**Overview of the MATLAB Environment**

MATLAB is a high-level technical computing language and interactive environment for algorithm development, data visualization, data analysis, and numeric computation. Using the MATLAB product, you can solve technical computing problems faster than with traditional programming languages, such as C, C++, and Fortran.

You can use MATLAB in a wide range of applications, including signal and image processing, communications, control design, test and measurement, financial modeling and analysis, and computational biology. Add-on toolboxes (collections of special-purpose MATLAB functions, available separately) extend the MATLAB environment to solve particular classes of problems in these application areas.

MATLAB provides a number of features for documenting and sharing your work. You can integrate your MATLAB code with other languages and applications, and distribute your MATLAB algorithms and applications. Features include:

* High-level language for technical computing
* Development environment for managing code, files, and data
* Interactive tools for iterative exploration, design, and problem solving
* Mathematical functions for linear algebra, statistics, Fourier analysis, filtering, optimization, and numerical integration
* 2-D and 3-D graphics functions for visualizing data
* Tools for building custom graphical user interfaces
* Functions for integrating MATLAB based algorithms with external applications and languages, such as C, C++, Fortran, Java™, COM, and Microsoft® Excel®

### The MATLAB System

The MATLAB system consists of these main parts:

#### Desktop Tools and Development Environment

This part of MATLAB is the set of tools and facilities that help you use and become more productive with MATLAB functions and files. Many of these tools are graphical user interfaces. It includes: the MATLAB desktop and Command Window, an editor and debugger, a code analyzer, and browsers for viewing help, the workspace, and folders.

#### Mathematical Function Library

This library is a vast collection of computational algorithms ranging from elementary functions, like sum, sine, cosine, and complex arithmetic, to more sophisticated functions like matrix inverse, matrix eigenvalues, Bessel functions, and fast Fourier transforms.

#### The Language

The MATLAB language is a high-level matrix/array language with control flow statements, functions, data structures, input/output, and object-oriented programming features. It allows both "programming in the small" to rapidly create quick programs you do not intend to reuse. You can also do "programming in the large" to create complex application programs intended for reuse.

#### Graphics

MATLAB has extensive facilities for displaying vectors and matrices as graphs, as well as annotating and printing these graphs. It includes high-level functions for two-dimensional and three-dimensional data visualization, image processing, animation, and presentation graphics. It also includes low-level functions that allow you to fully customize the appearance of graphics as well as to build complete graphical user interfaces on your MATLAB applications.

#### External Interfaces

The external interfaces library allows you to write C/C++ and Fortran programs that interact with MATLAB. It includes facilities for calling routines from MATLAB (dynamic linking), for calling MATLAB as a computational engine, and for reading and writing MAT-files.

**Transposing a Matrix.**Transpose A so that the row elements become columns. You can use either the transpose function or the transpose operator (.') to do this:

B = A.'

B =

1 2 3

4 5 6

7 8 9

10 11 12

There is a separate function called [ctranspose](http://www.mathworks.com/access/helpdesk/help/techdoc/ref/arithmeticoperators.html) that performs a complex conjugate transpose of a matrix. The equivalent operator for ctranpose on a matrix A is A':

A = [1+9i 2-8i 3+7i; 4-6i 5+5i 6-4i]

A =

1.0000 + 9.0000i 2.0000 -8.0000i 3.0000 + 7.0000i

4.0000 -6.0000i 5.0000 + 5.0000i 6.0000 -4.0000i

B = A'

B =

1.0000 -9.0000i 4.0000 + 6.0000i

2.0000 + 8.0000i 5.0000 -5.0000i

3.0000 -7.0000i 6.0000 + 4.0000i

## Documentation

The MATLAB program provides extensive documentation, in both printable and HTML format, to help you learn about and use all of its features. If you are a new user, begin with this Getting Started guide. It covers all the primary MATLAB features at a high level, including many examples.

To view the online documentation, select **Help** > **Product Help** in MATLAB. Online help appears in the Help browser, providing task-oriented and reference information about MATLAB features. For more information about using the Help browser, see [Getting Help](http://www.mathworks.com/access/helpdesk/help/techdoc/learn_matlab/f1-23058.html).

The MATLAB documentation is organized into these main topics:

* [Desktop Tools and Development Environment](http://www.mathworks.com/access/helpdesk/help/techdoc/matlab_env/bqrf3v_.html) — Startup and shutdown, arranging the desktop, and using tools to become more productive with MATLAB
* [Data Import and Export](http://www.mathworks.com/access/helpdesk/help/techdoc/import_export/ug_intropage.html) — Retrieving and storing data, memory-mapping, and accessing Internet files
* [Mathematics](http://www.mathworks.com/access/helpdesk/help/techdoc/math/bqqz59g.html) — Mathematical operations
* [Data Analysis](http://www.mathworks.com/access/helpdesk/help/techdoc/data_analysis/ug_intropage.html) — Data analysis, including data fitting, Fourier analysis, and time-series tools
* [Programming Fundamentals](http://www.mathworks.com/access/helpdesk/help/techdoc/matlab_prog/bqjgwp9.html) — The MATLAB language and how to develop MATLAB applications
* [Object-Oriented Programming](http://www.mathworks.com/access/helpdesk/help/techdoc/matlab_oop/ug_intropage.html) — Designing and implementing MATLAB classes
* [Graphics](http://www.mathworks.com/access/helpdesk/help/techdoc/creating_plots/bqrw9tj.html) — Tools and techniques for plotting, graph annotation, printing, and programming with Handle Graphics® objects
* [3-D Visualization](http://www.mathworks.com/access/helpdesk/help/techdoc/visualize/bqliccy.html) — Visualizing surface and volume data, transparency, and viewing and lighting techniques
* [Creating Graphical User Interfaces](http://www.mathworks.com/access/helpdesk/help/techdoc/creating_guis/bqz79mu.html) — GUI-building tools and how to write callback functions
* [External Interfaces](http://www.mathworks.com/access/helpdesk/help/techdoc/matlab_external/bp_kqh7.html) — MEX-files, the MATLAB engine, and interfacing to Sun Microsystems™ Java software, Microsoft® .NET Framework, COM, Web services, and the serial port

There is reference documentation for all MATLAB functions:

* [Function Reference](http://www.mathworks.com/access/helpdesk/help/techdoc/ref/f16-6011.html) — Lists all MATLAB functions, listed in categories or alphabetically
* [Handle Graphics Property Browser](http://www.mathworks.com/access/helpdesk/help/techdoc/infotool/hgprop/doc_frame.html) — Provides easy access to descriptions of graphics object properties
* [C/C++ and Fortran API Reference](http://www.mathworks.com/access/helpdesk/help/techdoc/apiref/bqoqnz0.html) — Covers functions used by the MATLAB external interfaces, providing information on syntax in the calling language, description, arguments, return values, and examples

The MATLAB online documentation also includes:

* [Examples](http://www.mathworks.com/access/helpdesk/help/techdoc/demo_example.html) — An index of examples included in the documentation
* [Release Notes](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/rn_intro.html) — New features, compatibility considerations, and bug reports for current and recent previous releases
* [Printable Documentation](http://www.mathworks.com/access/helpdesk/help/techdoc/matlab_product_page2.html) — PDF versions of the documentation, suitable for printing

In addition to the documentation, you can access demos for each product from the Help browser. Run demos to learn about key functionality of MathWorks™ products and tools.

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**Starting a MATLAB Session**

On Microsoft Windows® platforms, start the MATLAB program by double-clicking the MATLAB shortcut http://www.mathworks.com/access/helpdesk/help/techdoc/learn_matlab/membrane_shortcut.pngon your Windows desktop.

On Apple® Macintosh® platforms, start MATLAB by double-clicking the MATLAB icon in the Applications folder.

On UNIX® platforms, start MATLAB by typing matlab at the operating system prompt.

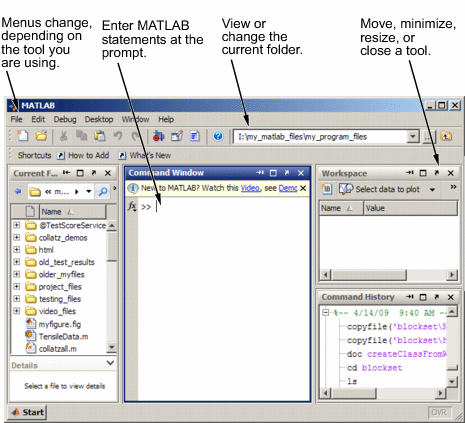
When you start MATLAB, by default, MATLAB automatically loads all the program files provided by The MathWorks for MATLAB and other MathWorks products. You do not have to start each product you want to use.

There are alternative ways to start MATLAB, and you can customize MATLAB startup. For example, you can change the folder in which MATLAB starts or automatically execute MATLAB statements upon startup.

#### The Desktop

When you start MATLAB, the desktop appears, containing tools (graphical user interfaces) for managing files, variables, and applications associated with MATLAB.

The following illustration shows the default desktop. You can customize the arrangement of tools and documents to suit your needs. For more information about the desktop tools, see [Desktop Tools and Development Environment](http://www.mathworks.com/access/helpdesk/help/techdoc/learn_matlab/f1-19180.html).

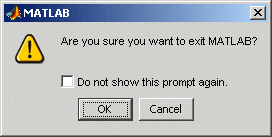


### Quitting the MATLAB Program

To end your MATLAB session, select **File** > **Exit MATLAB** in the desktop, or type quit in the Command Window. You can run a script file named finish.m each time MATLAB quits that, for example, executes functions to save the workspace.

#### Confirm Quitting

MATLAB can display a confirmation dialog box before quitting. To set this option, select **File** > **Preferences** > **General** > **Confirmation Dialogs**, and select the check box for **Confirm before exiting MATLAB**.



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| --- | --- |
| Function Reference | [[Click for Alphabetical List](http://www.mathworks.com/access/helpdesk/help/techdoc/ref/funcalpha.html) Alphabetical List](http://www.mathworks.com/access/helpdesk/help/techdoc/ref/funcalpha.html) |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  | | --- | --- | | [Desktop Tools and Development Environment](http://www.mathworks.com/access/helpdesk/help/techdoc/ref/f16-11063.html) | Startup, Command Window, help, editing and debugging, tuning, other general functions | | [Data Import and Export](http://www.mathworks.com/access/helpdesk/help/techdoc/ref/f16-5702.html) | General and low-level file I/O, plus specific file formats, like audio, spreadsheet, HDF, images | | [Mathematics](http://www.mathworks.com/access/helpdesk/help/techdoc/ref/f16-5872.html) | Arrays and matrices, linear algebra, other areas of mathematics | | [Data Analysis](http://www.mathworks.com/access/helpdesk/help/techdoc/ref/f16-48518.html) | Basic data operations, descriptive statistics, covariance and correlation, filtering and convolution, numerical derivatives and integrals, Fourier transforms, time series analysis | | [Programming and Data Types](http://www.mathworks.com/access/helpdesk/help/techdoc/ref/f16-42340.html) | Function/expression evaluation, program control, function handles, object oriented programming, error handling, operators, data types, dates and times, timers | | [Object-Oriented Programming](http://www.mathworks.com/access/helpdesk/help/techdoc/ref/brk7uzk.html) | Functions for working with classes and objects | | [Graphics](http://www.mathworks.com/access/helpdesk/help/techdoc/ref/f16-8602.html) | Line plots, annotating graphs, specialized plots, images, printing, Handle Graphics | | [3-D Visualization](http://www.mathworks.com/access/helpdesk/help/techdoc/ref/f16-8867.html) | Surface and mesh plots, view control, lighting and transparency, volume visualization | | [GUI Development](http://www.mathworks.com/access/helpdesk/help/techdoc/ref/f16-40727.html) | GUIDE, programming graphical user interfaces | | [External Interfaces](http://www.mathworks.com/access/helpdesk/help/techdoc/ref/f16-35614.html) | Interfaces to shared libraries, Java, .NET, COM and ActiveX, Web services, and serial port devices, and C and Fortran routines | |

## Summary by Version

This table provides quick access to what's new in each version. For clarification, see [Using Release Notes](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/rn_intro.html#brimf0h).

| **Version (Release)** | **New Features and Changes** | **Version Compatibility Considerations** | **Fixed Bugs and Known Problems** | **Related Documentation at Web Site** |
| --- | --- | --- | --- | --- |
| **Latest Version  V7.10 (R2010a)** | Yes  [Details](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/br_03sl.html) | Yes  [Summary](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/bqsrae0.html) | [Bug Reports](http://www.mathworks.com/support/bugreports/?product=ML&release=R2010a) Includes fixes | Printable Release Notes: [PDF](http://www.mathworks.com/access/helpdesk/help/pdf_doc/matlab/rn.pdf)  [Current product documentation](http://www.mathworks.com/access/helpdesk/help/techdoc/matlab.html) |
| V7.9 (R2009b) | Yes  [Details](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/br5fn4q.html) | Yes  [Summary](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/br2w416-1.html) | [Bug Reports](http://www.mathworks.com/support/bugreports/?product=ML&release=R2009b) Includes fixes | No |
| V7.8 (R2009a) | Yes  [Details](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/bro2uzv.html) | Yes  [Summary](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/brwf6pf-1.html) | [Bug Reports](http://www.mathworks.com/support/bugreports/?product=ML&release=R2009a) Includes fixes | No |
| V7.7 (R2008b) | Yes  [Details](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/brwf8ef-1.html) | Yes  [Summary](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/bro1tjq-1.html) | [Bug Reports](http://www.mathworks.com/support/bugreports/?product=ML&release=R2008b) Includes fixes | No |
| V7.6 (R2008a) | Yes  [Details](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/brga_tq.html) | Yes  [Summary](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/brga80l-1.html) | [Bug Reports](http://www.mathworks.com/support/bugreports/?product=ML&release=R2008a) Includes fixes | No |
| V7.5 (R2007b) | Yes  [Details](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/bq89ocy.html) | Yes  [Summary](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/bq89oxt-1.html) | [Bug Reports](http://www.mathworks.com/support/bugreports/?product=ML&release=R2007b) Includes fixes | No |
| V7.4 (R2007a) | Yes  [Details](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/bq1zizq.html) | Yes  [Summary](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/bq1zbsn.html) | [Bug Reports](http://www.mathworks.com/support/bugreports/?product=ML&release=R2007a) Includes fixes | No |
| V7.3 (R2006b) | Yes  [Details](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/bqutl42.html) | Yes  [Summary](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/bqt10_v-1.html) | [Bug Reports](http://www.mathworks.com/support/bugreports/?product=ML&release=R2006b) Includes fixes | No |
| V7.2 (R2006a) | Yes  [Details](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/bqsqsom.html) | Yes  [Summary](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/f0-68730.html) | [Bug Reports](http://www.mathworks.com/support/bugreports/?product=ML&release=R2006a) Includes fixes | No |
| V7.1 (R14SP3) | Yes  [Details](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/bqsqsu3.html) | Yes  [Summary](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/bqsqsu3.html) | [Bug Reports](http://www.mathworks.com/support/bugreports/?product=ML&release=R14SP3) Includes fixes | No |
| V7.0.4 (R14SP2) | Yes  [Details](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/bqsq452.html) | Yes  [Summary](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/bqsq452.html) | [Bug Reports](http://www.mathworks.com/support/bugreports/?product=ML&release=R14SP2) Includes fixes | No |
| V7.0.1 (R14SP1) | Yes  [Details](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/bqsq46c.html) | Yes  [Summary](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/bqsq46c.html) | [Fixed bugs](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/bugfixes_matlab_7-0-1.html) | No |
| V7 (R14) | Yes  [Details](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/bqsq45p.html) | Yes  [Summary](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/bqsq45p.html) | [Fixed bugs](http://www.mathworks.com/access/helpdesk/help/techdoc/rn/bugfixes_matlab_7-0.html) | No |

**Using Release Notes**

Use release notes when upgrading to a newer version to learn about:

* New features
* Changes
* Potential impact on your existing files and practices

Review the release notes for other MathWorks™ products required for this product (for example, MATLAB® or Simulink®). Determine if enhancements, bugs, or compatibility considerations in other products impact you.

If you are upgrading from a software version other than the most recent one, review the current release notes and all interim versions. For example, when you upgrade from V1.0 to V1.2, review the release notes for V1.1 and V1.2.