

# Matlab Quick Reference

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## Built-In Matrices

Calling with one argument gives a square matrix, two arguments (rows, columns) specifies a particular size.

zeros(n,m)	all zeros (0)
ones(n,m)	all ones (1)
eye(n,m)	Identity Matrix, ones on the main diagonal
rand(n, m)	random numbers between 0 and 1
diag([n1 n2])	Puts parameters on main diagonal of a square matrix
magic(n)	Magic Square
pascal(n)	Pascal's triangle (made symmetric)

## Matrix Manipulation

Colon e.g. 1:3	[1 2 3]
Colon with a step 1:2:10	Steps by middle parameter, [1 3 5 7 9]
A(row, col)	Returns element at position
1:end	[1 2 3 ... n]
linear indexing A(n)	Counts down the columns
building up a matrix	Separate columns with spaces and rows with semicolons (;)
delete a row	A(1, :) = []
delete a column	A(:,1) = []
' (single quote)	transpose
reshape	Change dimensions

## Matrix Operations

Standard arithmetic \*+/- operates on matrices with the algebraic rules for multiplication and division.

## Array Operations

Adding a dot (eg .\* ./) operates on arrays element-wise.

## Logical Indexing

Logical operations return a matrix of the same size with ones and zeros for true or false.

A>n	Matrix same size as A with 1 if the condition is true else 0
A(A>n)	Elements of A where condition true
find	List of locations of the elements that are 1 (true)
find(A>10)	List of locations of the elements that meet the condition

## Linear Algebra / Row Operations

First define a coefficient matrices A and C.

Swap rows	A([[row1 row2],:]) = A([[row2 row1],:])
Manipulate two rows at the same time	A([[row1 row2], :]) = ...
Divide a row (by n)	A ./ n
det(A)	Determinant of matrix
rref([A C])	Reduced Row echelon form
A\C	Left division
inv(A)	Matrix inverse
eig(A)	Eigenvalues of matrix

## Statistical Functions

Each of these functions operates on each column of a matrix. If passed one row, they give a single result for the row.

sum	Totals of columns
mean	Mean (average) of each column
max	Maximum value
min	Minimum value
median	Median ("middle" number)
mode	Mode ("most common" value)
std	Standard Deviation
var	Variance

## Polynomials

Use a vector  $x^4 + 3x^3 + 2x^2 - x + 1$  would be  $p = [1 \ 3 \ 2 \ -1 \ 1]$ .

roots(p)	Finds roots of a polynomial
poly(r1, r2)	Generates a polynomial with roots r1 and r2
conv(p1, p2)	Multiplies polynomials p1 and p2
deconv(p1, p2)	Divides polynomials
polyval(p, x)	Evaluates a polynomial at a value

## Importing Data

Double-click on the file in the Matlab Current Directory window to start the Import Data Wizard.

## Plotting

plot	Basic plotting command
axis	Add axes to the plot
legend	Add a legend
title	Add a title
xlabel	Label X axis
ylabel	Label Y axis
grid	Add a grid
box	Put a box around the plot

## Plotting Interface (GUI)

After creating a plot, use these options:

View   Figure Palette	Add plots
View   Property Editor	Modify current plot
Insert   X-label	
Insert   Y-label	
Insert   Title	
File   Generate M File	Code to reproduce formatting

## 3D Plotting

plot3(x, y, z)	3D Line graph
surf(z)	Surface Plot
mesh(z)	Wireframe surface

## Differential Equations

ode45	First solver to try
deval	Evaluate a solution at a point
odeplot	Plot on ODE
odeexamples	Some sample code
detools	Interactive solver

## Optimization

optimtool	Graphical interface
bintprog	Binary integer programming
fgoalattain	Multiobjective goal attainment
fminbnd	Nonlinear minimization
fmincon	Constrained nonlinear minimization
fminimax	Minimax optimization
fminsearch	Unconstrained nonlinear
fminunc	Unconstrained nonlinear
fseminf	Semi-infinite
fsolve	Solve system of non-linear
fzero	Find a root of non-linear
linprog	Linear programming
lsqcurvefit	nonlinear, least squares
lsqlin	Constrained, linear, least squares
lsqnonlin	Nonlinear, least squares
lsqnonneg	Minimum, linear, least squares
quadprog	Quadratic Programming

## Programming

if ... elseif ... else ... end	
switch ... case ... end	
for ...end	
while ... end	
continue	
break	

## Function

function r = myfunc(a,b,c)

Statements

end

## Anonymous Function

f = @(x,y)x^2+y^2;