

Ma2 For Windows

Ma2 is a software package which was written to:

- 1: Draw functions in Rectangular coordinates
- 2: Draw functions in polar coordinates
- 3: Draw sets of 2 parametric equations
- 4: Plot data points from a textfile
- 5: Integrate functions in Rectangular Coordinates
- 6: Find the zeros of functions

The following example will illustrate the use of Ma2. We will draw the graphs of some functions in rectangular coordinates.

At the Main Menu, click on the button labeled 1. to **Draw functions in Rectangular Coordinates**. You will see a graphics screen with a set of axes. Both the x and y axes are currently set to go from -5 to 5. At the top of the screen, you will see a menu of selections that we will use to set up our graphs. Each of these selections are explained briefly under **Help**. It's a good idea to read through the **Help** file to see what functions are available and how to enter them.

To begin, click on **Function**. A dialogue box will appear for you to enter your function. Type in x^2-x-5 . This is the quadratic function x^2-x-5 . Press the Enter key. Click on the **Draw** button at the upper left corner of the screen and the graph of the function will be drawn from $x = -5$ to $x = 5$. That's all there is to it. Now we'll look at some of the other features you will need.

Click on **Edit** and then **Stepsize**. The default value is 0.1. This means that the function is being plotted at every tenth of a unit, starting at $x = -5$. If your function looks jagged with sharp corners, you may need to change the stepsize to a smaller value, like 0.05.

Click on **File** and then **List Function Values**. This data list shows the value of the function at each value that was assigned to x. The function was plotted starting at $x = -5$ and evaluated every tenth of a unit all the way to $x = 5$. If you want hardcopy, you can select Print to print the data to a printer. Or you can edit and cut away some data, or save it to a file.

Click on **Axes**. With this dialogue window, change Minx to -4. Then press the Tab key to move the cursor to Maxx and change that from 5 to 8. Press Tab again and set Miny to -8, Tab again and set Maxy to 30. Press Enter, and the graphics screen is erased and refreshed with your new entries. Now Click on **Draw** again and see the parabola drawn on your new screen.

Click on **Edit** and then **Graph Title**. Type in your name and press enter. The title will appear at the top of the graphics box.

Click on **Axes** and then **Label Axes**. Enter some text to label the vertical and horizontal axes of your graph.

The graph of $y = x^2 - x - 5$ crosses the x-axis in 2 places. We often need to know the values of x where $y=0$, i.e., where the graph crosses the x-axis. These are called the zeros of the function. The graph crosses the x axis near $x=3$. To get a better approximation, click on **Zeros** and enter 3 for your first approximation. Click on the OK button and a new window opens to show a sequence of iterations that converge to a zero accurate to 8 decimal places, 2.79128785.

Editing Your Graph: When you have drawn a graph, you can save it as a bitmap(.bmp), .jpeg or .png. Click on File|Save Graph. You can just save the graph inside the graphing rectangle, or save the full graph to include axis labels and title. If you want to annotate or add something to your graph, you can load it into MSPaint in Windows or Preview on the Mac, and use the editing tools to add text, like the word *Parabola* next to your graph. If you want, you can save your annotated graph as .bmp, .jpg, or .png and then open it back into Ma2, using File|Open Graph.

Click on **Function** again and enter the new function $a*x^3+b*x^2+c*x+d$. This is the polynomial of degree 3, which is ax^3+bx^2+cx+d . The four coefficients are a,b,c and d. They are also called parameters. We can enter a function with parameters and then change the values of these parameters to draw different functions. You may enter up to as many as 6 parameters. Click on **Edit** and then **Parameters** to obtain the Parameters dialogue box. Enter the values $a = 1, b = 2, c = -3, d = -4$. Also, set the Axes back so x and y go from -5 to 5. You will see the current values of the Parameters listed across the bottom of the screen just below your function. Now click on **Draw** to draw the polynomial. Just for practice, try some different values for the parameters and draw up some more functions. For example, try $a = 2, b = -3, c = -12, d = 5$ or $a = -4, b = 0, c = 3, d = -2$.

Another way to change the parameters in a function is to use the sliders. At the Main Menu, click on **Sliders**. A new window opens where you can simply click on an arrow to change the value of a parameter and see the new graph drawn quickly. Using the sliders allows you to draw many graphs quickly to see how the parameters affect the behavior of the function. Click on the Erase checkbox in the Sliders window to either erase each graph or keep all your graphs.

Click on **Edit|Clear** to clear all your graphs from the graphing window.

Take some time to experiment with some of the other features of Ma2, like changing the graphing colors, background colors, opening and saving graphs, and printing.

When you type in a function to be drawn, it must be typed in with the proper symbols and syntax. Click on **Help** and read the information about how to enter functions. It tells you how to save graphs as bitmaps, jpegs or pngs to insert in another document, or copy a graph to the clipboard. Also, read about some of the other selections and then try them out to become familiar with the software.

Some Exercises:

1. A line passes through the points P(-2,-8) and Q(5,6).
a) Find the equation for this line in the form $y = mx+b$.

b) Use Ma2 to draw the line.

c) Find a line through R(0,4) which is perpendicular to the line in part a) above.

d) Draw this perpendicular line. Do these lines look perpendicular on the screen? Explain.

e) At what point do these two lines intersect?

2. Draw the graph of $y = \sqrt{x+2}$. [You may enter this as sqrt(x+2) or (x+2)^0.5]
What is the domain of this function?