mth 256

Maple Introduction

All *Maple* commands must be terminated with a semicolon (if output is desired) or a colon (to suppress output). Help on the syntax of any *Maple* command can be obtained by typing **?command**. For example, to get help with the **solve** command, type **?solve**.

Arithmetic

5+3 ;	Don't forget the semicolon.
5*3 ;	Multiply by *.
5/3 ;	Gives $\frac{5}{3}$.
evalf(5/3) ;	Gives you the decimal number.
2^10 ;	Gives 1024.
Pi ;	Gives you the exact constant π.
evalf(Pi^2) ;	Gives the decimal approximation of π^2.
sqrt(17) ;	Gives $\sqrt{17}$.
exp(1) ;	Returns the exact constant e.
I ;	Returns the imaginary number.

To extract a subexpression from an earlier line use the mouse and Cut and Paste or Copy and Paste. The arrow keys will move you around the screen.

% ;

Returns the previous output.

Algebra

factor(x^2 − y^2) ;

Factors the polynomial $x^2 - y^2$.

expand(%) ;

Expands the result.

Declaring constants, variables and functions

a := 5 ;

Sets the variable **a** to the value 5.

a := 'a' ;

Unassigns any value to **a**.

f := x−> x^2 + 5 ;

Defines the function $f(x) = x^2 + 5$.

f(3) ;

Gives the function evaluated at $x = 3$.

subs(x=2 , (x + 5)^2) ;

Substitutes the value $x = 2$ into the expression.

Logarithmic Functions

ln(exp(2)) ; Gives the natural log, $ln(e^2)$.

f := x–> (exp(x) + exp(–x)) / 2 ;
Remember exp( ) gives you the natural base.

f(ln(2)) ; Evaluate the function.

log[10] (10000) ; Gives log base 10.

log[2] (16) ; Shows the format for a general base.

Trigonometric Functions

cos(0) ;

sin(Pi/6) ;
expand(sin(x+y)) ;

sin(arcsin(x)) ;

arcsin(sin(x)) ;

Solving Equations

solve(5*x+3 = 1 , x) ;

solve(a*x^2+b*x+c = 0 , x);

Solves the quadratic equation.

fsolve(cos(x) = x , x) ;

Maple must use approximation methods to solve this one.

2D-Plots

restart ;

Begin a new session.

f := 2*x^3−5*x^2+x+2 ;

Assigns the polynomial to the expression f.

plot(f , x=−2..3) ;

Plots f over the interval $-2 \leq x \leq 3$.

plot(f , x=−2..3 , y=−50..50) ;

Sets the interval $-50 \leq y \leq 50$.

plot({ f , x^2−3} , x=−2..3) ;

More than one graph can be plotted by using braces { }.

Implicit Plotting

with(plots) :
implicitplot(x^2/9+y^2/3 = 1 , x=−5..5 , y=−5..5) ;

Implicitly plots the ellipse.

3D-Plots

f := sin(2*x+y) ; plot3d(f , x=−5..5 , y=−5..5 , style=patch) ;

Creates 3D plot.

Calculus

In general, capitalized commands in Maple show the math operation being performed, and lower case commands find the value of the math operation. Notice this feature with the following commands.

Limits

restart ;

limit(sin(x)/x , x=0) ; Calculates limit.

Limit(abs(x)/x , x=0 , left) ; Shows the directional limit.

value(%) ; Finds the value of the limit.

limit((x+1)/(2*x) , x=infinity) ;

(x+h)^3−x^3 ; % / h ; Get the difference quotient.

limit(% , h=0) ; Calculate the derivative.

Derivatives

diff(sin(x) , x) ; Gives the derivative $\frac{d}{dx}\sin x$.

f := x–> x^3–3*x^2 ; Create the function $f(x) = x^3 - 3x^2$.

D(f) ; This differentiates $f(x)$.

D(D(f)) ; (D@@2)(f) ; Gives the second derivative, $f''(x)$.

Integrals

restart ;
f := x–> x^2 ; Int(f(x) , x) ; Produces the integral, $\int x^2 dx$.

value(%) ; Evaluates the integral.

Int(f(x) , x = 1..3) ; value(%) ;
Gives the definite integral.

int(f(x)*sqrt(x) , x = 2..4) ;
Finds the value in one step.

Sequences

seq(i , i = 1..10) ;
Gives the long list of numbers.

g := x–> 1 / (x^2 + 1); Create the function $g(x) = \frac{1}{x^2+1}$.

seq(g(1/2 * i) , i = 1..10) ; evalf(%) ;
Gives lists of outputs.

seq(print(evalf([.5 * i , g(.5 * i)])) , i = 1..10) ;

Vectors and Matrices

restart ;
with(linalg) : Enter into linear algebra mode.

a := vector([1,2,5]) ; b := vector([1,1,1]) ;
Assign vectors **a** and **b**.

evalm(a) ; Shows **a** as a vector.

evalm(a+b) ; Adds the two vectors and displays the result.

evalm(2*a) ; Gives the scalar multiple.

norm(a,2) ; Gives the length of the vector.

dotprod(a,b) ; crossprod(a,b) ;
Gives $\mathbf{a} \cdot \mathbf{b}$ and $\mathbf{a} \times \mathbf{b}$.

Matrices

restart ;
with(linalg) : The colon suppresses output.

M := matrix([[1,2,4] , [2,0,−2] , [3,−1,1]]) ;

M ; Does nothing.

evalm(M) ; Shows the matrix.

N := matrix(3 , 3 , [0 , 3 , 4 , 2 , 7 , 4 , 1 , −3 , 2]) ;

evalm(M+N) ; evalm(M&*N) ;
Gives matrix addition and multiplication.

evalm(2*M) ; Returns scalar multiplication.

det(M) ;

A := array(identity , 1..3 , 1..3) ;
Defines **A** as the 3×3 identity matrix.

Done in TEX.