MATLAB Basics

BASIC COMMANDS & TOOLS

`a=5;`	Declare a variable:	`A=[1 2; 4 5];`	Declare a matrix
`help fn` `doc fn`	Show help for *fn*	`format short` `format long`	Toggle output detail
`clc`	Clear command window	`whos`	List defined variables
`clf`	Clear figure window	`;`	Suppress output

COMPARISON OPERATORS

`==`	equal to
`~=`	not equal to
`>`	greater than
`<`	less than
`>=`	greater than or equal to
`<=`	less than or equal to

LOGICAL OPERATORS

`&&`	and
`||`	or
`~`	unary not
`xor`	exclusive or (either)

MATHEMATICAL OPERATORS

ELEMENTWISE OPERATORS

`+`	addition
`-`	subtraction
`.*`	multiplication
`./`	right division
`.\`	left division
`+`	unary plus (positive)
`-`	unary minus (negative)
`:`	range
`.^`	exponentiation
`.'`	transpose

LINEAR-ALGEBRAIC OPERATORS

`*`	multiplication
`/`	right division `B/A=B*inv(A)`
`\`	left division `A\B=inv(A)*B`
`^`	exponentiation
`'`	complex conjugate transpose

ARRAY FUNCTIONS

CREATION

`eye(n)`	*n*×*n* identity matrix
`eye(m,n)`	*m*×*n* identity matrix
`ones(…)`	Matrix of 1s
`rand(…)`	Random matrix [0,1)
`zeros(…)`	Matrix of 0s
`linspace(a,b,n)`	Return linearly-spaced vector of *n* points between values *a* and *b*
`meshgrid(xv,yv)`	Return 2 grids based on *xv*, *yv*
`a:b`	Span range from *a* to *b*
`a:d:b`	Span from *a* to *b* in steps of *d*

MANIPULATION

`cat(dim,A,B)`	Concatenate arrays *A* and *B* along dimension *dim*.
`horzcat(A,B)`	Concatenate arrays horizontally
`vertcat(A,B)`	Concatenate arrays vertically
`reshape(A,x,y)`	Arrange *A* into new shape *x*×*y*

MATHEMATICAL

`inv(A)`	Invert matrix *A*
`linsolve(A,b)`	Return solution of *A***x*=*b*
`eig(A)`	Return eigenvalues of *A*

TRIGONOMETRIC & SPECIAL FUNCTIONS

`sin(x)`	Sine	`sinh(x)`	Hyp. sine	`sqrt(x)`	Square root
`cos(x)`	Cosine	`cosh(x)`	Hyp. cosine	`nthroot(x)`	Real *n*th root of *x*
`tan(x)`	Tangent	`tanh(x)`	Hyp. tangent	`besselj(nu,x)`	Bessel function of the first kind of order *nu*
`exp(x)`	Exponential	`log(x)`	Natural logarithm (ln)	`erf(x)`	Error function
`expm1(x)`	`exp(x)-1` (accurate for small x)	`log10(x)`	Logarithm base 10	`erfc(x)`	Complementary error function
`abs(x)`	Absolute value	`log1p(x)`	`log(1+x)` (accurate for small x)	`gamma(x)`	Γ function
(append "d" after any trigonometric name to yield result in degrees)				`i`	Imaginary unit

MATLAB Plotting

LOGICAL STRUCTURE

Plot features may be accessed directly via the handle tree or indirectly via various function calls.

BASIC PLOTTING

`plot(x,y)` `plot(x,y,…)`	Plot 2D data, *y* versus *x*. "`help plot`" for full details.	`poly(v)`	Return coefficients of polynomial with roots *v*
`fplot(@fn,rng)`	Plot 2D function *fn* over range *rng* = `[lo hi]`	`roots(v)`	Return roots of a polynomial with coefficients *v*
`plot3(x,y,z)`	Plot 3D data as line	`polyder(v)`	Return derivative coefs of poly *v*
`surf(Z)` `surf(x,y,Z)`	Plot 3D data as surface	`polyval(v,x)`	Evaluate polynomial with coefficients v at value x
`ezsurf('fn')`	Plot 3D function as surface	`polyint(v)`	Return integral coefs of poly *v*
`hold on` `hold off`	Toggle persistence of previous plots	`polyfit(x,y,n)`	Returns polynomial of *n*th degree which fits data in *x*,*y* best

AXES AND LINES

`factor(x)`	Return list of factors of *x*	`spline(x,y,xx)`	Return cubic-spline interpolation of *x*,*y* at *xx*
`isprime(x)`	Return primeness of x	`interp2(X,Y,V, Xq,Yq)`	Return 2D linear interpolation at *Xq*,*Yq* based on values *V* on grid *X*,*Y*
`primes(x)`	Return list of primes from zero up to and including *x*		

SUBPLOTS ETC.

`[T,Y] = ode45(odefun,tspan,y0,options)` `T` vector of time pts `Y` solution array

`odefun` handle to right side of DEs `tspan` interval `[t0, tf]` `y0` initial conditions

options
```
options = odeset('name1',value1,'name2',value2,...)
options = odeset('RelTol',1e-8,'InitialStep',1e-5)
```