

# Derive™ Tutorial Two

## Graphing

You can graph equations, functions, and inequalities. These graphs can involve color, dashed and thickened lines, and shading.

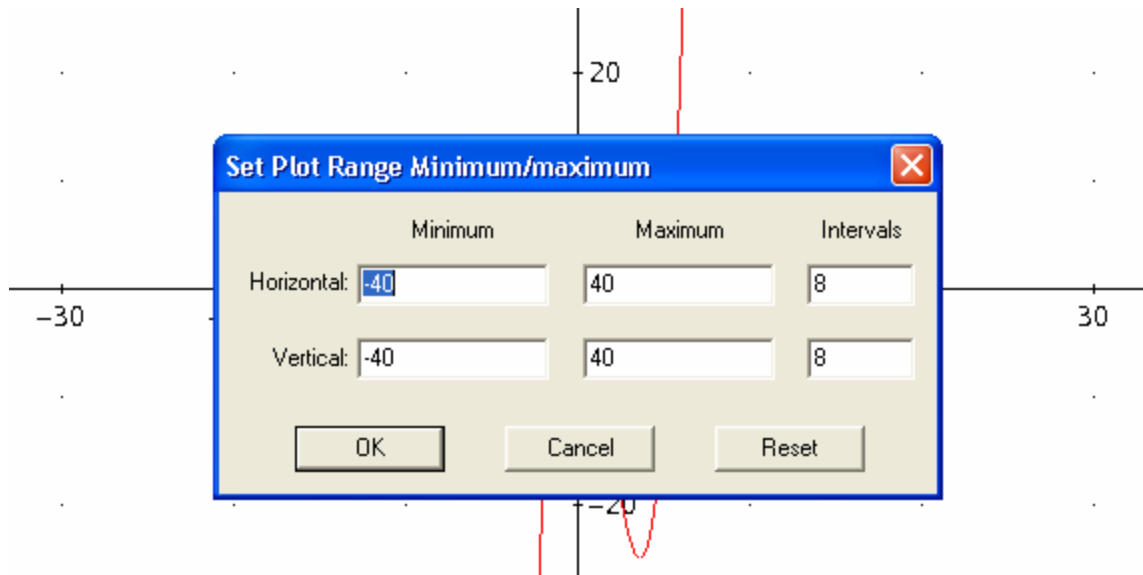
### Equations

Author the equation  $y = 2x + 3$ . To do this, recall that you move the cursor to the Entry line (if necessary) and type  $y = 2x + 3$  and press Enter. Click on the 2D-Plot window icon (the third icon from the right on the Icon menu bar at the top of the screen). Now, to plot this equation, click on the same 2D-Plot icon toward the left of the Icon menu bar.

Thus, to graph an equation, you Author it in the algebra window, click on the 2D-Plot icon on the top right of the screen to move to the Graphics window and then click on the same icon toward the left of the Icon menu bar.

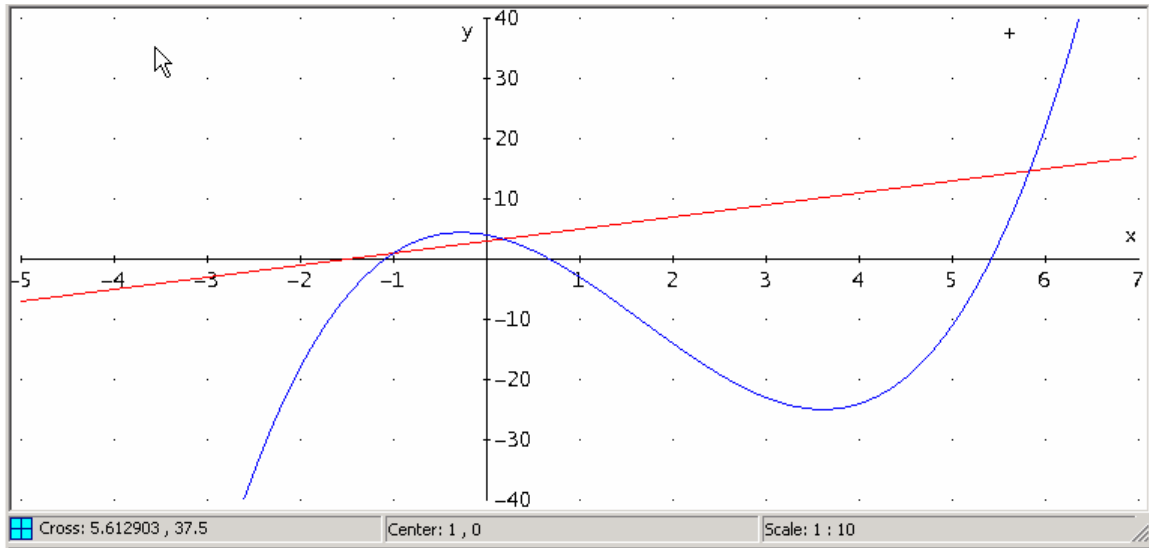
You can use the Trace feature to determine the coordinates of points on the graph of this equation. To do this, click anywhere on the graph with the arrow cursor and then click on the Trace icon (the icon with a red cursor on a curve). Move the cursor on the graph by pressing the left arrow key. The approximate coordinates of the point where the cursor is located is displayed in the lower left corner of the Graph window. Now move the cursor to the intersection of the graph and the x-axis. The x-coordinate of this point should be -1.5 and the y-coordinate will be 0 or approximately 0 ( $4.4 \times 10^{-16}$  is a number near 0).

To graph another equation in the same Graph window, click on the Algebra icon at the far right of the Icon menu bar. Delete any information in the Entry line by clicking on the red Delete icon to the immediate left of the Entry line (also found on the Icon menu bar). Author  $y = x^3 - 5x^2 - 3x + 4$ . Graph this equation in the Graph window as before. Notice that it is a different color and not entirely included in the Graph window. To display more of this graph, click on the Zoom out icon (four arrows pointing out). If the graph is not yet fully displayed, you may wish to click on the Zoom out icon until it is. Once you have displayed the graph using the Zoom out feature, you can adjust the horizontal axis. Use Set>Plot Range>Minimum/maximum to do this. Your screen should look something like this:



Change the Horizontal Minimum and Maximum to -5 and 7, respectively. Change the Intervals to 12 so that tick marks will be at the integer values. Click on OK to redisplay the graph. Your screen should look something like this:

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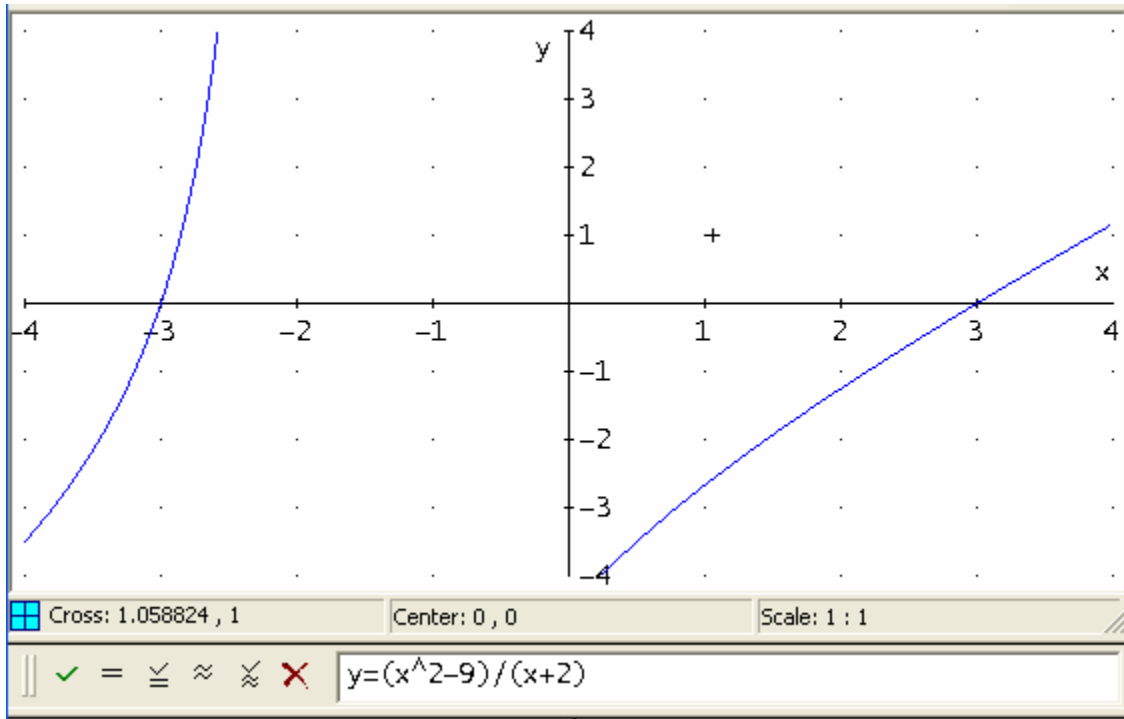
You can find approximate values of the intersection points of the two graphs, the zeros of the cubic equation, and the maximum and minimum values of the cubic equation using the Trace feature.

You can embed this Graph window in your Algebra window using the File>Embed command. To see the embedded graph, click on the Algebra icon (at the far right of the Icon menu).

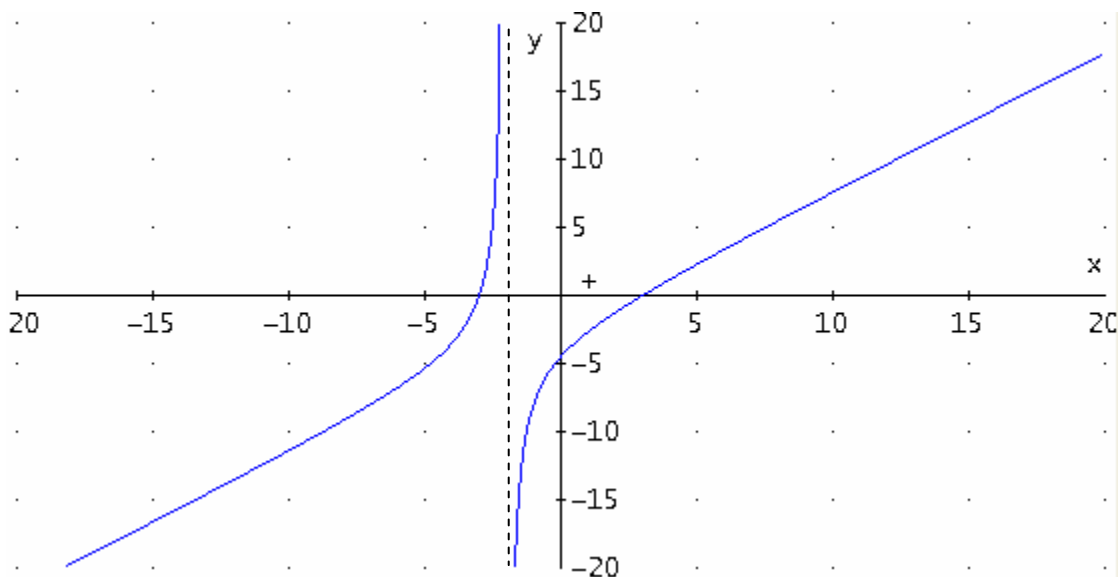
Return to the Graph window. To clear the Graph window, use the Edit>Delete All Plots command. Reset the Graph window to Default window using the Set>Plot Range>Minimum/maximum command. Click on Reset and then OK. The x-axis will be from -4 to 4 and the y-axis will also be from -4 to 4.

In the Graph window, Author the equation  $y = \frac{x^2 - 9}{x + 2}$  (be sure to include all necessary parentheses and press Enter). Click on the 2D-Plot icon. Your graph should look something like this:

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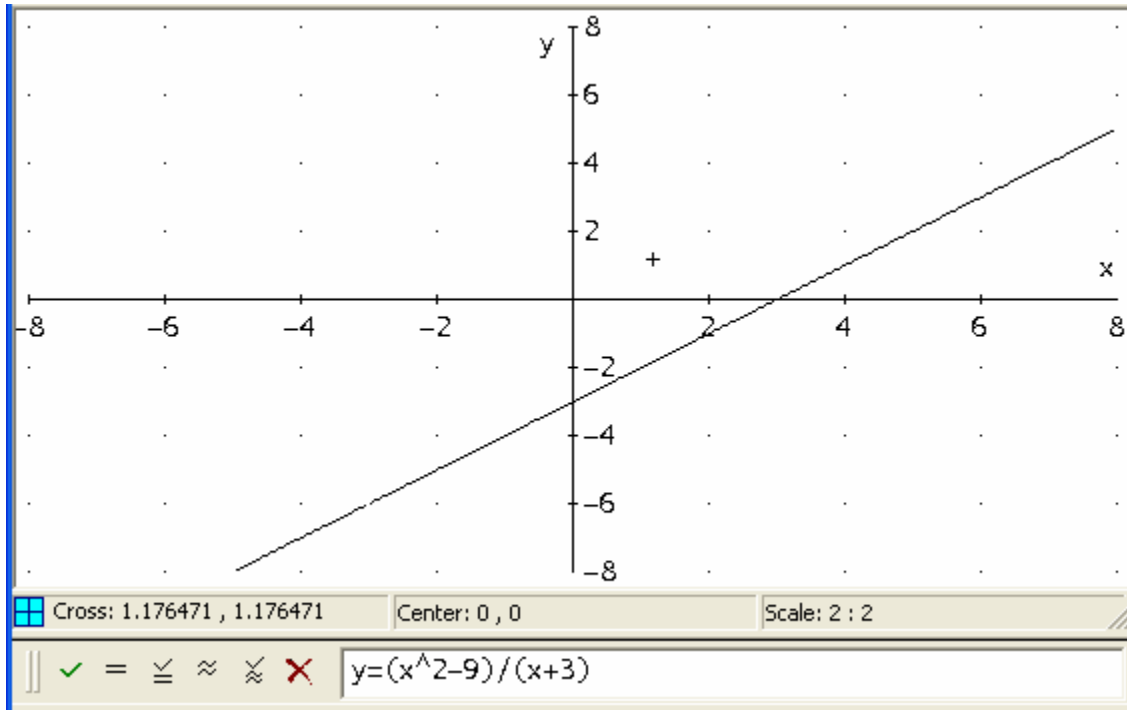


Click on the Zoom out icon three times to display most of the features of the graph. There are zeros at  $x = 3$  and  $x = -3$ , the two zeros of the numerator. And the cutoff of the graph is due to a vertical asymptote at  $x = -2$  which is a zero of the denominator. A hand-drawn graph of this equation should look something like this:



Now edit the equation on the Entry line by changing the 2 in the denominator to a 3. Be sure to press Enter. Before plotting this new equation, delete the first graph by clicking on the red Delete icon (the sixth icon from the left on the Icon menu). Now graph the edited equation. Observe that this equation is not defined at  $x = -3$ . To see what effect this has on the graph, click on the Zoom in icon (four arrows pointing in) twice and look at the graph where  $x = -3$ . You should see a hole in the graph.

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### Built-in Functions

You can graph a variety of functions that are built into Derive. To see the built-in functions that are available in Derive, click on Help in the Algebra Window's Main menu and select Online. Then click on the plus sign next to Built-in Functions and Constants. A list of built-in functions is displayed. Click on the Close box in the upper right corner of this window. Click on the red Delete icon.

Author  $y = \arccos(x)$  and click on the 2D-Plot icon. To determine the domain and range of this function, click on the graph and then on the Trace icon and move the cursor to the left and right ends of the graph. The leftmost point has coordinates that are approximately  $(-1, 3.141593)$  and rightmost point is  $(1, 0)$ . Thus the domain is the interval  $[-1, 1]$  and the range is  $[0, \pi]$ .

### Summary

You can graph an equation or function using the graphing features. You Author the equation or function and then click on the 2D-Plot icon if you Author the expression in the Graph window. If you Author the expression in the Algebra window, you first need to go to the Graph Window by clicking on the 2D-Plot icon in the Algebra window. Once you display the graph, you can zoom in or out, change the Graph window and Trace the graph. You can also embed the graph(s) into the Algebra window.

The Box icon, which is to the left of the Zoom out icon, allows you to select a box around a portion of the graph which will then become the new Graph window. To do this, click on the Box icon. On the graph, click at the location of the upper left corner of the box you wish to create. Hold down the left button of the mouse and drag the mouse to the location of the lower right corner of the box. Click on OK to display the graph in the new Graph window.