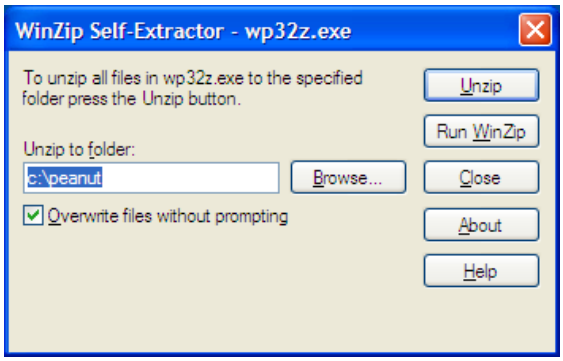
Winplot 1: Getting Started

1. **Download and install** (Windows only; sorry no Mac version available):

   a. Go to http://math.exeter.edu/rparris/winplot.html and click on Winplot in the upper left. This will download the file to your computer. Save it on the desktop or somewhere where you can find it.

   b. Open the file and run it. You will see a window similar to this. Unzip the file.



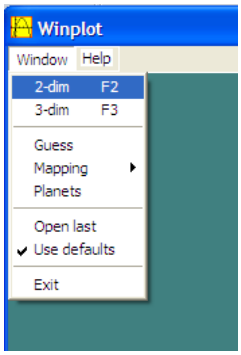
   c. It will unzip to a file called “peanut” on your “C” drive (or you can put it elsewhere). This should take a very few seconds.

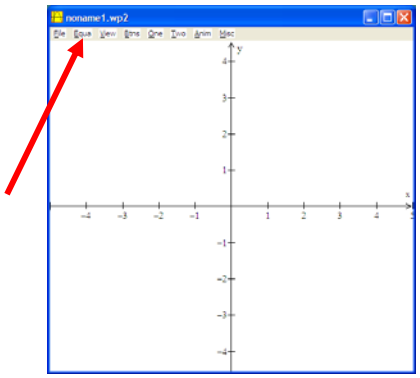
   HINT: Repeat a – c every few weeks since there are upgrades often. The new file will overwrite the old and save all your settings.

   d. Open the “peanut file” and right click on the file named Winplot.exe and choose “send to” > Desktop (create shortcut). This will put the yellow Winplot shortcut icon on your desktop and you can use it to open Winplot.

2. **A Practice Graph**

   a. In the upper right corner of the Winplot screen click “Widow” and then 2-dim and you will see the graph screen:





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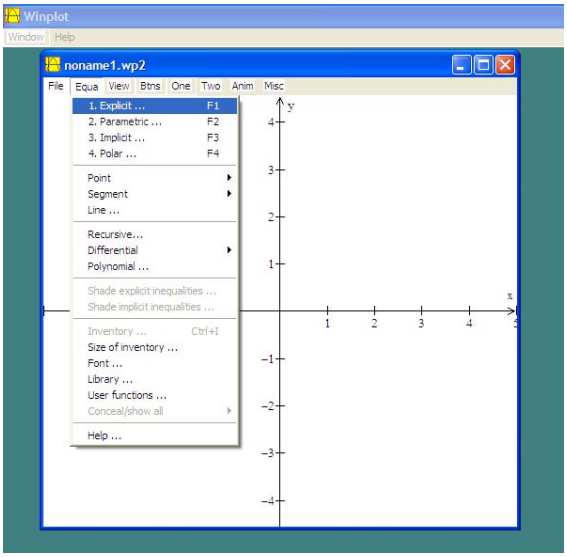
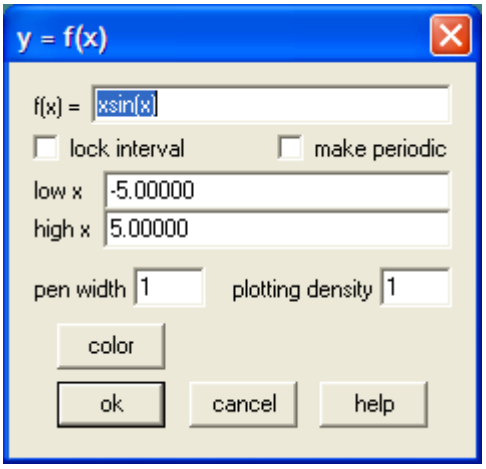
b. Click on “Equa” See red arrow above. And choose 1. Explicit.





c. This will open the “*y* = f(x)” window shown above right.

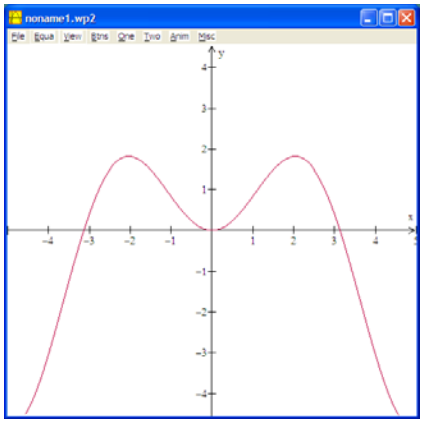
i. Enter the equation you want to graph in the top space. Here the graph is $y = x\sin(x)$

ii. The “Low x” and “high x” are set to the values on the screen by default. If you want to change them to restrict the domain check the “Lock interval” box and enter the new values.

iii. “pen width” makes the graph thicker. Experiment with this.

iv. “plotting density” can be changed if your graph appears to have short missing sections – this probably won’t happen.

v. “color” will give you a choice of colors. The colors change for each new graph, but you may reset them.



vi. Click “ok” and you should see the graph. (The “Inventory” screen will appear. This will be discussed in a later tutorial.

vii. Click the “Help” button to learn how to put open or closed circles or arrows on the end of the graphs

viii. Try some of the other equation types under the “EQUA” tab. Another tutorial will discuss these.

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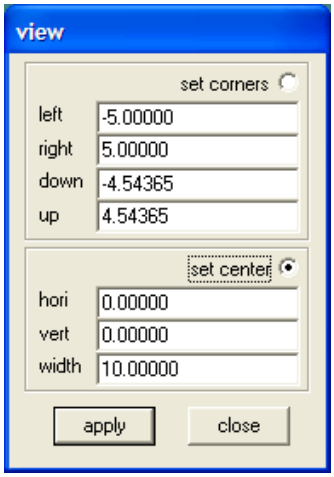
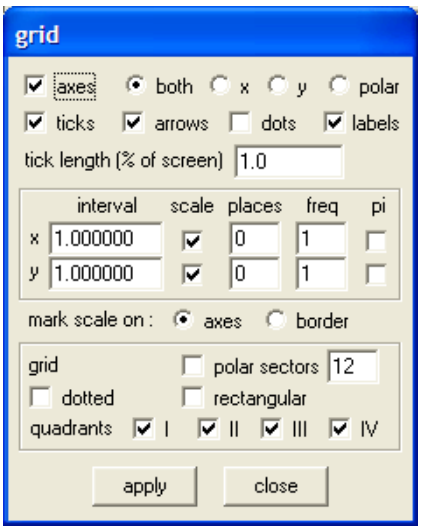
d. **Graph Window Adjustments – 1** Click on the graph and then Use **CTRL+V** and you will see this window. Click "set corners" or "set center" and adjust the viewing window. (Note: the background color may be changed under "MISC" > "Color" > "Background.")



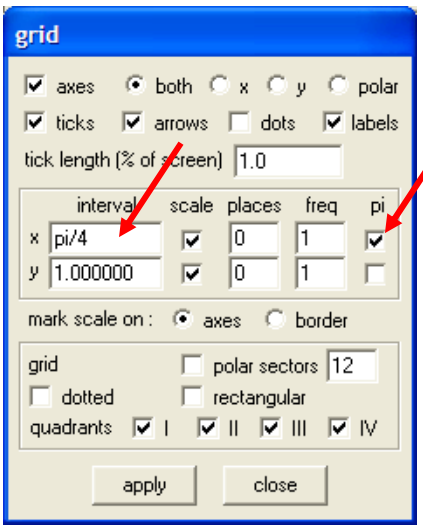
e. **Graph Window Adjustments – 2** click on the graph and then on **CTRL+G** to adjust the grid. The choices here are self-explanatory. Click and unclick things and then click "apply" to see what changes on the graph.

HINT 1: For trigonometric graph with multiples of π for the scale: Enter in the box next to *x* (or *y*) the multiple you want for the scale on that axis. Something like pi/4 (use "pi" for π). Then click the box under "pi", this will put a trig scale on the *x*-axis. (See figure on the right.)

BASIC



TRIG SCALE



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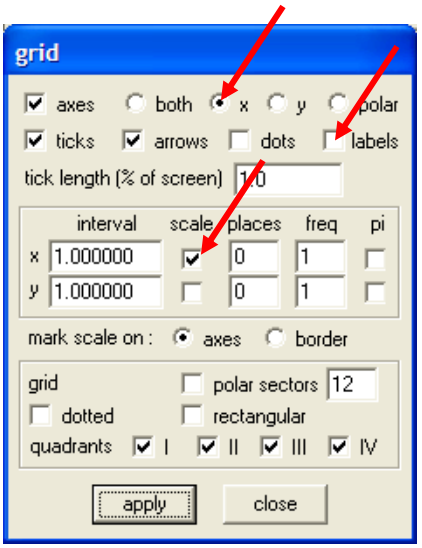
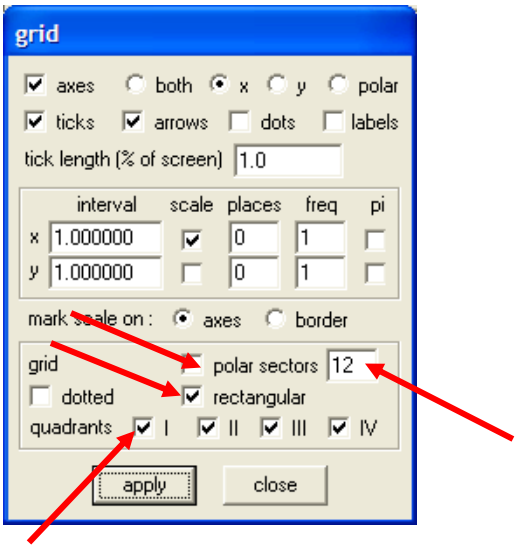
Hint 2: Grid Lines and Polar Grids. In the lower section Click “Rectangular” to get a rectangular grid. The grid lines appear at the intervals in the “x” and “y” section. Check the quadrant boxes to have the grid appear in the checked quadrants. For Polar Grids uncheck “rectangular” and check “polar” then set the number of polar sector you want in the “sectors” box.

NUMBER LINES



GRID LINES AND POLAR SECTORS



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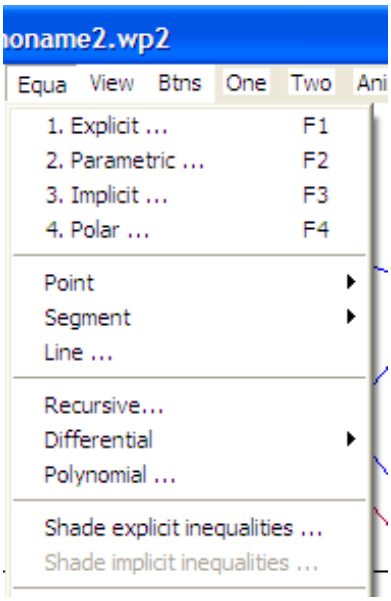
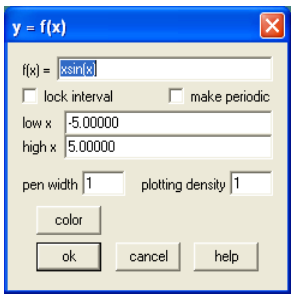
Winplot 2: The EQUA menu part 1

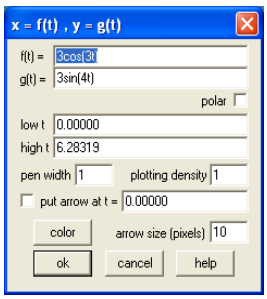
In this tutorial we will learn about graphing functions of various kinds. In fact we'll look at most the entries under the EQUA menu shown at the right. These are those most used from Algebra 1 through AP Calculus. You may explore the others on your own. Remember there is a HELP screen at the bottom of each drop down menu.

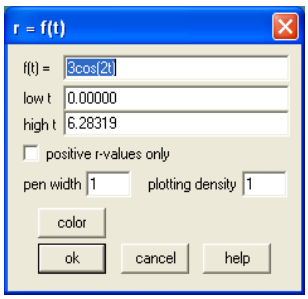


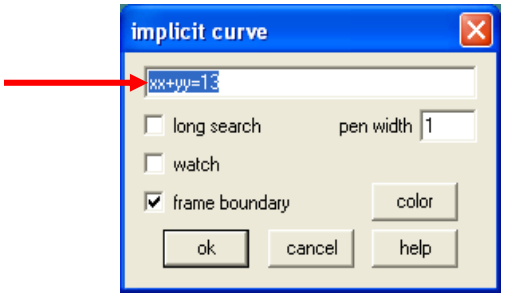
> HINT: On the graph screen under FILE click "Copy to Clipboard" or use the usual CTRL+C and then paste the graph without the window frame into any word processor document or into PowerPoint. The size, placement, etc. may be changed as with any other graphic.

1. **Curves:** Set the viewing window as explained in the first tutorial. Under the EQUA menu the first 4, Explicit, Parametric, Implicit and Polar, are similar. You may mix and match these on the same screen.









In each, the equation is entered in the box at the top. The graph for explicit functions goes from one side of the screen to the other unless you check the "lock interval" box and set the "low x" and "high x" values. Parametric and polar graphs are graphed from $t = 0$ to $t = 2\pi$ unless you change them. Implicit graphs do not need a domain.

> HINT: Variables are only a single letter; therefore the quick way to enter x^2 is to type xx (arrow).

Pen width can be changed. The thinnest width is 1; enter a larger number for thicker graphs.

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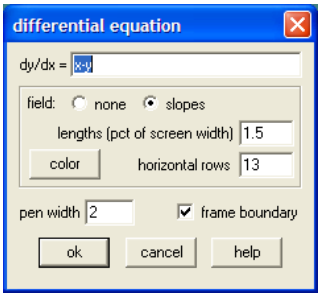
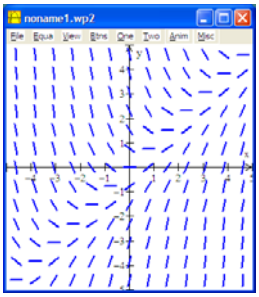
Color is set automatically but may be changed by clicking the "color" button.

2. **Points, segments and lines** are entered by entering the coordinates. Points and segments may be made solid or open and the color may be changed. Arrows may be added to segments by checking the box in the entry window.

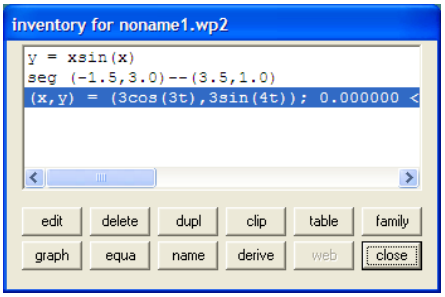
3. In the third section sequences with a **recursive** definition may be entered. Also a **polynomial** may be entered. The polynomial may be changed by moving the roots on the graph.

4. **Differential** is where you enter **slope fields**. Enter the differential equation in the form $dy/dx = f(x, y)$. I usually set the "horizontal rows" to an odd number. This way if the origin is at the center of the screen the slope field segments will appear on the axes.





5. **Inventory**. When graphing there is an inventory screen that lists the equations currently entered. Some of the buttons at the bottom are



EDIT: select and equation and this will allow you to edit it.

GRAPH: this toggles the selected graph on and off

DELETE: guess what this does.

EQUA: prints the equation on the screen in the same color as the graph.

DUPL: Open an edit box and allows you to duplicate the graph after changing parameters.

NAME: Adds a name in front of the equation in the inventory box.

DERIVE: Graphs the derivative of the selected graph.

TABLE: Produces a table of values of the selected graph – one graph at a time.

CLOSE: Hides the box. CTRL+i will bring it back.

6. The two **shade** commands let you shade above, below or between graphs. The two drop down menus let you select any graph that is in the inventory. The x-interval section lets you start and stop the shading as shown below.

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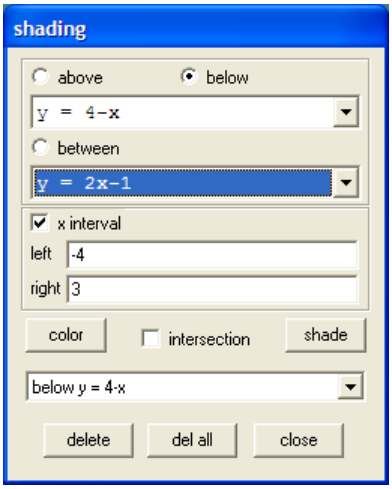

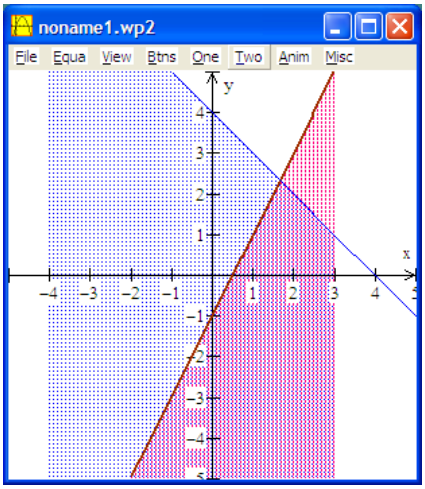

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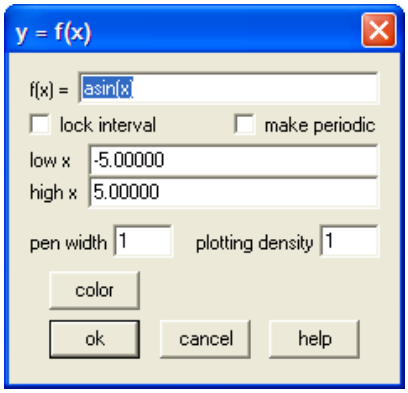
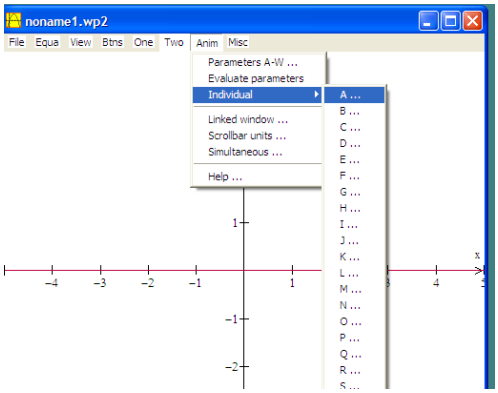
Winplot 3: Animations

In this tutorial we will look at animations. Let's start with a simple example from trigonometry.

Example 1: First, graph the equation $y = A\sin(x)$ which is entered as shown in the first illustration as f(x) = asin(x). However, you will not see a graph yet.

Next click on "Anim" at the top of the graph screen, then "Individula" then click on "A". You may use any of the letters listed. This will bring up the A slider box.

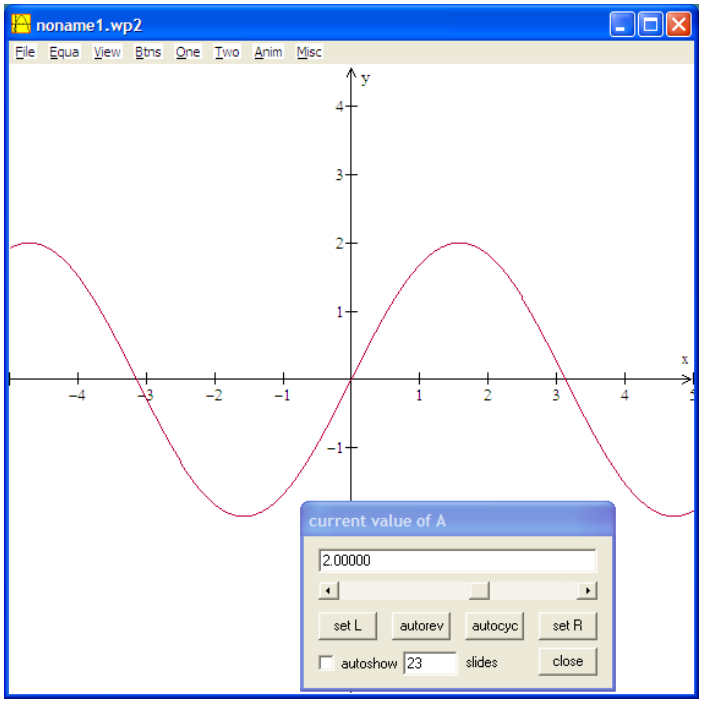




Move the slider with your mouse or click on the arrows and you can change the value of "A" and the corresponding value change will be made on the graph.

The default range is [-10, 10] . This can be changed by typing in any value and clicking "set L" for the lower end and "set R" for the upper end.

The two "auto" settings will run through the values automatically. When this is happening type Q to quit, P to pause, F for faster and S for slower.



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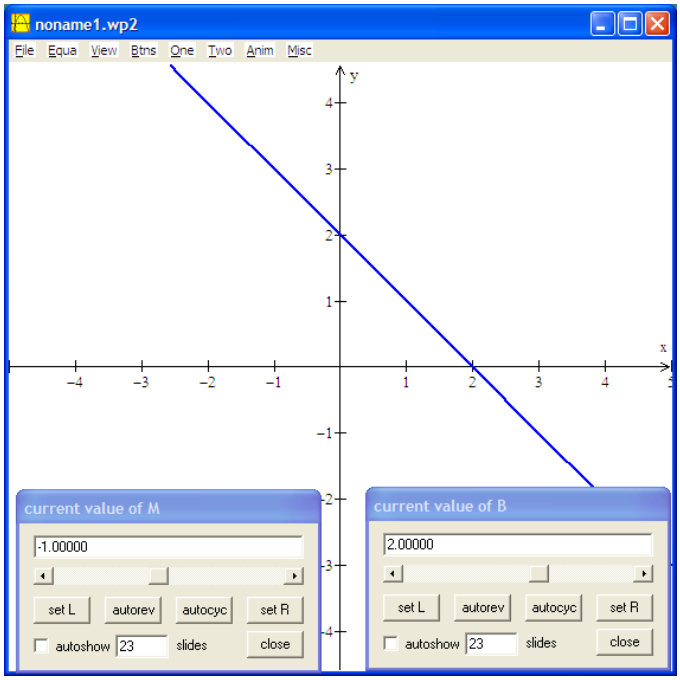
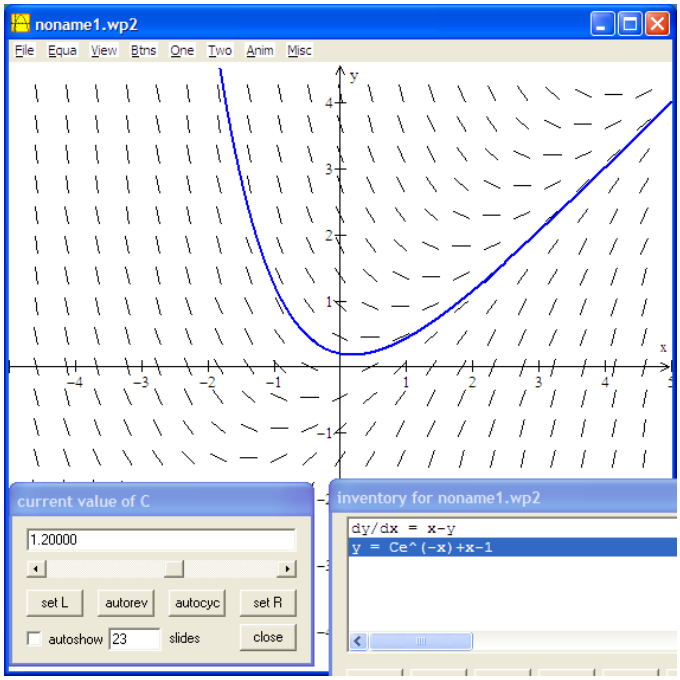
Example 2: You may use more than one letter at a time. Start a new graph and enter the equation $y = mx + b$ as f(x) = mx +b. Then open the "m" and "b" sliders and investigate the equation of a line.



Example 3: One of my favorite places to use the sliders is on a slope field to investigate the solutions of a differential equation. Under Equa > differential > dy/dx enter a differential equation and plot the slope field. Then in the Equa > Explicit box enter the general solution with the constant, C. Use the "C" slider to investigate the particular solutions for different value of C. (The illustration is $dy/dx = x - y$ with general solution of $y = Ce^{-x} + x - 1$.)



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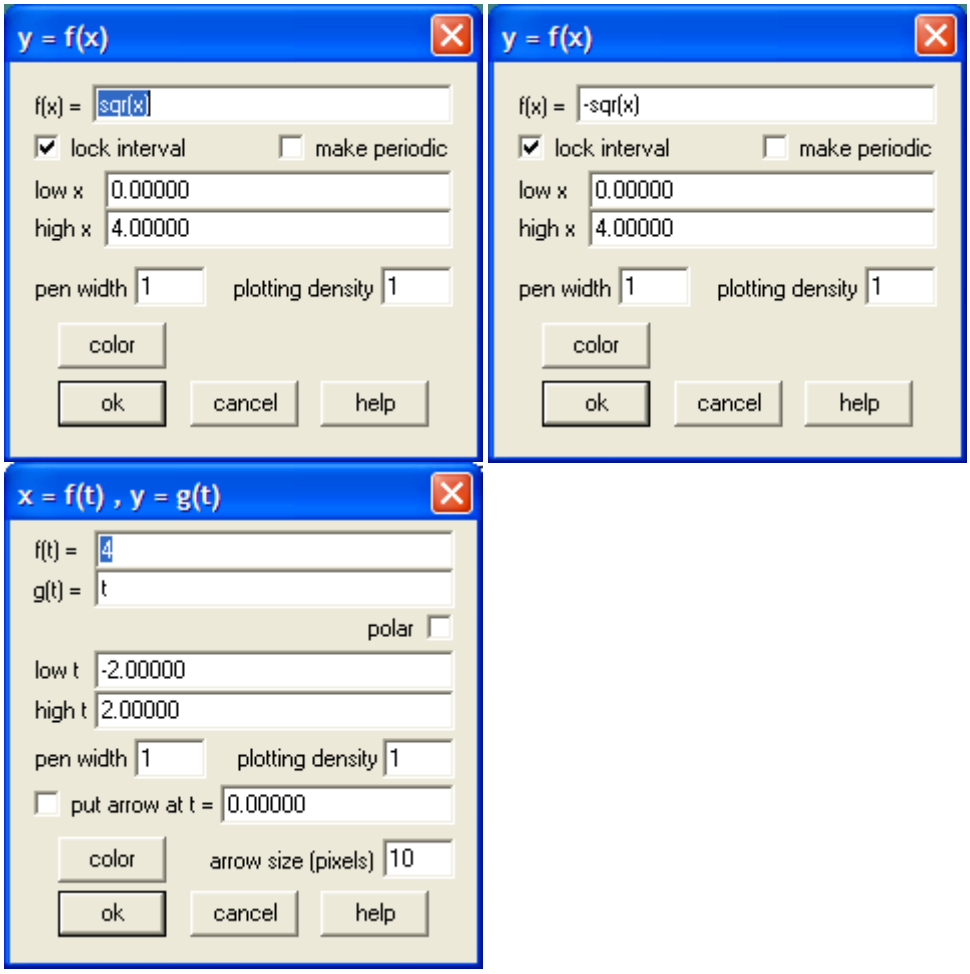
Winplot 4: Revolving a region around a line.

This example will show you how to see a region being revolved around a line.

Revolve the graphs below around the line $x = 6$

$$y = \sqrt{x} \text{ for } x \in [0,4]$$
$$y = -\sqrt{x} \text{ for } x \in [0,4]$$
$$x = 4 \text{ for } y \in [-2,2]$$

1. In the 2-dim screen graph the 3 equations. Check lock interval and set the high and low values shown. If you use different colors the faces of the solid will be the same as the part being revolved.



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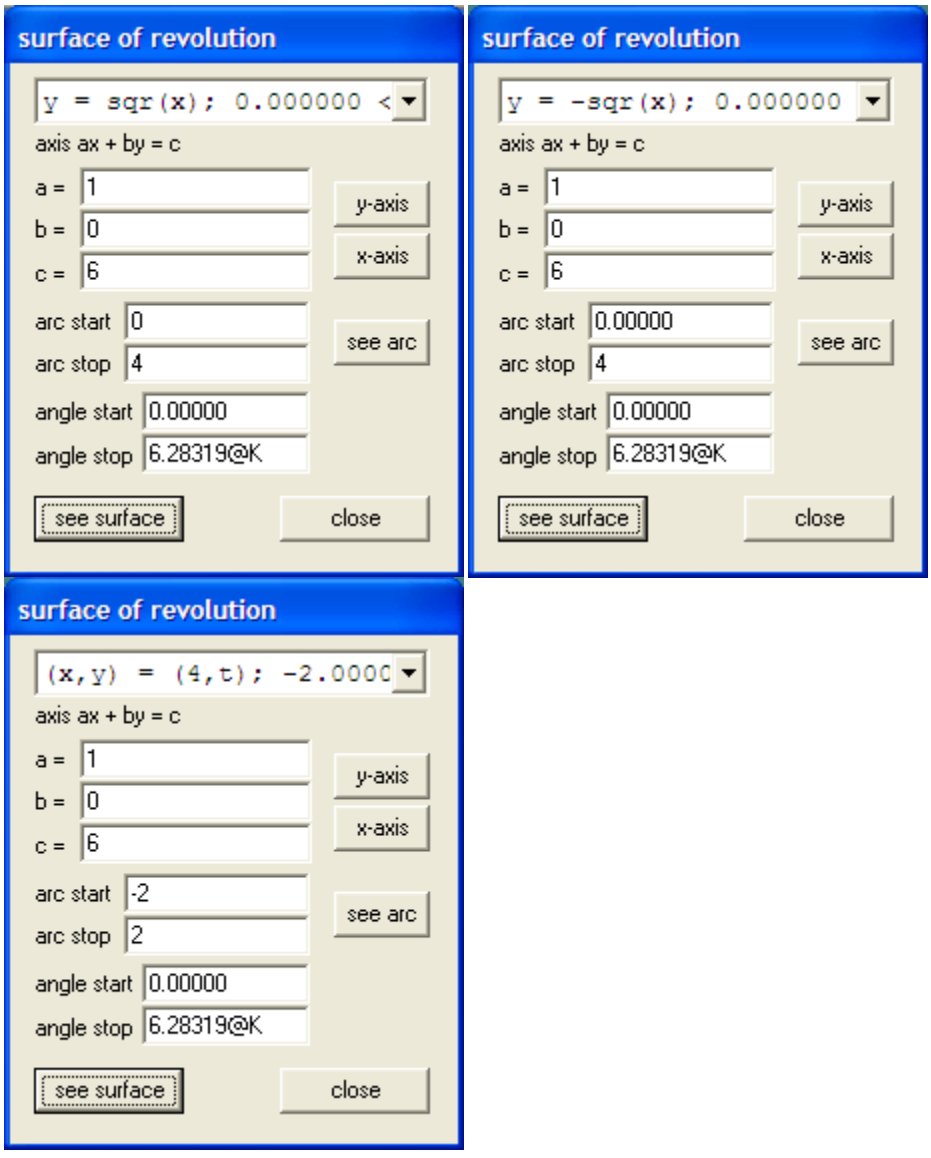
2. Under ONE, select “surface of revolution.” Select the equations from the drop down list at the top and enter the other values as shown. Click “see surface” after each. They will all graph on the same 3-dim window. You may use the arrow keys to turn the graph at any time.

Note the arc start and arc stop values and the angle start and stop values

The @K is what will make this work. You may use any letter. If you just want to see the result then omit the @K.

The coefficients *a, b,* and *c* are for the axis of revolution written in the form ax + by = c.



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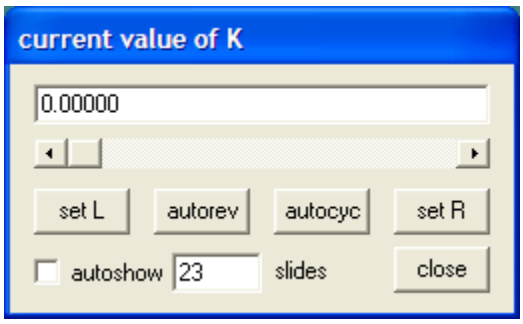
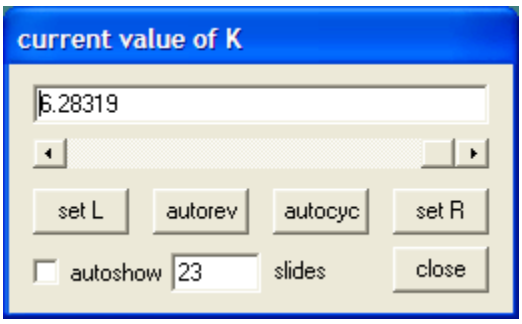
3. On the 3-dim screen click “ANIM” and then “individual” and then” K” and then set the left and right values as shown

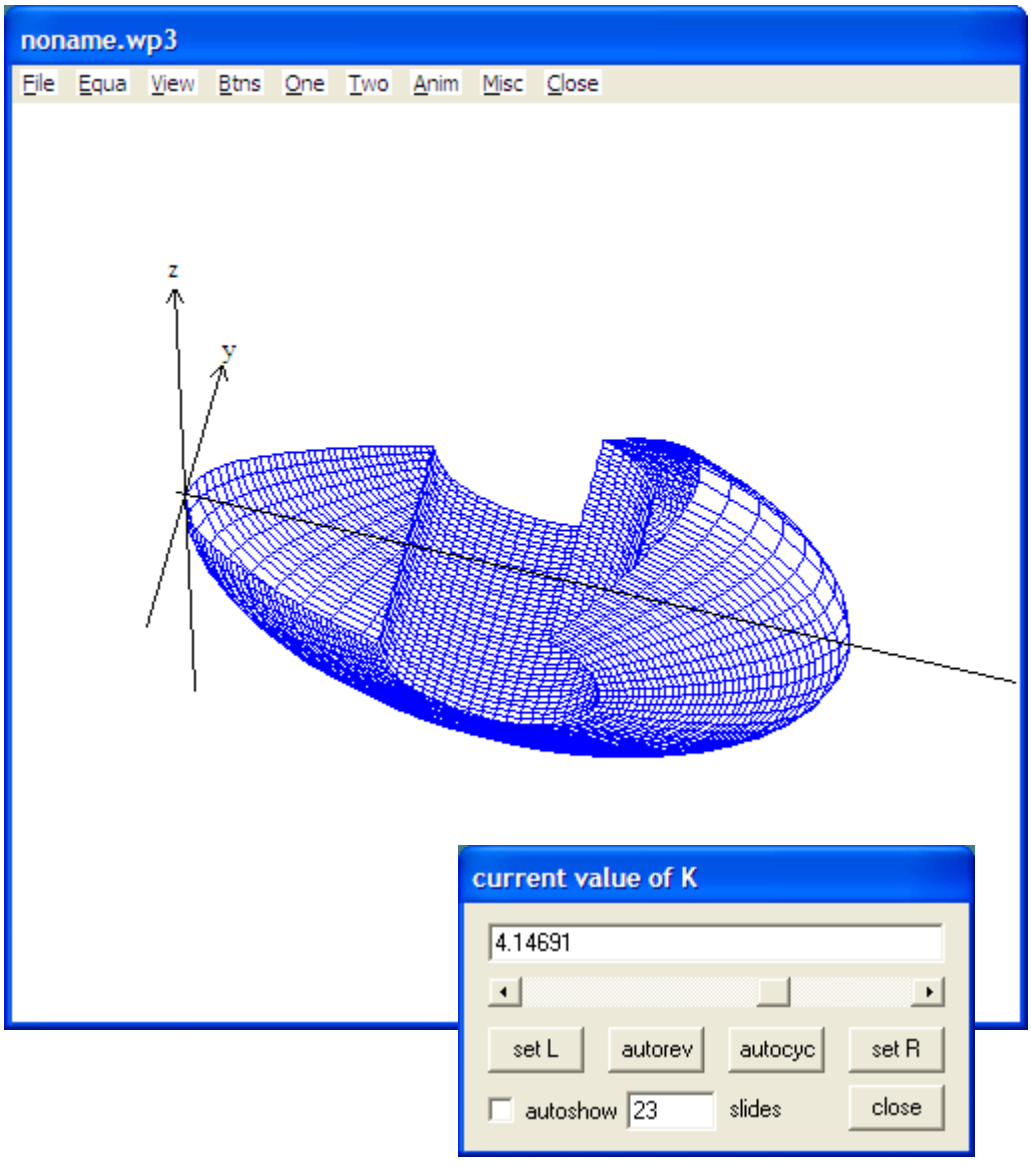




Enter 0 and click “set L”

Enter 2pi and click “set R”

Slide the K slider to see the revolution.



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