HOW TO USE MATHEMATICA

Open *Mathematica* by clicking at the icon. Start a new document.
You can perform simple calculations on numbers, use functions such as sin, cos, and exponential function which are already built in the software. In addition you can perform a number of symbolic operations (operations on expressions in the form of functions). These operations include simplify, expand, differentiate, integrate, solve differential equations, work with matrices, plot 2- and 3- dimensional graphs and many more. When you type a command, or an expression you need to press

Shift –Enter

For example
2+3 or 4*3 or 2^3 or 24/2

Shift-Enter

Will give out put (respectively), 5; 12 or 8 or 12.

Functions

Sqrt[64]; Log[23.4]; Sin[7.23]; Cos[2.18]; Exp[13]

Shift-Enter
Will produce these values as output.

Example: $f(x) = x\sin^2 x$ can be entered as
f[x_]=x*(Sin[x])^2
We can then use
Solve[f[x]==0,x] to solve the equation $x\sin^2 x = 0$.
Of course the solution *x=0* will be given as output..
Differentiation can be performed as
D[x*Sin[x]^2,x].
Integration as:
Integrate[x*Sin[x]^2,x]

Remember to use Shift-Enter after each of these commands.

Plot Function Graph:

Plot[Sin[x],{x,0,2Pi}]
Shift-Enter
Will produce graph of sinx, x = 0 to x = π .
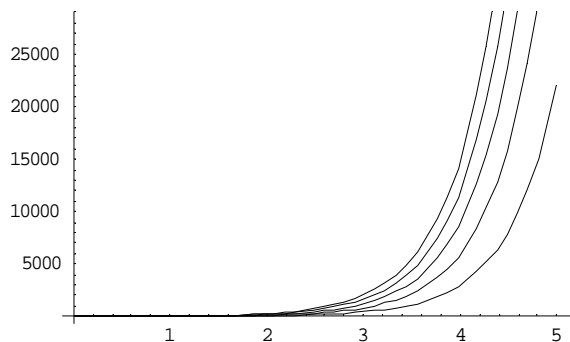
Graph of Solution Curves

We have seen that the one parameter family of solutions of $y' = 2y$ is given by $y = Ce^{2x}$.
We can plot the family of solutions for different values of C using
Plot[Evaluate[Table[C*Exp[2*x],{C,1,5}]],{x,0,5}].
Shift-Enter
It produces:

Using Mathematica Routine

We can directly insert the differential equation to obtain graph of family of solutions. For this a package (subroutine) of Mathematica will be used.

Suppose we have differential equation $\dfrac{dy}{dx} = \dfrac{f}{g}$.

<<Graphics\PlotField.m
Shift-Enter {This will open the package}. Then use
PlotVectorField[{g,f]},{x,-5,5},{y,-5,5}]
Shift-Enter.
The direction field of the solution curves will be the output.

For example, if we have $\dfrac{dy}{dx} = \sin(x - y)$, then input

PlotVectorField[{1,Sin[x-y]},{x,-5,5},{y,-5,5}]

The output will be