

# MATLAB handbook

## Some useful functions

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### Introduction

For each command, try `help <command>` or `doc <command>` to get more information.

### 1 Workspace and operators

<code>edit</code>	- Open a file in the editor.
<code>save</code>	- Save the workspace.
<code>load</code>	- Load a saved workspace.
<code>whos</code>	- List the workspace variables.
<code>clear</code>	- Clear the variables.
<code>close</code>	- Close current figure window.
<code>pack</code>	- Free the unused memory.
<code>clc</code>	- Clear the command window.
<code>figure</code>	- Open a new figure.
<code>exit</code>	- Exit MATLAB.
<code>+</code> <code>-</code> <code>*</code> <code>/</code>	- Sum, subtraction, multiplication, division.
<code>'</code>	- Matrix complex conjugate transpose.
<code>.'</code>	- Matrix transpose.
<code>.*</code> <code>./</code>	- term by term multiplication (respectively division).
<code>a:b:c</code>	- interval from <code>a</code> to <code>c</code> with step <code>b</code> .

### 2 Vector and matrices

<code>size</code>	- Dimensions of a vector/matrix.
<code>length</code>	- Largest dimension of a vector/matrix.
<code>vec(1)</code>	- First element of vector <code>vec</code> .
<code>vec(end)</code>	- Last element of vector <code>vec</code> .
<code>ones(m,n)</code>	- <code>m</code> -by- <code>n</code> matrix filled with ones.
<code>zeros(m,n)</code>	- <code>m</code> -by- <code>n</code> matrix filled with zeros.
<code>rand(m,n)</code>	- <code>m</code> -by- <code>n</code> matrix with values uniformly distributed (i.e. following $\mathcal{U}([0; 1])$ ).
<code>randn(m,n)</code>	- <code>m</code> -by- <code>n</code> matrix with values distributed using normal distribution (i.e. following $\mathcal{N}(0, 1)$ ).

### 3 Matrices - operations

<code>size(A)</code>	- Size of <code>A</code> .
<code>numel(A)</code>	- Number of elements of <code>A</code> .
<code>det(A)</code>	- Determinant of <code>A</code> .
<code>inv(A)</code>	- Inverse of <code>A</code> .
<code>pinv(A)</code>	- Pseudo-inverse of <code>A</code> (equal to <code>inv(A)</code> if <code>A</code> is invertible).
<code>trace(A)</code>	- Trace of <code>A</code> (sum of diagonal elements).
<code>eig(A)</code>	- Eigen-values of <code>A</code> .
<code>expm(A)</code>	- Matrix exponential of <code>A</code> .
<code>reshape(A, [p q])</code>	- Reshape matrix <code>A</code> to <code>p</code> -by- <code>q</code> (Number of elements should match).
<code>A(:)</code>	- Single column version of <code>A</code> .

### 4 Plots

<code>plot(x,y)</code>	- Plot <code>y</code> vs. <code>x</code> .
<code>hold (on off)</code>	- Keep (discard) current graph.
<code>semilogx</code>	- Plot with logarithmic x-axis.
<code>loglog</code>	- Plot with logarithmic axes.
<code>imagesc</code>	- Scale and display an image.
<code>imshow</code>	- Display an image.
<code>plot3</code>	- Three-dimensional plot.
<code>surf</code>	- Surface plot.

### 5 Control system

<code>tf</code>	- Define a transfer function.
<code>series</code>	- Cascade systems.
<code>feedback</code>	- Create feedback system.
<code>pzmap</code>	- Pole-zero map.
<code>rlocus</code>	- Root locus diagram.
<code>bode</code>	- Bode diagram.
<code>impz</code>	- Impulse response.
<code>step</code>	- Step response.
<code>freqresp</code>	- Evaluate frequency response.
see <code>doc control</code> for more.	

### 6 Image operations

<code>imread</code>	- Open an image file.
<code>imwrite</code>	- Write an image file.
<code>graythres</code>	- Find a gray level for thresholding.
<code>im2bw</code>	- Convert an grayscale image to binary.
<code>bwareaopen</code>	- Remove small objects in binary image.
<code>imdilate</code>	- Apply image dilation.
<code>imerode</code>	- Apply image erosion.
<code>strel</code>	- Define a structuring element for morphology operations.
<code>edge</code>	- Edge detection.
<code>conv2</code>	- 2D convolution.
<code>filt2</code>	- 2D filtering.
<code>medfilt2</code>	- Median filter.

### Other useful tools

<code>guide</code>	- Graphic user interfaces.
<code>simulink</code>	- Simulation of model-based systems.
<code>profi</code>	- Performance analysis tool.

### Other resources

Useful information can be found at <http://www.ece.iit.edu/~gaw> (Professor Williamson's website). Also <http://www.mathworks.com> contains information about functions, support and user community.