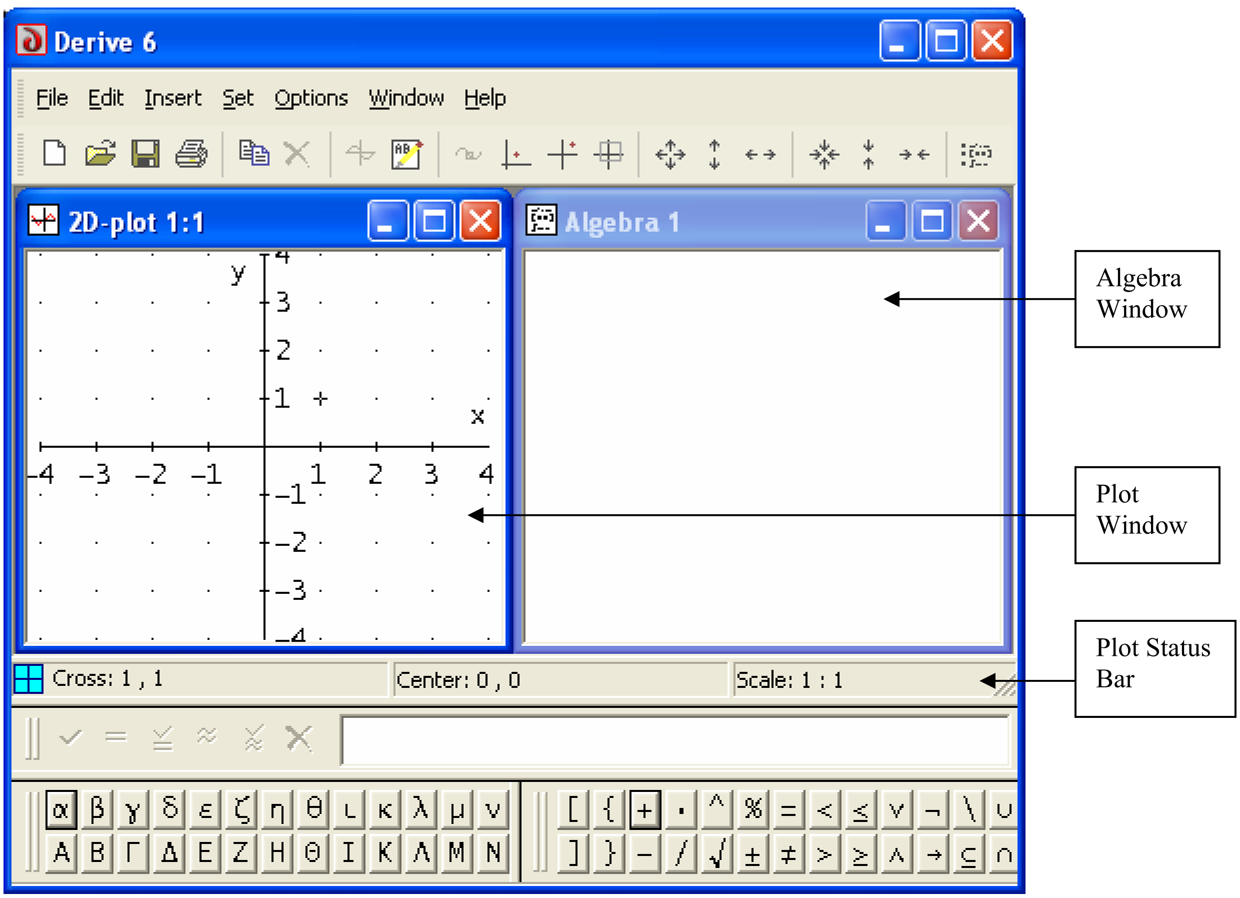

Figure 1: Derive with a "plot" window

The Plot Cursor:

The cursor in the *plot window* is represented by a small cross, and its coordinates are shown in the *plot status bar* (when the plot window is active). Move the cursor using the arrow keys on the keyboard, or by clicking on the desired location in the plot window.

Graphing an Equation:
Start by authoring an equation in the algebra window. Highlight the equation, and activate the plot window by clicking in it. Then click the "plot" button at the top of the screen. See Figure 2 below.

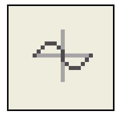

Figure 2: "Plot" Button

You must use only the variables *x* and *y* in the equation. The independent variable is *x*, and is plotted on the horizontal axis, while the dependent variable, *y* is plotted on the vertical axis. If you author an expression in *x*, with no equal sign, Derive will plot the equation $y = expression$. Likewise, if you author an expression in *y*, with no equal sign, Derive will plot the equation $x = expression$. You can plot many equations in the same plot window.

Try This:
Author the equation $y = x^2 - 3x - 1$ in the algebra window. Activate the plot window, and plot the equation. You should get the result in Figure 3.

Delete the previous plot by clicking in the plot window and pressing the "delete" key. Author the equation $x^2 + y^2 = 4$ and plot it. You should get the result in Figure 4. Interestingly, this is the equation of a circle, and yet the graph doesn't appear to be exacly circular. Read about setting the aspect ratio in the "Changing the Look of a Plot" section of this document.

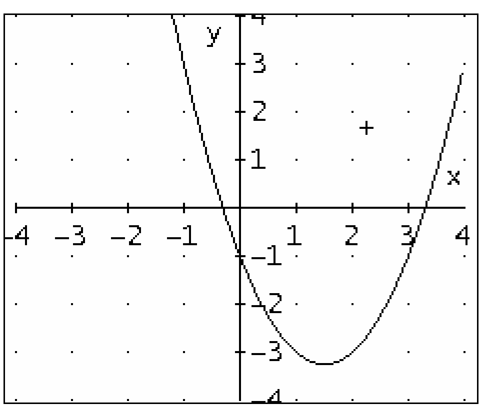

Figure 3: Derive Plot

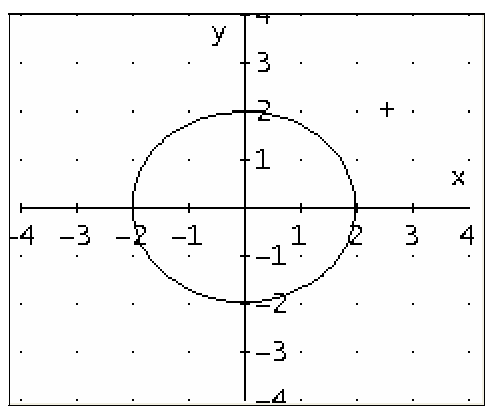

Figure 4: Derive Plot

Delete the previous plot. Author the expression $\frac{1}{2}x^3 - 2x + 1$ and plot it. You should get the result in Figure 5.

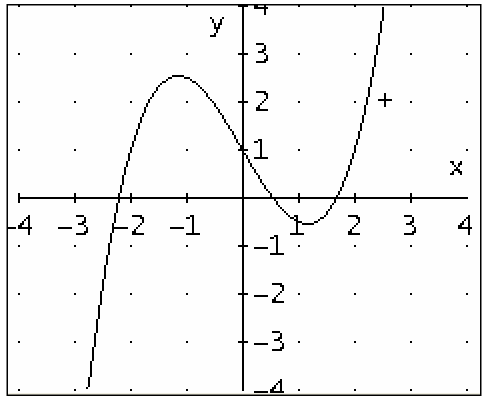

Figure 5: Derive Plot

Changing the Look of a Plot:
You can change things like like plot color by choosing "Display ..." from the Options menu when the plot window is active.

You can zoom in or out in various ways by using the plot buttons with arrows (Figure 6), when the plot window is active.

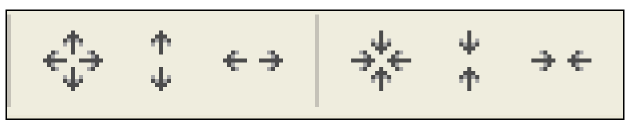

Figure 6: "Zoom" Buttons

You can change the window "dimensions" by selecting "Plot Range ... Maximum/minimum" from the Set menu when the plot window is active. The number of "intervals" controls the number of tickmarks in each direction. For example, with the settings shown in Figure 7, the horizontal axis shows 8 units, with tickmarks every $\frac{1}{2}$ unit. The vertical axis shows 16 units, with tickmarks every 2 units.

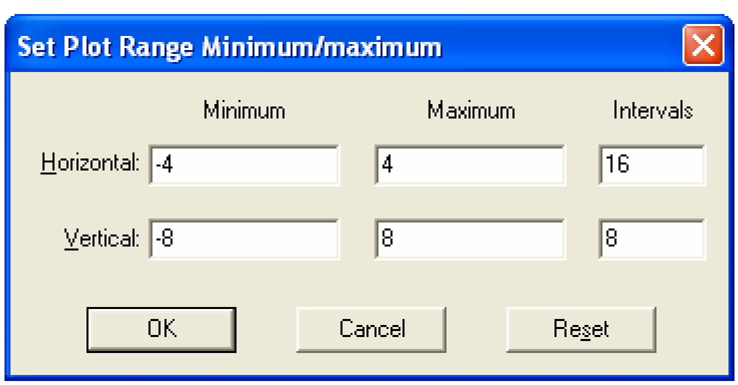

Figure 7: "Plot Range" Dialog Box

Another way to change the plot range is to use the "Center on Cross," "Center on Origin," and "Set Range" buttons when the plot window is active. (See Figure 8.) After clicking the "Set Range" button, use the mouse to draw a box around the portion of the graph you wish to enlarge.

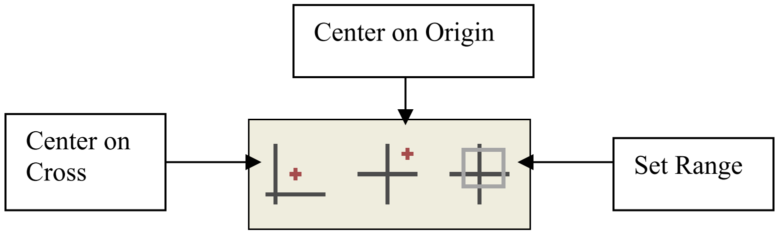

Figure 8: More Plot Buttons

Making the scales on the two axes look equal (to make circles look circular, for example) is a two-step process. First, use the "Set Plot Range" command to make sure that the horizontal and vertical axes show the same distance; i.e., make sure that Maximum minus Minimum is equal for both axes. Then choose "Aspect Ratio ..." from the Set menu when the plot window is active. Change the relative sizes to the same number. (See Figure 9.) "Aspect Ratio" refers to the dimensions of the plot window, not the values on the *x*- and *y*-axes.

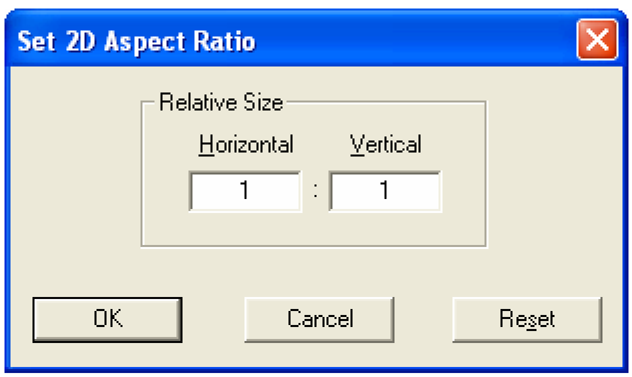

Figure 9: Aspect Ratio Dialog box

"Tracing" a Graph:
To move the cursor along a graph, click the "Trace" button at the top of the screen when the plot window is active (see Figure 10). Then click on the graph to place the cursor. Move the cursor with the left and right arrow buttons on the keyboard. The coordinates of the cursor are located in the plot status bar. To turn off the trace feature, click the "Trace" button a second time.

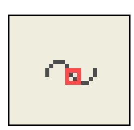

Figure 10: "Trace" Button

Copying Graphs from Derive onto Your Homework Paper:
When copying graphs, be sure to draw the axes and show equally spaced tickmarks. Better yet, use graph paper. Put numbers on a few tickmarks in each direction to indicate scale.

Exercises

Use *Derive*^{TM} *6* for the following exercises. Use standard mathematical notation to record the results ***on a separate sheet of notebook paper.*** Do not turn in a print-out of your Derive session. Be sure to show axes and scale on all your graphs. The phrase "sketch the graph ..." below means: use Derive to draw the graph, and then copy it onto your homework paper.

1. Sketch the graph of the equation $(x-2)^2+(y+1)^2=9$. You'll need to change the plot range so that you can see the entire graph. Let the horizontal axis show values from -4 to 6 and the vertical axis show values from -5 to 5. You might also want to set the number of "intervals" to 10 in each direction, so that you get integer values on the tickmarks. You should also change the aspect ratio so that the scales on the *x*- and *y*- axes are equal.

2. Sketch the graph of $y=x^2$. Use the trace feature to approximate the point(s) where the graphs of $y=x^2$ and $(x-2)^2+(y+1)^2=9$ intersect. Show five decimal places of accuracy in your answer.

3. Sketch the graphs of $y=x$ and $y=\sqrt{x^2}$. Are they the same graph? What does this mean about the quantities $\sqrt{x^2}$ and *x*?

4. Sketch the graphs of $y=|x|$ and $y=\sqrt{x^2}$. Are they the same graph? What does this mean about the quantities $\sqrt{x^2}$ and $|x|$?

5. Sketch the graph of $y=\sqrt[3]{x}$. Notice that Derive shows only the part of the graph that has nonnegative *x*-values. Use the fact that $\sqrt[3]{-x}=-\sqrt[3]{x}$ to plot points for $x=-1$ and $x=-4$ on your paper, and use those points to complete the graph of $y=\sqrt[3]{x}$ on your paper. Your completed graph should be the graph of a function; that is, it should pass the vertical line test.