

## Starting and Stopping

<code>octave</code> [ <code>--gui</code> ]	start Octave CLI/GUI session
<code>octave file</code>	run Octave commands in <i>file</i>
<code>octave --eval code</code>	evaluate <i>code</i> using Octave
<code>octave --help</code>	describe command line options
<code>quit</code> or <code>exit</code>	exit Octave
<code>Ctrl-C</code>	terminate current command and return to top-level prompt

## Getting Help

<code>help command</code>	briefly describe <i>command</i>
<code>doc</code>	browse Octave manual
<code>doc command</code>	search for <i>command</i> in Octave manual
<code>lookfor str</code>	search for <i>command</i> based on <i>str</i>

## Command Completion and History

<code>TAB</code>	complete a command or variable name
<code>Alt-?</code>	list possible completions
<code>Ctrl-r Ctrl-s</code>	search command history

## Directory and Path Commands

<code>cd dir</code>	change working directory to <i>dir</i>
<code>pwd</code>	print working directory
<code>ls [options]</code>	print directory listing
<code>what</code>	list .m/.mat files in the current directory
<code>path</code>	search path for Octave functions
<code>pathdef</code>	default search path
<code>addpath (dir)</code>	add directory to search path
<code>getenv (var)</code>	value of environment variable

## Package Management

Add-on packages are independent of core Octave, listed at <https://packages.octave.org/>

<code>pkg install -forge pkg</code>	download and install <i>pkg</i>
<code>pkg install file.tar.gz</code>	install pre-downloaded package file
<code>pkg list</code>	show installed packages
<code>pkg load / pkg unload</code>	load/unload installed package
<code>statistics optimization</code>	various common packages
<code>control signal image</code>	
<code>symbolic</code>	

## Matrices

Square brackets delimit literal matrices. Commas separate elements on the same row. Semicolons separate rows. Commas may be replaced by spaces, and semicolons may be replaced by newlines. Elements of a matrix may be arbitrary expressions, assuming all the dimensions agree.

[ <i>x</i> , <i>y</i> , ... ]	enter a row vector
[ <i>x</i> ; <i>y</i> ; ... ]	enter a column vector
[ <i>w</i> , <i>x</i> ; <i>y</i> , <i>z</i> ]	enter a 2×2 matrix
<code>rows columns</code>	number of rows/columns of matrix
<code>zeros ones</code>	create matrix of zeros/ones
<code>eye diag</code>	create identity/diagonal matrix
<code>rand randi randn</code>	create matrix of random values
<code>sparse spalloc</code>	create a sparse matrix
<code>all</code>	true if all elements nonzero

<code>any</code>	true if at least one element nonzero
<code>nnz</code>	number of nonzero elements

## Multi-dimensional Arrays

<code>ndims</code>	number of dimensions
<code>reshape squeeze</code>	change array shape
<code>resize</code>	change array shape, lossy
<code>cat</code>	join arrays along a given dimension
<code>permute ipermute</code>	like N-dimensional transpose
<code>shiftdim</code>	
<code>circshift</code>	cyclically shift array elements
<code>meshgrid</code>	matrices useful for vectorization

## Ranges

Create sequences of real numbers as row vectors.

<i>base</i> : <i>limit</i>	
<i>base</i> : <i>incr</i> : <i>limit</i>	
<i>incr</i> == 1 if not specified. Negative ranges allowed.	

## Numeric Types and Values

Integers saturate in Octave. They do not roll over.

<code>int8 int16 int32 int64</code>	signed integers
<code>uint8 uint16 uint32 uint64</code>	unsigned integers
<code>single double</code>	32-bit/64-bit IEEE floating point
<code>intmin intmax flintmax</code>	integer limits of given type
<code>realmin realmax</code>	floating point limits of given type
<code>inf nan NA</code>	IEEE infinity, NaN, missing value
<code>eps</code>	machine precision
<code>pi e</code>	3.14159..., 2.71828...
<code>i j</code>	$\sqrt{-1}$

## Strings

A *string constant* consists of a sequence of characters enclosed in either double-quote or single-quote marks. Strings in double-quotes allow the use of the escape sequences below.

<code>\\</code>	a literal backslash
<code>\"</code>	a literal double-quote character
<code>'</code>	a literal single-quote character
<code>\n</code>	newline, ASCII code 10
<code>\t</code>	horizontal tab, ASCII code 9
<code>sprintf sscanf</code>	formatted IO to/from string
<code>strcmp</code>	compare strings
<code>strcat</code>	join strings
<code>strfind regexp</code>	find matching patterns
<code>strrep regexpr</code>	find and replace patterns

## Index Expressions

<code>var(idx)</code>	select elements of a vector
<code>var(idx1, idx2)</code>	select elements of a matrix
<code>var([1 3], :)</code>	rows 1 and 3
<code>var(:, [2 end])</code>	the second and last columns
<code>var(1:2:end, 2:2:end)</code>	get odd rows and even columns
<code>var1(var2 == 0)</code>	elements of <i>var1</i> corresponding to zero elements of <i>var2</i>
<code>var(:)</code>	all elements as a column vector

## Cells, Structures, and Classdefs

<code>var{idx} = ...</code>	set an element of a cell array
<code>cellfun (f, c)</code>	apply a function to elements of cell array
<code>var.field = ...</code>	set a field of a structure
<code>fieldnames (s)</code>	returns the fields of a structure
<code>structfun (f, s)</code>	apply a function to fields of structure
<code>classdef</code>	define new classes for OOP

## Assignment Expressions

<code>var = expr</code>	assign value to variable
<code>var(idx) = expr</code>	only the indexed elements are changed
<code>var(idx) = []</code>	delete the indexed elements

## Arithmetic Operators

If two operands are of different sizes, scalars and singleton dimensions are automatically expanded. Non-singleton dimensions need to match.

<code>x + y</code> , <code>x - y</code>	addition, subtraction
<code>x * y</code>	matrix multiplication
<code>x .* y</code>	element-by-element multiplication
<code>x / y</code>	right division, conceptually equivalent to <b>(inverse (y') * x')</b>
<code>x ./ y</code>	element-by-element right division
<code>x \ y</code>	left division, conceptually equivalent to <b>inverse (x) * y</b>
<code>x .\ y</code>	element-by-element left division
<code>x ^ y</code>	power operator
<code>x .^ y</code>	element-by-element power operator
<code>+= -= *= ./= /=</code>	in-place equivalents of the above operators
<code>./= \= .\= ^= .^=</code>	
<code>-x</code>	negation
<code>+x</code>	unary plus (a no-op)
<code>x'</code>	complex conjugate transpose
<code>x.'</code>	transpose
<code>++x --x</code>	increment/decrement, return <i>new</i> value
<code>x++ x--</code>	increment/decrement, return <i>old</i> value

## Comparison and Boolean Operators

These operators work on an element-by-element basis. Both arguments are always evaluated.

<code>&lt; &lt;= == &gt;= &gt;</code>	relational operators
<code>!= ~=</code>	not equal to
<code>&amp;</code>	logical AND
<code> </code>	logical OR
<code>! ~</code>	logical NOT

## Short-circuit Boolean Operators

Operators evaluate left-to-right. Operands are only evaluated if necessary, stopping once overall truth value can be determined. Non-scalar operands are converted to scalars with **all**.

<code>x &amp;&amp; y</code>	logical AND
<code>x    y</code>	logical OR

Operator Precedence

Table of Octave operators, in order of **decreasing** precedence.

() {} .	array index, cell index, structure index
' ' ^ . ^	transpose and exponentiation
+ - ++ -- !	unary minus, increment, logical “not”
* / \ .* ./ .\	multiplication and division
+ -	addition and subtraction
:	colon
< <= == > > !=	relational operators
&	element-wise “and” and “or”
&&	logical “and” and “or”
= += -= *= /= etc.	assignment, groups left to right
; ,	statement separators

General programming

endfor, endwhile, endif etc.	can all be replaced by end.
for x = 1:10	for loop
endfor	
while (x <= 10)	while loop
endwhile	
do	do-until loop
until (x > 10)	
if (x < 5)	if-then-else
elseif (x < 6)	
else	
endif	
switch (tf)	switch-case
case "true"	
case "false"	
otherwise	
endswitch	
break	exit innermost loop
continue	go to start of innermost loop
return	jump back from function to caller
try	cleanup only on exception
catch	
unwind_protect	cleanup always
unwind_protect_cleanup	

Functions

```
function [ret-list =] function-name [ (arg-list) ]
    function-body
endfunction
```

*ret-list* may be a single identifier or a comma-separated list of identifiers enclosed by square brackets.

*arg-list* is a comma-separated list of identifiers and may be empty.

Function Handles and Evaluation

@func	create a function handle to <i>func</i>
@(vars) expr	define an anonymous function
str2func func2str	convert function to/from string
functions ( <i>handle</i> )	Return information about a function handle

<i>f</i> ( <i>args</i> )	Evaluate a function handle <i>f</i>
feval	Evaluate a function handle or string
eval ( <i>str</i> )	evaluate <i>str</i> as a command
system ( <i>cmd</i> )	execute arbitrary shell command string

Anonymous function handles make a copy of the variables in the current workspace at the time of creation.

Global and Persistent Variables

global <i>var</i> = ...	declare & initialize global variable
persistent <i>var</i> = ...	persistent/static variable

Global variables may be accessed inside the body of a function without having to be passed in the function parameter list provided that they are declared global when used.

Common Functions

disp	display value of variable
printf	formatted output to <b>stdout</b>
input scanf	input from <b>stdin</b>
who whos	list current variables
clear <i>pattern</i>	clear variables matching pattern
exist	check existence of identifier
find	return indices of nonzero elements
sort	return a sorted array
unique	discard duplicate elements
sortrows	sort whole rows in numerical or lexicographic order
sum prod	sum or product
mod rem	remainder functions
min max range mean	basic statistics
median std	

Error Handling, Debugging, Profiling

error ( <i>message</i> )	print message and return to top level
warning ( <i>message</i> )	print a warning message
debug	guide to all debugging commands
profile	start/stop/clear/resume profiling
profshow	show the results of profiling
profexplore	

File I/O, Loading, Saving

save load	save/load variables to/from file
save -binary	save in binary format (faster, smaller)
dlmread dlmwrite	read/write delimited data
csvread csvwrite	read/write CSV files
xlsread xlswrite	read/write XLS spreadsheets
fopen fclose	open/close files
fprintf fscanf	formatted file I/O
textscan	
fflush	flush pending output

Math Functions

type doc <function> to find related functions.	
cov corrcoef	covariance, correlation coefficient
tan tanh atan2	trig and hyperbolic functions
cross curl del2	vector algebra functions
det inv	determinant, matrix inverse
eig	eigenvalues and eigenvectors
norm	vector or matrix norm

rank	matrix rank
qr	QR factorization
chol	Cholesky factorization
svd	singular value decomposition
fsolve	solve nonlinear algebraic equations
lsode ode45	integrate nonlinear ODEs
dassl	integrate nonlinear DAEs
integral	integrate nonlinear functions

union	set union
intersection	set intersection
setdiff	set difference

roots	polynomial roots
poly	matrix characteristic polynomial
polyder polyint	polynomial derivative/integral
polyfit polyval	polynomial fitting/evaluation
residue	partial fraction expansion
legendre bessell	special functions

conv conv2	convolution, polynomial multiplication
deconv	deconvolution, polynomial division

fft fft2 ifft	FFT / inverse FFT
freqz	FIR filter frequency response
filter	filter by transfer function

Plotting and Graphics

plot plot3	2D / 3D plot with linear axes
line	2D or 3D line
patch fill	2D patch, optionally colored
semilogx semilogy	logarithmic axes
loglog	
bar hist	bar chart, histogram
stairs stem	stairs and stem plots
contour	contour plot
mesh trimesh surf	plot 3D surfaces

figure	new figure
hold on	add to existing figure
title	set plot title
axis	set axis range and aspect
xlabel ylabel zlabel	set axis labels
text	add text to a plot
grid legend	draw grid or legend

image imagesc spy	display matrix as image
imwrite saveas print	save figure or image
imread	load an image
colormap	get or set colormap

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