

Mathematica Tip Sheet

Built-In Constants:

$\pi = \text{Pi}$ $e = \text{E}$ $i = \sqrt{-1} = \text{I}$ $\infty = \text{Infinity}$

Built-In Functions:

Abs[x]	Sin[x]	ArcSin[x]
Sqrt[x]	Cos[x]	ArcCos[x]
Exp[x]	Tan[x]	ArcTan[x]
Log[x] (= ln x)	Sec[x]	ArcSec[x]
Log[b, x] (= log _b (x))	Csc[x]	ArcCsc[x]
n! or Factorial[n]	Cot[x]	ArcCot[x]

Grouping:

Parentheses - ()	Used for grouping for basic operations, like +, -, *, /, ^.
Square Brackets - []	Used for functions to indicate the variable quantity to be used. (f[x]).
Curly Braces - { }	Used for lists, vectors, matrices, and ranges of values for options.

Assigning Values:

<code>x = value</code>	Assigns <i>value</i> to the variable <i>x</i> .
<code>x = y = value</code>	Assigns <i>value</i> (the same value) to <u>both</u> the variables <i>x</i> and <i>y</i> .
<code>Clear[x,y]</code>	Clears all values (if any) previously assigned to <i>x</i> and <i>y</i> . (USE OFTEN!)
<code>x == y</code>	Tests whether <i>x</i> is equal to <i>y</i> , often used when trying to solve equations.
<code>expr/.x->value</code>	Replaces every <i>x</i> in <i>expr</i> with <i>value</i> .
<code>expr/.{x->xval, y->yval}</code>	Replaces <i>x</i> and <i>y</i> in <i>expr</i> with <i>xval</i> and <i>yval</i> , respectively.
<code>f[x_]=expr</code>	Defines a function <i>f</i> , of one variable. Remember the underscore (_)!
<code>g[x_, y_]=expr</code>	Defines a function <i>g</i> , of two variables.

Some Algebra Commands:

<code>Expand[expr]</code>	Multiplies out products and powers in the <i>expr</i> .
<code>Factor[expr]</code>	Factors <i>expr</i> over the integers.
<code>Apart[expr]</code>	Decomposes <i>expr</i> into partial fractions.
<code>Simplify[expr]</code>	Performs algebraic transformations to give the simplest form of <i>expr</i> .
<code>Solve[lhs==rhs,x]</code>	Solves the polynomial equation <i>lhs=rhs</i> (exactly) for <i>x</i> . (Notice the double equal sign ==.)
<code>FindRoot[lhs==rhs,{x,a,b}]</code>	Numerically solves the polynomial equation <i>lhs=rhs</i> for <i>x</i> , starting in the interval (<i>a</i> , <i>b</i>).
<code>a=x/.Solve[lhs==rhs,x]</code>	Stores the solution value as the variable <i>a</i> . If there is more than one solution, add <code>[[n]]</code> at the end of the command to store the <i>n</i> th result as <i>a</i> .
<code>sol=x/.FindRoot[lhs==rhs,{x,a,b}]</code>	Stores the solution value as the variable <i>sol</i> .
<code>Solve[{eq1,eq2,...,eqN}, {x1,x2,...,xN}]</code>	Solves a system of <i>N</i> equations (written with ==), for the variables <i>x1</i> , ..., <i>xN</i> .

Manipulating Lists and Vectors:

<code>letters={a,b,c}</code>	A list called <code>letters</code> with three entries, <i>a</i> , <i>b</i> , and <i>c</i> . OR A vector called <code>letters</code> with components, <i>a</i> , <i>b</i> , and <i>c</i> .
<code>letters[[n]]</code>	Returns the <i>n</i> th element in the list called <code>letters</code> . (<code>letters[[3]] = c</code>).
<code>Dot[u,v]</code> or <code>u.v</code>	Returns the dot product of two vectors <i>u</i> and <i>v</i> .
<code>Cross[u,v]</code>	Returns the cross product of two <u>three-dimensional</u> vectors <i>u</i> and <i>v</i> .
<code>Table[f[x],{x,a,b,n}]</code>	Creates a table (list) of values of <code>f[x]</code> , going from <i>x=a</i> to <i>x=b</i> in increments of <i>n</i> . (If no increment is specified, the default value of 1 is used.)
<code>Tableform[list]</code>	Prints the elements of a list in a vertical table.

Some Calculus Commands:

<code>D[expr,x]</code>	Finds $\frac{d}{dx}(\text{expr})$.
<code>D[expr,{x,n}]</code>	Finds $\frac{d^n}{dx^n}(\text{expr})$.
<code>f'[x]</code>	Finds the first derivative of a previously defined function <code>f[x]</code> .
<code>f''[x]</code>	Finds the second derivative of a previously defined function <code>f[x]</code> .
<code>Integrate[expr,x]</code>	Evaluates the indefinite integral $\int \text{expr} \, dx$.
<code>Integrate[expr,{x,a,b}]</code>	Evaluates the definite integral $\int_a^b \text{expr} \, dx$.
<code>Limit[expr,x->a]</code>	Evaluates $\lim_{x \rightarrow a} \text{expr}$.
<code>Sum[a[n],{n,a,b}]</code>	Evaluates $\sum_{n=a}^b a[n]$.

Some Graphics Commands:

<code>Plot[f[x],{x,a,b},options]</code>	Creates a 2D plot of $y=f[x]$ for the interval $a \leq x \leq b$.
<code>Plot[{f[x],g[x]},{x,a,b},options]</code>	Creates a 2D plot of $y=f[x]$ and $y=g[x]$ on a single set of axes.
<code>Plot3D[f[x,y],{x,a,b},{y,c,d},options]</code>	Creates a 3D plot of $z=f[x,y]$ over the region $a \leq x \leq b$, $c \leq y \leq d$.
<code>ParametricPlot[f[t],{t,a,b},options]</code>	Creates a 2D plot of the parametrically defined function $f[t]=\{x[t],y[t]\}$ for $a \leq t \leq b$.
<code>ParametricPlot3D[f[t],{t,a,b},options]</code>	Creates a 3D plot of the parametrically defined function $f[t]=\{x[t],y[t],z[t]\}$ for $a \leq t \leq b$.
<code>ListPlot[{{x1,y1},{x2,y2},{x3,y3}}]</code>	Plots the points with coordinates $(x1,y1)$, $(x2,y2)$, $(x3,y3)$.
<code>Show[{graph1,graph2},options]</code>	Displays the two graphs <code>graph1</code> , <code>graph2</code> on a single set of axes.

Some Selected Plot Options:

<code>AspectRatio->value</code>	Sets the height-to-width ratio for the plot.
<code>Axes->False</code>	Exclude axes in the plot. (Default is True).
<code>AxesLabel->{xlabel,ylabel}</code>	Labels to put on the axes.
<code>PlotPoints->value</code>	The number of points to plot. (Default is 25).
<code>PlotRange->{min,max}</code>	The range of values to display on the plot.
<code>PlotStyle->{Thickness[w]}</code>	Gives all curves a thickness of <code>w</code> as a fraction of the plot width.
<code>PlotStyle->{RGBColor[a,b,c]}</code>	Produces color graphs: <code>a</code> , <code>b</code> , and <code>c</code> are values between 0 and 1 which represent the saturation of red, green, and blue, respectively.

A Few Other Useful Commands:

<code>%</code>	Refers to the last answer output from Mathematica. Caution: This is the last output generated, which is not necessarily the answer directly above the line on which <code>%</code> is entered.
<code>N[expr,n]</code>	Returns a decimal value for <code>expr</code> , with <code>n</code> significant digits.
<code>//N</code>	When typed after another command, converts it to a numerical (decimal) result.
Semicolon: ;	Used at the end of successive lines of input, it evaluates, but suppresses output.
Space:	Used between two variables, it indicates a multiplication. For example, <code>x y</code> (with the space) means <code>x*y</code> , but <code>xy</code> (without any space) refers to a variable name.

Some Menu Commands / Other Items:

<code>SHIFT + ENTER</code>	Executes an input cell.
Cell → Delete All Output	Deletes all output in the active notebook.
Evaluation → Abort Evaluation	Stops the evaluation of a cell which is currently running.
Palettes → BasicMathInput	Opens general palette with basic symbols.
Evaluation → Quit Kernel → Local	Clears all memory in current session.
Help → Documentation Center	Opens the Help Browser.