FUNCTIONS

$\sin\left(\frac{\pi}{6}\right) = 0.5$ $\sin(30) = -0.988$ Radians are default, as they should be!

$\sin(30°) = 0.5$ $\sin(30\text{deg}) = 0.5$ Use the measuring cup for the raised circle.

Open menu Help, item Mathcad Help, and use search to find out how to insert an arcsine.

$\exp(2) = 7.389$ $e^2 = 7.389$ or the sqaure root

$\ln(e^2) = 2$ $\log(e^2) = 0.869$ $\log(e^2, e) = 2$ The ln is always base e.

$\ln(10^2) = 4.605$ $\log(10^2) = 2$ $\log(10^2, 10) = 2$ Base 10 is default for log.

For a square root use \: $\sqrt{9} = 3$

For another root, use Ctrl+\: $\sqrt[3]{27} = 3$

You can define your own functions much like you define your own variables:

$\text{sqr}(x) := x^2$ $\text{sqr}(2) = 4$ $\text{sqr}(3) = 9$

You can also define piecewise functions. How about a function that is a parabola for negative x, but linear for positive x?

$\text{parlin}(x) := \text{if}(x < 0, x^2, x)$

$\text{parlin}(-2) = 4$ $\text{parlin}(-1) = 1$ $\text{parlin}(1) = 1$ $\text{parlin}(2) = 2$

You could cap off the large values at negative x at 3:

$\text{parlin}(x) := \text{if}(x < 0, \text{if}(x^2 < 3, x^2, 3), x)$

$\text{parlin}(-2) = 3$ $\text{parlin}(-1) = 1$ $\text{parlin}(1) = 1$ $\text{parlin}(2) = 2$

How about capping it off at both sides? Does it need 3 if constructs or is 2 enough? I think you need 3 (without using build in piecewise functions like min and absolute).

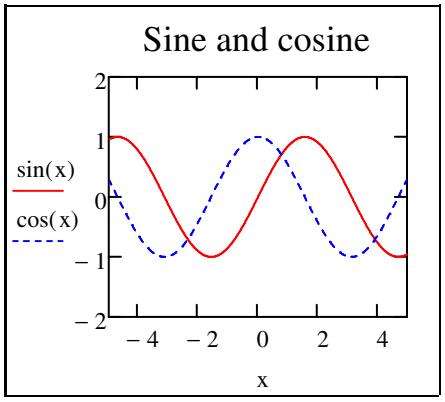
You can also define functions that produce strings. Use a double quote to start a string and get out of it using the arrow key:

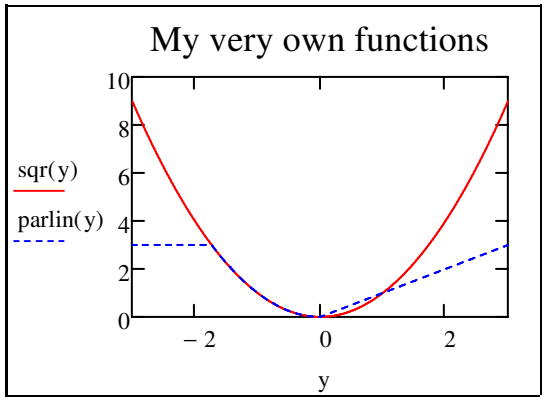
$\text{textsign}(x) := \text{concat}(\text{"x is "}, \text{if}(x > 0, \text{"positive"}, \text{"not positive"}))$

$\text{textsign}(-3) = \text{"x is not positive"}$ $\text{textsign}(0) = \text{"x is not positive"}$ $\text{textsign}(2) = \text{"x is positive"}$

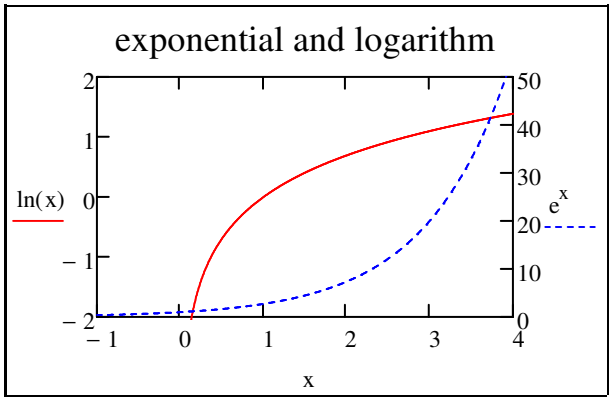
QUICK PLOTS

Simple plots are started by typing @ (Shift 2), or using the graph toolbar. After typing @, fill in the axes placeholders appropriately. Right-click the graph and select Properties and Format to add a border and title:





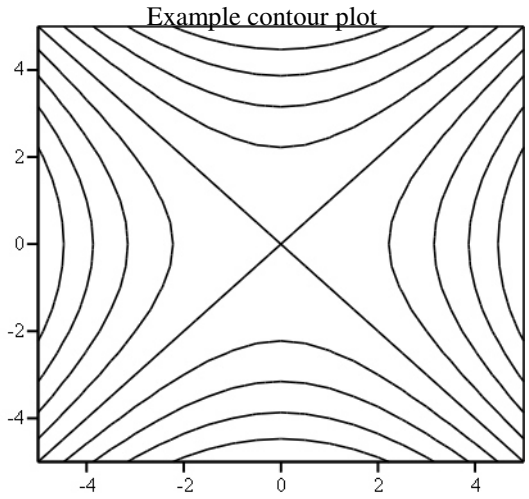
Use the Format menu to enable a second y-axis if needed:

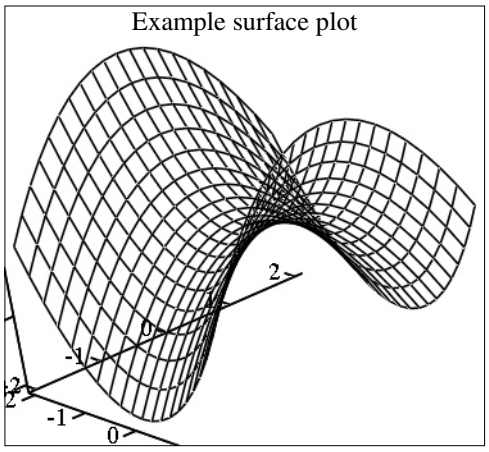


Without the second y-axis, you would either not see the logarithm or the exponential properly.

For functions of two variables, you can either do a contour plot or a three-dimensional surface plot. *Note: I had to set the monitor to 16 bit to get the 3D graphs to work. Alternatively, create a Mathcad desltop item, right-click it, select Compatibility, and disable desktop composition.*

$f(x,y) := x^2 - y^2$ The function we will plot.





I had to change the axes in Properties, Quickplot Data, to get a decent graph. I also had to grab an axis and move it around.

Note: to do plots of space curves in three-dimensional space, use CreateSpace, then select a *scatter plot* from the menu Insert / Graph or graph toolbar. Then use the right-click Properties menu to change points into lines. This is *not* said in the Mathcad help.

RANGE VARIABLES

A range variable is a list of equally spaced numbers, like say 1.5, 2, 2.5, ..., 4. To create a range variable with those values, type 1.5,2;4 (note that the semi-colon contains a comma and a point:

$rv_1 := 1.5, 2 .. 4 =$

1.5
2
2.5
3
3.5
4

$rv_2 := -2 .. 3 =$

-2
-1
0
1
2
3

if you leave out the second value the increment will be 1

Suppose the coins of a country have diameters 0.5, 1, 1.5, 2, and 2.5 cm. You want to compare coin volumes in cubic mm for coin thicknesses 1 mm and 0.7 mm using range variables.

First look under Help, Reference Tables, and find the formula for the volume of a right circular cylinder. Define a function that way:

$V_{cyl}(r, h) := \pi \cdot r^2 \cdot h$ $V_{cyl} = f(any1, any2) \rightarrow any1\text{^}2 \cdot any2$

Define the coin thicknesses and a range variable with the diameter values D:

$t_1 := 1mm$ $t_2 := 0.7mm$ $D := 0.5cm, 1cm .. 2.5cm$

$t_1 = 1 \cdot mm$ $t_2 = 0.7 \cdot mm$ $D =$

0.5	·cm
1	
1.5	
2	
2.5	

You *must* specify the units on *each* member of the range variable

Now we can evaluate the coin volumes:

$V_{cyl}\left(\frac{D}{2}, t_1\right) =$

19.635	$\cdot mm^3$
78.54	
176.715	
314.159	
490.874	

$V_{cyl}\left(\frac{D}{2}, t_2\right) =$

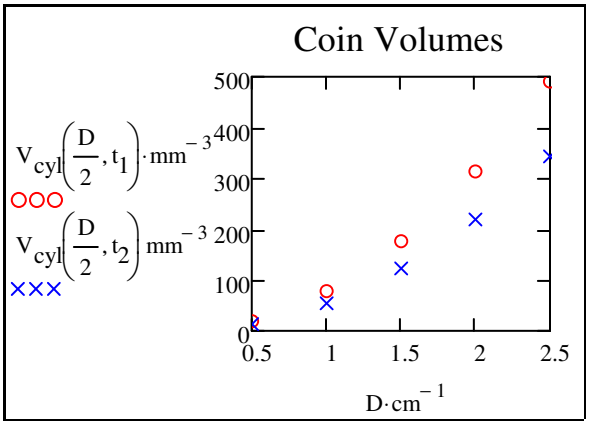
13.744	$\cdot mm^3$
54.978	
123.7	
219.911	
343.612	

Do not try to assign these to a range variable.

I had some problems with Mathcad converting range variables to matrices without my permission. Buggy, buggy.

People pay $1,600.00 for that?

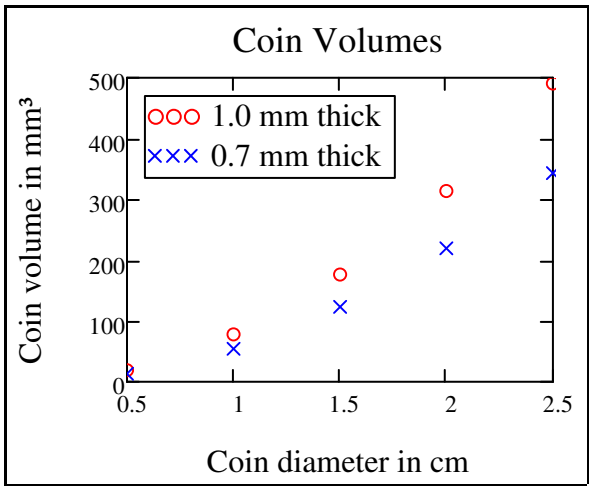
Let's plot this!



Note that Mathcad does *not* add units to the numbers on the axes; they are nondimensional numbers. Therefore, to get Mathcad to list the numbers that *multiply* the centimeters in D, you must *divide* D by cm. And it goes similarly for V_{cyl}.

Use the right-click Format menu to put in the border and title, and to show the trace as symbols instead of a line.

To make a presentation-quality graph, you want to hide the trace arguments, add explicit x and y labels, and add a legend. Do that with the right-click Format menu.



To put the superscript 3 in the label of the y axis, use the Microsoft character map program found in the Start Menu / Accessories / System Tools.

Note: If you are plotting some function, and Mathcad does not put enough points in the curve (buggy, buggy), use a range variable as independent variable. That allows you to specify the plot points yourself.