Appendices - Quick Reference Guides

■ A. Common Mathematical Operations - Traditional Notation versus *Mathematica* Notation

The following list demonstrates how to translate common mathematical operations described using traditional notation into *Mathematica* notation. In many instances *Mathematica*'s palettes (see Section 1.5) will allow the user to input commands using traditional notation without having to convert to *Mathematica* notation.

Operation	Traditional Notation	*Mathematica* Notation
Define a function	$f(x) = x^2$	**f = x^2** or **f[x_] = x^2** or **f[x_] := x^2** (delayed assignment)
Evaluate a function	$f(1)$	**f /. x -> 1** or **f[1]**
Square root	$\sqrt{f(x)}$	**Sqrt[f[x]]**
Absolution value	$\lvert f(x) \rvert$	**Abs[f[x]]**
Limit	$\lim_{x \to a} f(x)$	**Limit[f[x], x -> a]**
Derivative	$f'(x)$	**f'[x]** or **D[f[x], x]**
Second derivative	$f''(x)$	**f''[x]** or **D[f[x], {x, 2}]**
Indefinite integral	$\int f(x)\,dx$	**Integrate[f[x], x]**
Definite integral (Exact)	$\int_a^b f(x)\,dx$	**Integrate[f[x], {x, a, b}]**
Definite integrate (Approximate)	$\int_a^b f(x)\,dx$	**NIntegrate[f[x], {x, a, b}]**
Pi	π	**Pi** or π (from palette menu)
Euler number	e	**E** or e (from palette menu)
Imaginary number	i	**I** or i (from palette menu)
Infinity	∞	**Infinity** or ∞ (from palette menu)
Sine function	$\sin x$	**Sin[x]**
Inverse sine function	$\arcsin x$ or $\sin^{-1} x$	**ArcSin[x]**
Exponential function	e^x	**E^x** or **Exp[x]** or e^x (from palette menu)
Natural logarithm (base e)	$\ln x$	**Log[x]**
Logarithm (base a)	$\log_a x$	**Log[x, a]**
Define i-th element of a sequence	$x_i = a$	**x[i] = a** or $x_i = a$ (from palette menu)

■ B. Useful Commands for Plotting, Solving, and Manipulating Mathematical Expressions

Mathematica Command	Description
Plot[*f*[*x*], {*x, a, b*}]	Plot a function $f(x)$ on the interval $[a, b]$
Plot3D[*f*[*x, y*], {*x, a, b*}, {*y, c, d*}]	Plot a two-variable function $f(x, y)$ on $[a, b]\times[c, d]$
ParametricPlot[{*x*[*t*], *y*[*t*]}, {*t, a, b*}]	Plot parametric equations $x = f(t),\ y = g(t)$ on $[a, b]$
PolarPlot[*f*[*θ*], {*θ, a, b*}]	Plot polar function $r = f(\theta)$ on $[a, b]$
ContourPlot[*f*[*x, y*], {*x, a, b*}, {*y, c, d*}]	Plot contour of $f(x, y)$ on $[a, b]\times[c, d]$
ContourPlot[*F*[*x, y*] == 0, {*x, a, b*}, {*y, c, d*}]	Plot implicit function $F(x, y) = 0$ on $[a, b]\times[c, d]$
Solve[*f*[*x*] == *g*[*x*], *x*]	Solve an equation $f(x) = g(x)$ for x
DSolve[*F*(*x, y, y*'(*x*)) == 0, *y*[*x*], *x*]	Solve a differential equation $F(x, y, y'(x)) = 0$ for $y(x)$ with initial value $y'(0) = a$
Part[*expr***,*i*]** or *expr*[[*i*]]	Refer to *i*-th element of list *expr*
N[*expr***]** or **N[***expr***,*n*]** (*n*-digit precision)	Numerical approximation of a quantity *expr*
Simplify[*expr***]**	Reduce an expression *expr* to most simple

■ C. Useful Editing and Programming Commands

Mathematica Command	Description
SHIFT+ENTER	Evaluates input
%	Refers to previous output
%%	Refers to second previous output
%k or **Out[k]**	Refers to output line *k*
In[k]	Refers to input line *k*
CTRL+L	Reproduces the previous input
CTRL+SHIFT+L	Reproduces the previous output
?Plot	Lists all *Mathematica* commands containing the expression **Plot** (or any other specified command)
(* *expr* ***)**	Insert comment *expr* (unevaluated)
If[*test***,***expr***,***else***]**	Evaluate *expr* if *test* is true; otherwise, evaluate *else*
Do[*expr***,{i,min,max,step}]**	Evaluate *expr* through loop *i* running from *min* to *max* with increment *step*
While[*test***,** *expr***]**	Evaluate *expr* while *test* is true; otherwise stop

D. Formatting Cells in a Notebook

Mathematica organizes a notebook in terms of data boxes called cells. The size of a cell is indicated by the corresponding size of the right bracket symbol attached to the right hand margin of each cell. A new cell can always be created by moving the cursor to any position between cells and begin typing. To edit a cell, just move the cursor to the desired position within that cell.

Each cell can be formatted to perform a specified function. By default, a new cell is always formatted as an input cell, which are used to evaluate *Mathematica* expressions. *Mathematica* outputs are contained within output cells, naturally. Other cell formats included title, section, subsection, text, formula, etc. The format of a cell is indicated by the left-most box on the toolbar. To change its format, first highlight the cell by clicking on the right bracket symbol attached to it. Then click on the indicator box and choose the desired format.

E. Saving and Printing a Notebook

Saving or printing a notebook can be accomplished by going to the File menu and selecting the desired option. To print a portion of a notebook that has been highlighted, choose the Print Selection option instead. To save your Notebook in other formats such as PDF, print it by selecting the desired format as the output source.

References

1. J. Rogawski, *Calculus: Early Transcendentals*, 2nd Edition, W.H. Freeman and Co., New York, 2012.