MATHEMATICA IN A NUTSHELL

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Basics:

_ SHIFT-ENTER = "compute"
_ ( ) = grouping, [ ] = function argument, { } = table/list item markers
_ Pre-defined functions usually begin with a capital: e.g. Sin[2]
_ N[…] or … //N for numeric approximation
_ % = "previous" , % number = "refer to line number"
_ Use the palette (Tab switches fields)
_ Control-C and Control-V copy and paste
_ formatting output: Expand[ ] , Simplify[ ], and FullSimplify[ ]
_ Enter plain text via Format…Style…Text under horizontal line
_ Help Index
_ Open new notebook, cut, and paste for neatness

Useful Functions:

_ Plot[expression, {variable, domain min, domain max}]

Add ins: PlotRange _ { range min, range max}
AxesLabel _ {"x title", "y title"}
PlotLabel _ "Title"

_ Solve[something = = something else, variable]
and similarly for NSolve

_ Series[expression to expand, {variable, expand about, up to order}]

_ Matrices:
format is {{11, 12, 13}, {21, 22, 23}, {31, 32, 33}}
matrix multiplication is "period" not "*"
Det[ ] , Inverse[ ], Eigenvalues[ ], Eigenvectors[ ]

Differential Equations:

_ apostrophe is "prime"

_ DSolve[y'[x] = = 3*y[x], y[x], x] will solve (dy/dx)=3y for y as a function of x

_ with initial condition: DSolve[{y'[x] = = 3*y[x], y[0] = = 2}, y[x], x]

_ compare NDSolve[{y'[x] = = 3*y[x], y[0] = = 2}, y, {x,0,2}] along with
y[1]/.% and Plot[Evaluate[y[x] /.% line number],{x,0,3}]

_ For coupled equations dv/dt = -x and dx/dt = v (SHO with omega = 1)
NDSolve[{v'[t] = = -x[t], x'[t] = = v[t], v[0] = = 0,
x[0] = = 1},{v,x},{t,0,6.28}]

User-Defined Functions:

_ name your functions and variables in all lower case

_ underscore = "to be assigned later"

_ name[a_, b_] := messy expression that's a function of a and b

_ to evaluate: name[2,3]

_ to plot: Plot[name[2,z], {z,0,4}]
or Plot3D[name[x,y], {x,0,3},{y,0,3}]