

MATLAB[®]

The Language of Technical Computing

Computation

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MATLAB Notebook User's Guide
Version 5.2

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MATLAB Notebook User's Guide

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Printing History: December 1996 First printing First printing for MATLAB 5
January 1998 Revised for 5.2 (online version)

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Preface

The *MATLAB Notebook User's Guide* assumes you have some experience with both MATLAB and Microsoft Word. The manual does not attempt to teach you word processing or how to use MATLAB.

This manual includes task-oriented as well as reference information about the MATLAB Notebook. The manual consists of these chapters and an appendix:

- Chapter 1 introduces the MATLAB Notebook.
- Chapter 2 describes how to use the MATLAB Notebook, discussing simple procedures and more complex ones.
- Chapter 3 describes each menu item on the **Notebook** menu, which contains all the MATLAB Notebook commands.
- Appendix A is a glossary of MATLAB Notebook terms.

This manual describes how to use the Notebook on both Microsoft Windows and Macintosh platforms. The interface for both platforms is virtually identical; the screen shots shown in this manual, except where noted, are from the Microsoft Windows platform.

Typographic Conventions

To Indicate...	This Guide Uses...	Example
Characters to type at the MATLAB prompt and example code	Monospace type.	To access the Notebook, enter Notebook
New terms	<i>Italics.</i>	A Notebook document is called an <i>M-book</i> .
Keys	Boldface with an initial capital letter.	Press the Return key.
GUI controls	Boldface with an initial capital letter (if applicable).	Select the Evaluate Cell command.

Keyboard Conventions

This manual uses special notation for the key combinations you use for keyboard shortcuts and mouse actions:

Ctrl-Enter	Hold down the Control (or Ctrl) key, then press the Enter key.
Click	Click the mouse button.
Double-click	Click the mouse button twice rapidly without moving the mouse.

In this manual, all actions with a mouse button imply using the left mouse button.

How To Learn To Use the Notebook

The MATLAB Notebook software and documentation provide a variety of ways to learn how to use the product:

- Chapter 2 of this manual describes how to perform typical tasks using the Notebook. The sections in the beginning of that chapter will help you get started using the Notebook.
- The README.DOC file is actually a Notebook document. It includes some simple examples that illustrate how to use the Notebook. To access this file, start Word, then open `\matlab\notebook\readme.doc`.
- Sample Notebook documents stored in `\matlab\notebook` show examples in different technical areas. Look for documents that have a doc extension.

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Getting Started

The MATLAB Notebook allows you to access MATLAB's numeric computation and visualization software from within a word processing environment (Microsoft Word).

Using the Notebook, you can create a document that contains text, MATLAB commands, and the output from MATLAB commands. You can think of this document as a record of an interactive MATLAB session annotated with text or as a document embedded with live MATLAB commands and output.

The Notebook is useful for creating electronic or printed:

- Documents
- Records of MATLAB sessions
- Class notes
- Textbooks and handbooks
- Technical reports

System Requirements

Microsoft Windows

Before you begin installing the Notebook the following software must be installed on your PC:

- Microsoft Word 95 (Word 7.0) or Word 97
- MATLAB 5

Macintosh

Before you begin installing the Notebook, the following software must be installed on your Macintosh:

- Microsoft Word 6.0
- System 7.0 and AppleScript 1.1
or System 7.5, which includes AppleScript
- MATLAB 5

Installing The Notebook

The Notebook is installed as part of the installation process (see the *MATLAB Installation Guide for Microsoft Windows and Macintosh* for details). Starting the Notebook is discussed in Chapter 2.

Learning to Use the Notebook

The Notebook software and documentation provide a variety of ways to learn how to use the product:

- Chapter 2 explains how to create a Notebook document or M-book and describes how to perform common Notebook tasks. Chapter 3 provides reference material about each Notebook command available through the Notebook menu.
- The Notebook Readme file is an actual Notebook document that includes a tutorial describing how to use the Notebook. Double-click on the Notebook Readme file to begin using the Notebook.
- On Microsoft Windows platforms, review sample Notebook documents stored in the Notebook folder.

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Notebook Documents

A Notebook document is called an *M-book*. An M-book contains text, MATLAB commands, and the output from MATLAB commands. You can think of an M-book as a record of an interactive MATLAB session annotated with text, or as a document embedded with live MATLAB commands and their output.

About the M-Book Template

When you create or edit an M-book, Word applies the M-book template. The M-book template allows you to access MATLAB from a Word document and governs the format of M-books. When you create or open an M-book, the template:

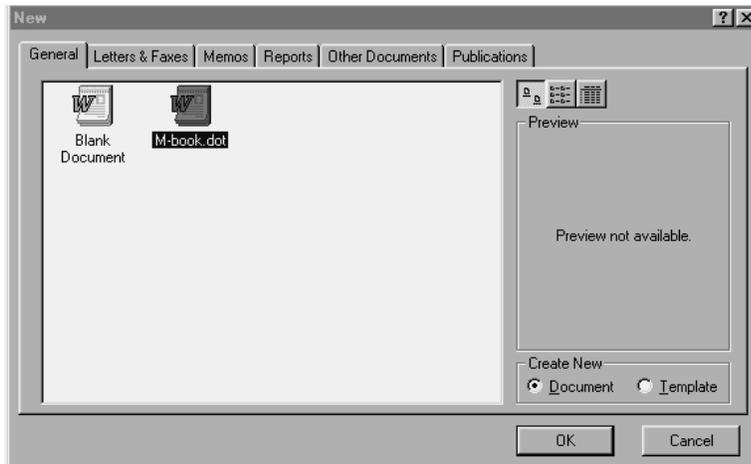
- Starts MATLAB if it is not already running and uses DDE (for Microsoft Windows) or Apple events (for Macintosh) to communicate between Word and MATLAB.
- Defines macros that enable MATLAB to interpret the different types of *cells* which hold MATLAB commands and their output.
- Creates the **Notebook** menu described in Chapter 3.
- Defines the styles used for text and cells.

Starting the Notebook

To begin using the Notebook, you must first start Word. What you do next depends on whether you want to create a new M-book or edit an existing M-book.

Creating an M-Book

To create a new M-book, select **New** from the Word **File** menu. From the **New** dialog box, select the M-book template M-book.dot, then click on the **OK** button. The figure below shows the **New** dialog box (for Microsoft Windows platforms) with the M-book template selected.



The **New** dialog box for Macintosh platforms is slightly different than that for Microsoft Windows platforms; the Macintosh version is shown below.



Word creates a new document using the M-book template and starts MATLAB if it is not already running. The Notebook then adds the **Notebook** menu to the menu bar at the top of your screen.

Editing an M-Book

To edit an existing M-book, do one of the following:

- Start Word and open the M-book document using the **Open** command from the **File** menu.
- Start Word and select the M-book from the list of documents at the bottom of the **File** menu.
- Double-click the M-book on your desktop.

Word opens the document using the M-book template and starts MATLAB if it is not already running. The Notebook then adds the **Notebook** menu to the menu bar at the top of your screen.

Alternate Start-Up Method (Microsoft Windows)

On Microsoft Windows platforms, you can also start the Notebook directly from the MATLAB command line, by typing

```
not ebook
```

to create a new M-book, or

```
not ebook <M- book>
```

to edit an existing M-book. Microsoft Word is started automatically.

Converting a Word Document to an M-Book

To convert a Word document to an M-book, follow these steps:

- 1 Create a new M-book.
- 2 From the **Insert** menu, select the **File** command.
- 3 Select the file you want to convert.
- 4 Click on the **OK** button.

Entering the M-Book Contents

This section describes how to enter text and evaluate MATLAB commands in an M-book.

Entering Text

Enter text and MATLAB commands in an M-book the same way you enter text in any other Word document. You can control the appearance of text by defining new styles. The default style for text is the Normal style. You can use Word to create and format the text in your M-book.

You can add new styles to the M-book template and modify predefined styles. For more information, see the Word documentation and the “Modifying Styles in the M-Book Template” on page 2-19.

Defining MATLAB Commands

The Notebook uses *input cells* to define MATLAB commands. Input cells can consist of a single-line command, a multiple-line command, or a command embedded within text. Use the steps described below to create an input cell:

- 1 Type the command as text. Do not press the **Enter** or **Return** key – keep the cursor at the end of the text.
- 2 Select the **Define Input Cell** command from the Notebook menu or press **Alt-D** (for Windows) or **⌘5 -^D** (for Macintosh).

The Notebook defines the MATLAB command as an input cell, enclosing the command within cell markers and formatting it according to the input style. All input cells are enclosed in *cell markers*, which are bold, gray brackets. They differ from the brackets used to enclose matrices by their size and weight. The Notebook uses bold dark green characters to denote input cells.

Defining and Evaluating MATLAB Commands

You can also define a MATLAB command as an input cell and send the command to MATLAB for evaluation with a single action. Use the following steps to define and evaluate a MATLAB command:

- 1 Type the command as text and leave the cursor at the end of the text. Do *not* press the **Enter** or **Return** key.
- 2 Select the **Evaluate Cell** command from the **Notebook** menu or press **Ctrl-Enter** (for Windows) or **^Return** (for Macintosh).

The Notebook uses *output cells* to store the output from MATLAB commands. The Notebook displays output cells, enclosed within cell markers, immediately after the input cell. The Notebook uses blue characters for numeric or text output. The Notebook uses red characters for error messages.

The following example shows the sequence of steps to define and evaluate a MATLAB command.

1. Type the MATLAB command:

```
a = magic(2)
```

2. Select the **Evaluate Cell** command from the **Notebook** menu, or press **Ctrl-Enter** (for Window) or **^Return** (for Macintosh). The Notebook displays the command as an input cell and the results as an output cell:

```
[ a = magic(2) ]
```

```
[ a =  
    1    3  
    4    2 ]
```

Entering Multiline MATLAB Commands

If you enter a MATLAB command that continues onto more than one paragraph, you must highlight the entire command to evaluate it or define it as an input cell. Otherwise, if after you have entered the entire command, you select the **Evaluate Cell** command, or press **Ctrl-Enter** (for Windows) or **^Return** (for Macintosh), MATLAB evaluates only the last paragraph.

Entering Commands to Initialize the Workspace

You can use *autoinit cells* to specify MATLAB commands to be automatically evaluated each time an M-book is opened. This is a quick and easy way to initialize the workspace. *Autoinit cells* are simply input cells with the following additional characteristics:

- The Notebook evaluates the autoinit cells when it opens the M-book.
- The Notebook displays the commands in autoinit cells using dark blue characters.

Autoinit cells are otherwise identical to input cells.

Creating an Autoinit Cell

You can create an autoinit cell in two ways.

- Enter the MATLAB command as text, then convert the command to an autoinit cell by selecting the **Define AutoInit Cell** command.
- If you already entered the MATLAB command as an input cell, you can convert the input cell to an autoinit cell. Either highlight the input cell or position the cursor in the cell, then select the **Define AutoInit Cell** command.

Evaluating an Autoinit Cell

To evaluate an autoinit cell:

- 1 Position the cursor in the autoinit cell.
- 2 Select the **Evaluate Cell** command or press **Ctrl-Enter** (for Windows) or **^+Return** (for Macintosh).

Grouping MATLAB Commands

The Notebook allows you to enter a sequence of MATLAB commands and evaluate them as a group. A *cell group* is a multiline input cell or autoinit cell that contains more than one MATLAB command.

A cell group cannot contain text or output cells. All the output from a cell group appears in a single output cell that the Notebook places immediately after the group.

When you create a cell group, the Notebook defines it as an input cell unless its first line is an autoinit cell, in which case the Notebook defines the group as an autoinit cell.

If a cell group includes a command that produces text or numeric output and a command that produces graphic output, the text or numeric output always comes first. The Notebook orders the output this way regardless of the order of the commands in the group.

Cell groups are useful when several MATLAB commands are needed to fully define a graphic. For example, if you define all the MATLAB commands that produce a graphic as a cell group and then evaluate the cell, the Notebook generates a single graphic that includes all the graphic components defined in the commands. If instead you define all the MATLAB commands that generate the graphic as separate input cells, evaluating the cells generates multiple graphic output cells.

Creating a Cell Group

To create a cell group:

- 1 Highlight the input cells that are to make up the group.
 - a If the selection includes output cells, the Notebook deletes them.
 - b If the selection includes text, the Notebook places the text after the cell group. However, if the text precedes the first input cell in the selection, the Notebook leaves it where it is.
 - c If you highlight part or all of an output cell but not its input cell, the Notebook includes the input cell in the cell group.
- 2 Select the **Group Cells** command or press **Alt-G** (for Windows) or **⌘ -^G** (for Macintosh).

The Notebook converts the highlighted cells into a cell group and replaces cell markers with a single pair that surrounds the group.

Evaluating a Cell Group

You evaluate a cell group the same way you evaluate an input cell (because a cell group is an input cell):

- 1 Position the cursor anywhere in the cell or in its output cell.
- 2 Either select the **Evaluate Cell** command or press **Ctrl-Enter** (for Windows) or **^+Return** (for Macintosh).

When MATLAB evaluates a cell group, the output for all commands in the group appears in a single output cell. By default, the Notebook places the output cell immediately after the cell group the first time the cell group is evaluated. If you evaluate a cell group with an existing output cell, the Notebook places the results in the output cell wherever it is located in the M-book.

The next example shows the steps involved in converting separate input cells to a cell group, then evaluating the cell group.

Enter the input cells:

```
[t = 0:pi/10:2*pi;]  
[X,Y,Z] = cylinder(4*cos(t)+1);  
mesh(X,Y,Z)
```

Highlight the cells:

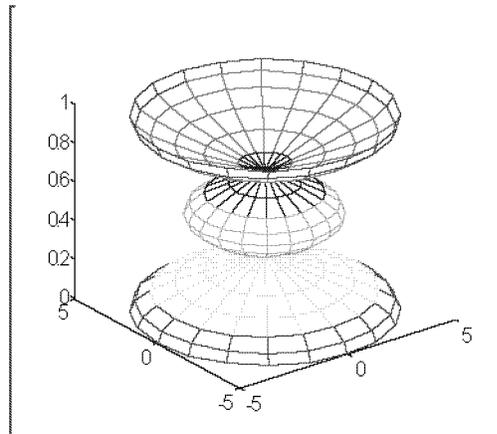
```
[t = 0:pi/10:2*pi;]  
[X,Y,Z] = cylinder(4*cos(t)+1);  
mesh(X,Y,Z)
```

Select the Group Cells command.

The Notebook displays the commands as one cell:

```
[t = 0:pi/10:2*pi;  
X,Y,Z] = cylinder(4*cos(t)+1);  
mesh(X,Y,Z)
```

To evaluate the cell group, select the Evaluate Cell command or press Ctrl-Enter (for Windows) or ^-Return (for Macintosh). The Notebook displays the output:



Embedding a MATLAB Command in Text

The Notebook allows you to embed a MATLAB command in a paragraph of text. The following example shows a MATLAB command in a descriptive line of text:

The command `[z = magi c(3)]` generates a 3 x 3 magic square:

```
[z =  
      8      1      6  
      3      5      7  
      4      9      2]
```

To enter the text paragraph and evaluate the embedded command:

- 1 Type the text, including the command.
- 2 Highlight the embedded command using the mouse.
- 3 Select the **Evaluate Cell** command or press **Ctrl-Enter** (for Windows) or **^+Return** (for Macintosh).

As the example shows, the Notebook converts the command to an input cell, sends it to MATLAB to be evaluated, and displays the results in an output cell.

Using Calc Zones

You can partition your M-book into self-contained sections. A *calc zone* is a contiguous block of related text, input cells, and output cells that describes a specific operation or problem. The Notebook defines a calc zone as a document section and places section breaks before and after the calc zone. Section breaks at the beginning or end of a document, however, are not displayed as in Word documents. An M-book can contain any number of calc zones.

Instructors might use calc zones to prepare problem sets for their students. By making each problem a separate calc zone, they can create and test each problem on its own. Note that variables used in one calc zone are not local to the calc zone.

Creating a Calc Zone

After you create the text and cells you want to include in the calc zone, you define the calc zone by following these steps:

- 1 Highlight the cells and text to be included in the calc zone.
- 2 Select the **Define Calc Zone** command.

You must highlight an input cell and its output cell in their entirety to include them in the calc zone.

Evaluating a Calc Zone

To evaluate a calc zone:

- 1 Position the cursor anywhere in the calc zone.
- 2 Select the **Evaluate Calc Zone** command or press **Alt-Enter** (for Windows) or **⌘ -^ -Return** (for Macintosh).

The Notebook sends each input cell in the calc zone to MATLAB to be evaluated. By default, the Notebook places the output cell immediately after the calc zone the first time the calc zone is evaluated. If you evaluate a calc zone with an existing output cell, the Notebook places the results in the output cell wherever it is located in the M-book.

Converting a Cell to Text

To convert an input cell (or an autoint cell or a cell group) to text:

- 1 Position the cursor in the cell.
- 2 Select the **Undefine Cells** command or press **Alt-U** (for Windows) or **⌘ -^ -U** (for Macintosh).

The Notebook converts the cell to text, reformatting the cell contents according to the Normal style. When you convert a cell to text, the Notebook also undefines its output cell.

Bringing MATLAB Command Window to the Front

Use the **Bring MATLAB to Front** command to bring the MATLAB command window to the foreground.

Protecting Your Workspace Integrity

When you work on more than one M-book in a single word processing session:

- Each M-book uses the same “copy” of MATLAB.
- All M-books share the same workspace.

If you use the same variable names in more than one M-book, data used in one M-book can be affected by another M-book. You can protect the integrity of your workspace by specifying the `clear` command as the first autoinit cell in the M-book.

Data Consistency

An M-book can be thought of as a sequential record of a MATLAB session. When executed in order, from the first MATLAB command to the last, the M-book accurately reflects the relationships among these commands.

If, however, you change an input cell or output cell as you refine your M-book, the Notebook does not automatically recalculate input cells that depend on either the contents or the results of the changed cells. As a result, the M-book may contain inconsistent data.

When working on an M-book, you might find it useful to select the **Evaluate M-book** command periodically to ensure that your M-book data is consistent. You could also use calc zones to isolate related commands in a section of the M-book. You can then use the **Evaluate Calc Zone** command to execute only those input cells contained in the calc zone.

Evaluating Cells

This section discusses how to evaluate individual cells, a range of cells, a document section, and the entire M-book.

Evaluating an Input Cell, Autoinit Cell, or Cell Group

To evaluate an input cell, an autoinit cell, or a cell group:

- 1 Position the cursor in the cell or its output cell.
- 2 Select the **Evaluate Cell** command or press **Ctrl-Enter** (for Windows) or **^-Return** (for Macintosh).

If there is no output cell, the Notebook creates one and places it immediately after the input cell that generated it. If there is an output cell, the Notebook replaces its contents, wherever it is in the M-book.

Evaluating a Range of Input Cells

To evaluate more than one MATLAB command contained in different but contiguous input cells:

- 1 Highlight the range of cells and text that includes the input cells you want to evaluate.
- 2 Select the **Evaluate Cell** command or press **Ctrl-Enter** (for Windows) or **^-Return** (for Macintosh).

The Notebook evaluates each input cell in the selection, inserting new output cells or replacing existing ones.

Evaluating the Entire M-Book

To evaluate the entire M-book, either select the **Evaluate M-book** command or press **Alt-R** (for Windows) or **⌘ -^R** (for Macintosh).

The Notebook begins at the top of the M-book regardless of the cursor position and evaluates each input cell in the M-book. As it evaluates the M-book, the Notebook inserts new output cells or replaces existing output cells.

Controlling How Multiple Input Cells Are Evaluated

The **Stop evaluating on error** check box controls how multiple input cells are evaluated, as when an entire M-book is evaluated. If this option is checked and an error occurs when evaluating an input cell, no more input cells are evaluated. If this option is not checked, evaluation will continue, regardless of whether or not errors occur.

Evaluating a Calc Zone

To evaluate a calc zone:

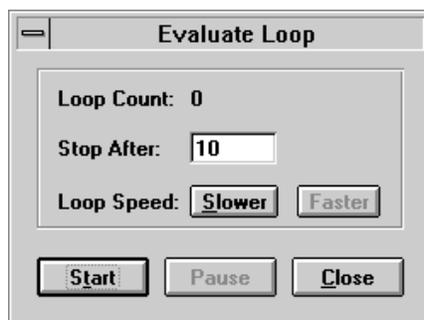
- 1 Position the cursor anywhere in the calc zone.
- 2 Select the **Evaluate Calc Zone** command or press **Alt-Enter** (for Windows) or **⌘ -^ -Return** (for Macintosh).

The Notebook evaluates the entire calc zone, regardless of the cursor position. As it evaluates the input cells in the calc zone, it inserts new output cells or replaces existing ones.

Evaluating MATLAB Commands in a Loop

To evaluate a sequence of MATLAB commands repeatedly:

- 1 Highlight the input cells, including any text or output cells located between them.
- 2 Either select the **Evaluate Loop** command or press **Alt-L** (for Windows) or **⌘ -^ -L** (for Macintosh). The Notebook displays the **Evaluate Loop** dialog box:



You can take these actions:

- You can specify the number of times you want MATLAB to evaluate the commands by entering a number in the **Stop After** field.
- You can start processing the commands by clicking on the **Start** button; the label on the button changes to **Stop**.
- You can suspend processing the commands by clicking on the **Pause** button; the label on the button changes to **Continue**.
- You can change the delay between iterations by clicking on the **Faster** and **Slower** buttons, either before you start loop processing or during processing.
- You can stop processing the commands by clicking on the **Stop** button.

Working with MATLAB Output

This section discusses MATLAB output, including general information about output cells, numeric output, graphic output, and printing.

Output Cells

If you evaluate an input cell for which there is no output cell, the Notebook places an output cell immediately after the input cell that generated it. If you evaluate an input cell for which there is an output cell, the Notebook replaces the results in the output cell wherever it is in the M-book.

If you evaluate a cell group, all output for the group follows the group in a single output cell.

How the Notebook Displays Output

You can control the spacing of numeric output and the size of graphic output. You can examine and modify these formats with the **Notebook Options** command. For more information, see “Controlling Numeric Output Format” on page 2-20 and “Controlling Graphic Output” on page 2-23.

Converting Output Cells to Text

You can convert an output cell to text using the **Undefine Cells** command. If the output is numeric or textual, the Notebook removes the cell markers and converts the cell contents to text according to the Normal style. If the output is graphical, the Notebook removes the cell markers and dissociates the graphic from its input cell, but does not alter its contents. This command does not affect the associated input cell.

To undefine an output cell:

- 1 Highlight the cell you want to undefine.
- 2 Either select the **Undefine Cells** command or press **Alt-U** (for Windows) or **⌘ -^U** (for Macintosh).

If you want to delete output cells, use the **Purge Output Cells** command, or press **Alt-P** (for Windows) or press **⌘ -^U** (for Macintosh).

Printing

You can print all or part of an M-book by selecting the **Print** command from the **File** menu. Word follows these rules when printing M-book cells and graphics:

- Cell markers are not printed.
- Input cells, autoinit cells, and output cells (including error messages) are printed according to their defined styles. If you prefer to print these cells using black type instead of colors or shades of gray, you can modify the styles.

Modifying Styles in the M-Book Template

You can modify the predefined styles stored in the M-book template. These styles control the appearance of text and cells. Word defines the Normal style, which is the default style for text. The Notebook defines the styles that control the contents of cells.

For example, if you print an M-book on a color printer, input cells appear dark green, output and autoinit cells appear dark blue, and error messages appear red. If you print the M-book on a grayscale printer, these cells appear as shades of gray. If you prefer to print these cells using black type, you need to modify the color of the Input, Output, AutoInit, and Error styles. See the Word documentation for more information.

The table below describes the default styles used by the Notebook. There are slight differences between the defaults for Microsoft Windows and Macintosh platforms. If you modify styles, you can use the information in the tables below to help you return the styles to their original settings.

For Microsoft Windows

Style	Font	Size	Weight	Color
Normal	Times New Roman	10 points		Black
AutoInit	Courier New	10 points	Bold	Dark Blue
Error	Courier New	10 points	Bold	Red
Input	Courier New	10 points	Bold	Dark Green
Output	Courier New	10 points		Blue

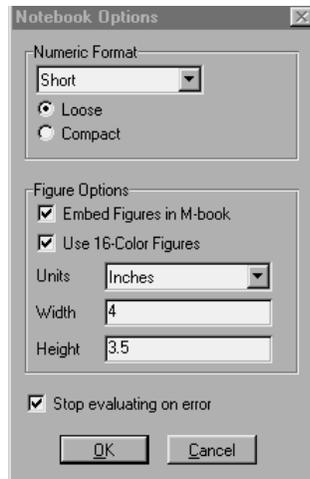
For Macintosh

Style	Font	Size	Weight	Color
Normal (text)	Times	12 points		Black
AutoInit (cells)	Courier	10 points	Bold	Dark Blue
Error (messages)	Courier	10 points	Bold	Red
Input (cells)	Courier	10 points	Bold	Dark Green
Output (cells)	Courier	10 points		Blue

When you change a style, Word applies the change to all characters in the M-book that use that style and gives you the option to change the template. Be careful making changes to the template because if you choose to apply the changes to the template, you will affect all new M-books you create using the template. See the Word documentation for more information.

Controlling Numeric Output Format

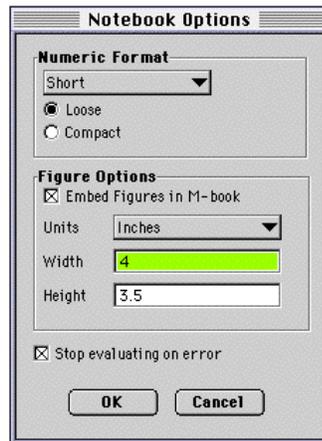
You can control the format of numeric output with the Numeric Format settings on the **Notebook Options** dialog box. To access this dialog box, select the **Notebook Options** command (Microsoft Windows version shown below).



← Numeric format settings

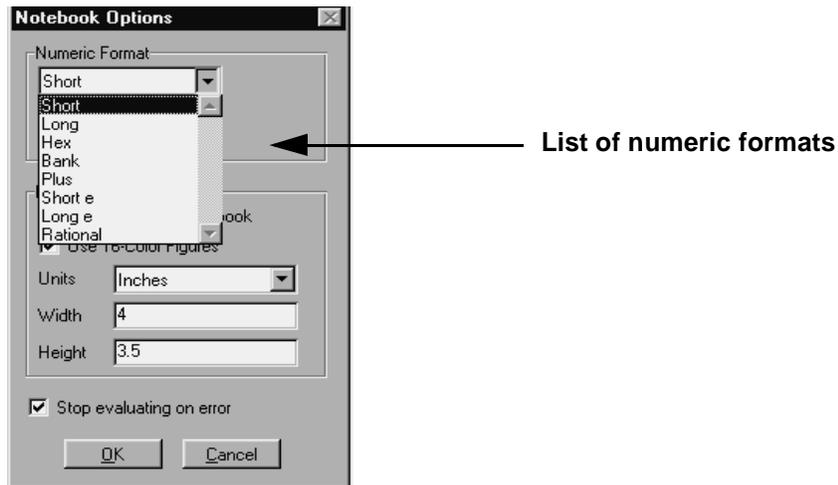
The **Notebook Options** dialog box for Macintosh platforms is slightly different from the Microsoft Windows version; below is the Macintosh version. Note that

the remaining screen images in this chapter are based on the Microsoft Windows version.



← Numeric format settings

You can change how the Notebook displays the output by choosing a format option from the list. These settings correspond to the choices available with the MATLAB format command. For more information, see the MATLAB online documentation. The figure below shows the available formats.



Also, you can specify whether a blank line appears between the input and output cells by selecting Loose or Compact format. Loose format adds an empty line; Compact format does not.

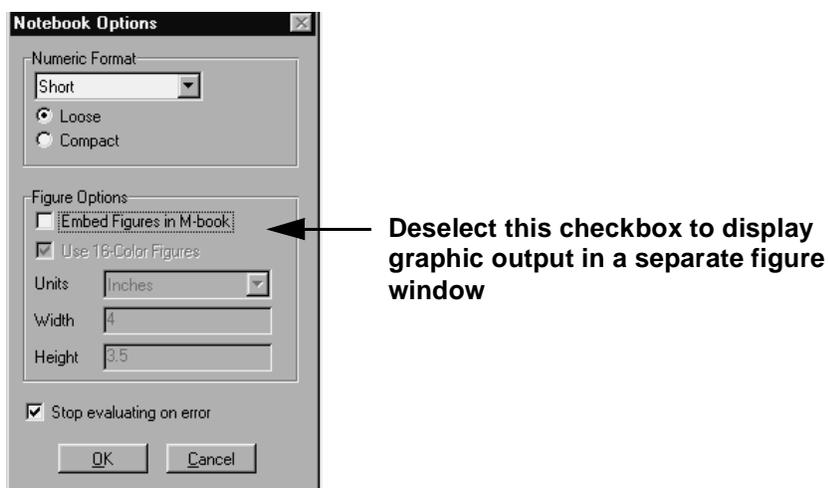
After selecting a format option, click on the **OK** button to accept the settings. These settings take effect for output generated after you click on the **OK** button. They do not affect existing output unless you re-evaluate the appropriate input cells. Click on the **Cancel** button to ignore the changes.

Controlling Graphic Output

You can control graphic output by embedding graphic output in an M-book, by allowing graphic output on a per-input-cell basis, or by sizing graphic output. For Microsoft Windows, you can also control printing to use 16-color or 256-color mode.

Embedding Graphic Output in the M-Book

By default, graphic output is embedded in the M-book. You can choose to display graphic output in a separate figure window by deselecting the **Embed Figures in M-book** check box on the **Notebook Options** dialog box.



Embedded figures do not include Handle Graphics® objects generated by the `ui control` and `ui menu` functions.

The Notebook determines whether to embed a figure in the M-book by examining its `visible` property. If the value of the property is off, the Notebook embeds the figure. If you set the value of the property to on, all graphic commands acting on the “current” figure are shown in a figure window and are not embedded in the M-book.

Controlling Output on a Per-Input-Cell Basis

The **Toggle Graph Output for Cell** command suppresses or allows graph output from an input cell. If an input or autoint cell generates figure output that you wish to suppress, place the cursor in the input cell and choose this command. The string `(no graph)` will be placed after the input cell to indicate that graph output for that cell will be suppressed. To allow graph output for that cell, place the cursor inside the input cell and choose **Toggle Graph Output for Cell** again. The `(no graph)` marker will be removed. This command overrides the “Embed Figures in M-book” option, if that option is set in the **Notebook Options** dialog.

Sizing Graphic Output

Set the default size of embedded graphics by using the **Notebook Options** command. The values in the **Height** and **Width** fields set the size of graphics generated after you press the **OK** button. Changing the default size of figures in this way does not affect figures already generated. To change figures you have already generated, re-evaluate the input cells that produced that output.

You can resize an embedded figure by selecting the figure and manipulating its handles. Select the figure by clicking the left mouse button anywhere in the figure. Word displays handles around the figure. Dragging the corner handles adjusts the adjacent sides, and dragging a center handle adjusts that side. If you need more information about how this works, consult the Word documentation. If you resize an embedded figure using its handles and then regenerate the figure, its size reverts to its original size.

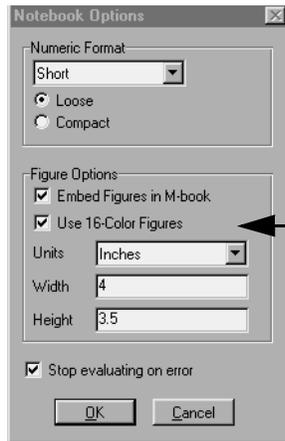
Cropping Graphic Output. You can crop an embedded figure to cut off areas you do not want to show. Select the graphic, then hold down the **Shift** key and drag a sizing handle toward the center of the graphic.

Adding White Space Around Graphic Output. You can add white space around an embedded figure by moving the boundaries of a graphic outward. Select the graphic, then hold down the **Shift** key and drag a sizing handle away from the graphic.

Printing Graphic Output (Microsoft Windows Only)

If you print graphic output that includes surfaces or patches, the output uses 16-color mode by default. You can have your graphics drawn using 256-color mode by making sure the **Use 16-Color Figures** check box on the **Notebook Options** dialog box is *deselected*.

The option applies to graphics generated after selecting the option and clicking on the **OK** button. To print generated figures correctly, you may need to regenerate the figures before printing. For example, if you have figures that were generated using 256 colors, and you select the **Use 16-Color Figures** option, then you need to regenerate the figures (using 16-color mode) before printing.



This check box controls whether 16-color or 256-color mode is used for printing

Notebook Commands

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Overview

This chapter describes the Notebook commands. Each command is listed in alphabetical order and can be accessed from the **Notebook** menu. The Microsoft Windows version of the **Notebook** menu is shown below.

Notebook	Window	Help
Define Input Cell		Alt+D
Define AutoInit Cell		
Define Calc Zone		
Undefine Cells		Alt+U
Purge Output Cells		Alt+P
Group Cells		Alt+G
Ungroup Cells		
Hide Cell Markers		Alt+[
Toggle Graph Output for Cell		
Evaluate Cell		Ctrl+Enter
Evaluate Calc Zone		Alt+Enter
Evaluate M-book		Alt+R
Evaluate Loop		Alt+L
Bring MATLAB to Front		Alt+M
Notebook Options...		

The Macintosh version of the **Notebook** menu differs somewhat from the Microsoft Windows version; the Macintosh version is shown below.

Notebook		
Define Input Cell		⌘^D
Define AutoInit Cell		
Define Calc Zone		
Undefine Cells		⌘^U
Purge Output Cells		⌘^P
Group Cells		⌘^G
Ungroup Cells		
Hide Cell Markers		⌘^[
Toggle Graph Output for Cell		
Evaluate Cell		^Return
Evaluate Calc Zone		⌘^Return
Evaluate M-book		⌘^R
Evaluate Loop		⌘^L
Bring MATLAB to Front		⌘^M
Notebook Options...		

Purpose Bring the MATLAB command window to the foreground.

Description The **Bring MATLAB to Front** command brings the MATLAB command window to the foreground.

Define AutoInit Cell

Purpose Create an autoinit cell.

Description The **Define AutoInit Cell** command creates an autoinit cell by converting the current paragraph, highlighted text, or input cell.

An autoinit cell is an input cell that is automatically evaluated whenever you open an M-book.

If you select this command while the cursor is in a paragraph of text, the Notebook converts the entire paragraph to an autoinit cell. If you select this command while text is highlighted, the Notebook converts the text to an autoinit cell.

If you select this command while the cursor is in an input cell, the Notebook converts the input cell to an autoinit cell.

The Notebook formats the autoinit cell using the AutoInit style, originally defined as bold, dark blue, 10-point Courier New (for Windows) or Courier (for Macintosh) font.

See Also For more information about autoinit cells, see “Entering Commands to Initialize the Workspace” in Chapter 2.

For information about evaluating autoinit cells, see the description of the **Evaluate Cell** command later in this chapter.

Purpose Create a calc zone.

Description The **Define Calc Zone** command defines the highlighted text, input cells, and output cells as a calc zone.

A calc zone is a contiguous block of related text, input cells, and output cells that describes a specific operation or problem.

The Notebook defines a calc zone as a document section, placing section breaks before and after the calc zone. However, Word does not display section breaks at the beginning or end of a document.

See Also For information about evaluating calc zones, see the description of the **Evaluate Calc Zone** command later in this chapter.

For more information about sections, see the Word documentation.

Define Input Cell

Purpose Create an input cell.

Description The **Define Input Cell** command creates an input cell by converting the current paragraph, selected text, or autoinit cell.

An input cell contains a MATLAB command.

If you select this command while the cursor is in a paragraph of text, the Notebook converts the entire paragraph to an input cell. If you select this command while text is selected, the Notebook converts the text to an input cell.

If you select this command while the cursor is in an autoinit cell, the Notebook converts the autoinit cell to an input cell.

The Notebook encloses the text in cell markers and formats the cell using the Input style, originally defined as bold, dark green, 10-point Courier New (for Windows) or Courier (for Macintosh) font.

See Also For more information about creating and evaluating input cells, see “Defining and Evaluating MATLAB Commands” in Chapter 2.

For information about evaluating input cells, see the **Evaluate Cell** command in this chapter.

Purpose Evaluate a calc zone.

Description The **Evaluate Calc Zone** command sends the input cells in the current calc zone to MATLAB to be evaluated.

A calc zone is a contiguous block of related text, input cells, and output cells that describes a specific operation or problem.

The current calc zone is the Word section that contains the cursor.

As the Notebook evaluates each input cell, it generates an output cell. When you evaluate an input cell for which there is no output cell, the Notebook places the output cell immediately after the input cell that generated it. If you evaluate an input cell for which there is an output cell, the Notebook replaces the results in the output cell wherever it is in the M-book.

Evaluate Cell

Purpose Evaluate an input cell or cell group.

Description The **Evaluate Cell** command sends the current input cell or cell group to MATLAB to be evaluated. The Notebook displays the output or an error message in an output cell.

An input cell contains a MATLAB command. A cell group is a single, multiline input cell that contains more than one MATLAB command.

If you evaluate an input cell for which there is no output cell, the Notebook places the output cell immediately after the input cell that generated it. If you evaluate an input cell for which there is an output cell, the Notebook replaces the results in the output cell wherever it is in the M-book. If you evaluate a cell group, all output for the cell appears in a single output cell.

An input cell or cell group is the current input cell or cell group if:

- The cursor is in the input cell or cell group.
- The cursor is at the end of the line that contains the closing cell marker for the input cell or cell group.
- The cursor is in the output cell for the input cell or cell group.
- The input cell or cell group is selected.

Evaluating a cell that involves a lengthy operation may cause a time-out. If this happens, Word displays a time-out message and asks whether you want to continue waiting for a response or terminate the request. If you choose to continue, Word resets the time-out value and continues waiting for a response. Word sets the time-out value; you cannot change it.

See Also For information about evaluating calc zones, see the description of the **Evaluate Calc Zone** command in this chapter.

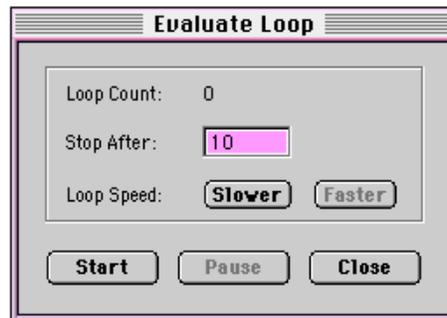
For information about evaluating the entire M-book, see the description of the **Evaluate M-book** command in this chapter.

For information about evaluating cells repeatedly, see the description of the **Evaluate Loop** command in this chapter.

Purpose Evaluate input cells repeatedly.

Description The **Evaluate Loop** command evaluates the highlighted input cells repeatedly. To evaluate input cells repeatedly, follow these steps:

- 1 Highlight the input cells you want to evaluate.
- 2 Select the **Evaluate Loop** command. The Notebook displays the **Evaluate Loop** dialog box:



- 3 Enter the number of times you want MATLAB to evaluate the highlighted commands in the **Stop After** field, then click on the **Start** button. The label on the button changes to **Stop**. The Notebook begins evaluating the commands and indicates the number of completed iterations in the **Loop Count** field.

To increase the delay at the end of each iteration, click on the **Slower** button. To decrease this delay, click on the **Faster** button.

To suspend evaluation of the commands, click on the **Pause** button. The label on the button changes to **Resume**. To continue evaluation, click on the **Resume** button.

To stop processing the commands, click on the **Stop** button.

To close the **Evaluate Loop** dialog box, click on the **Close** button.

Evaluate M-book

Purpose	Evaluate the entire M-book.
Description	<p>The Evaluate M-book command evaluates the entire M-book, sending all input cells to MATLAB to be evaluated. The Notebook begins at the top of the M-book regardless of the cursor position.</p> <p>As the Notebook evaluates each input cell, it generates an output cell. When you evaluate an input cell for which there is no output cell, the Notebook places the output cell immediately after the input cell that generated it. If you evaluate an input cell for which there is an output cell, the Notebook replaces the results in the output cell wherever it is in the M-book.</p>
See Also	For information about evaluating sections of the M-book, see “Using Calc Zones” in Chapter 2, and the description of the Evaluate Calc Zone command in this chapter.

Purpose	Create a multiline input cell.
Description	<p>The Group Cells command converts the input cells in the selection into a single multiline input cell called a cell group.</p> <p>If you include text in the selection, the Notebook moves it after the cell group. However, if text precedes the first input cell in the group, the text will remain before the group.</p> <p>If you include output cells in the selection, the Notebook deletes them. If you select all or part of an output cell before selecting this command, the Notebook includes its input cell in the cell group.</p> <p>If the first line in the cell group is an autoinit cell, the entire group acts as a sequence of autoinit cells. Otherwise, the group acts as a sequence of input cells. You can convert an entire cell group to an autoinit cell with the Define AutoInit Cell command.</p> <p>A cell group is especially useful when you want to enter a sequence of commands that produces a single graphic. For more information, see “Grouping MATLAB Commands” in Chapter 2.</p> <p>You evaluate a cell group using the Evaluate Cell command. When you evaluate a cell group, all of its output follows the group and appears in a single output cell.</p>
See Also	For information about converting a cell group to individual input cells, see the description of the Ungroup Cells command in this chapter.

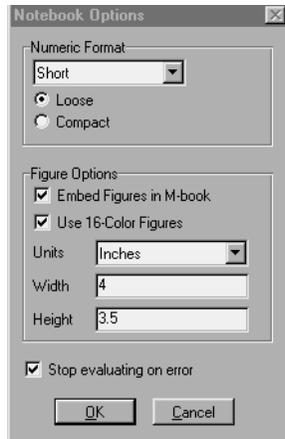
Hide (Show) Cell Markers

Purpose Hide (or show) cell markers.

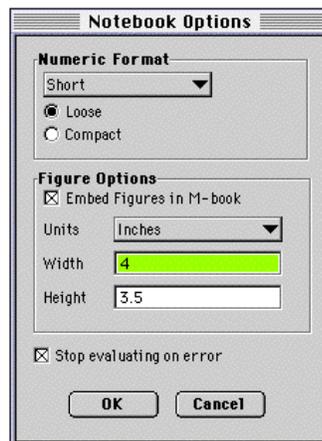
Description The **Hide Cell Markers** command hides cell markers in the M-book.
When you select this command, it changes to **Show Cell Markers**.
These commands do not affect printing of cell markers. The Notebook does not print cell markers regardless of whether they appear on the screen.

Purpose Control display of the Notebook output.

Description The **Notebook Options** command allows you to examine and modify display options for numeric and graphic output. When you select this command, the Notebook displays the following dialog box on *Microsoft Windows* platforms:



The **Notebook Options** command displays a slightly different dialog box on *Macintosh* platforms, as shown below.



Notebook Options

Controlling Numeric Output Format. The Numeric Format settings control the format of numeric output. You can change how the Notebook displays the output by choosing a format option from the list. These settings correspond to the choices available with the MATLAB `format` command. Also, you can control the extra space between input and output cells by selecting Loose or Compact format.

Click on the **OK** button to accept the settings. These settings take effect for output generated after you click on the **OK** button. They do not affect existing output unless you re-evaluate the appropriate input cells. Click on the **Cancel** button to ignore the settings.

Controlling Graphic Output. The **Figure Options** settings control graphic output:

- The **Embed Figures in M-book** check box controls whether the Notebook includes graphic output in the M-book. By default, graphic output is embedded in the M-book. If the check box is not selected, the Notebook displays graphic output in a separate figure window.

The **Toggle Graph Output for Cell** command overrides the “Embed Figures in M-book” option, if that option is set.

For more information, see “Embedding Graphic Output in the M-Book” in Chapter 2.

- (*For Microsoft Windows only*) – The **Use 16-Color Figures** check box controls whether graphic output uses 16 or 256 colors. If you print graphic output that includes surfaces or patches, you should generate the output using 16-color graphics instead of the default 256 colors. 16-color mode output always prints correctly on a color printer, or with gray levels on a grayscale printer. 256-color mode output prints colors as black, regardless of the output device.
- The **Units** list and the **Width** and **Height** fields control the size of graphic output. You can set the units by selecting an item from the **Units** list. You can specify the exact size of the output by entering values in the **Width** and **Height** fields. For more information, see “Sizing Graphic Output” in Chapter 2.

Controlling How Multiple Input Cells Are Evaluated. The **Stop evaluating on error** check box controls how multiple input cells are evaluated, as when an entire M-book is evaluated. If this option is checked and an error occurs when evaluating an input cell, no more input cells are evaluated. If this option is not checked, evaluation will continue, regardless of whether or not errors occur.

The **OK** and **Cancel** Buttons. Press the **OK** button to accept the settings. These settings take effect for output generated after you click on the **OK** button. They do not affect existing output unless you re-evaluate the appropriate input cells. Press the **Cancel** button to ignore the settings.

Purge Output Cells

Purpose	Delete output cells.
Description	The Purge Output Cells command deletes all output cells from the current selection.
See Also	For information about converting output cells to text, see the Undefine Cells command in this chapter.

- Purpose** Suppress or allow graph output on a per-input-cell basis.
- Description** The **Toggle Graph Output for Cell** command suppresses or allows graph output from an input cell. If an input or autoinit cell generates figure output that you wish to suppress, place the cursor in the input cell and choose this command. The string (no graph) will be placed after the input cell to indicate that graph output for that cell will be suppressed. To allow graph output for that cell, place the cursor inside the input cell and choose **Toggle Graph Output for Cell** again. The (no graph) marker will be removed. This command overrides the “Embed Figures in M-book” option, if that option is set in the **Notebook Options** dialog.
- See Also** Notebook Options

Undefine Cells

Purpose	Convert cells to text.
Description	<p>The Undefine Cells command converts the selected cells to text. If no cells are selected but the cursor is in a cell, the Notebook undefines that cell. The Notebook removes the cell markers and reformats the cell according to the Normal style.</p> <p>If you undefine an input cell, the Notebook automatically undefines its output cell. However, if you undefine an output cell, the Notebook does not undefine its input cell. If you undefine an output cell containing an embedded graphic, the graphic remains in the M-book but is no longer associated with an input cell.</p>
See Also	<p>For information about deleting output cells, see the description of the Purge Output Cells command in this chapter.</p> <p>For information about the Normal style, see “Modifying Styles in the M-Book Template” in Chapter 2.</p>

Purpose Convert a cell group to input cells.

Description The **Ungroup Cells** command converts the current cell group into a sequence of individual input cells or autoint cells. If the cell group is an input cell, the Notebook converts the cell group to input cells. If the cell group is an autoint cell, the Notebook converts the cell group to autoint cells. The Notebook deletes the output cell for the cell group.

A cell group is a single input cell that contains more than one MATLAB command.

A cell group is the current cell group if:

- The cursor is in the cell group.
- The cursor is at the end of a line that contains the closing cell marker for the cell group.
- The cursor is in the output cell for the cell group.
- The cell group is selected.

See Also For information about creating cell groups, see the description of the **Group Cells** command in this chapter.

Ungroup Cells

Glossary

Autoinit Cell. Autoinit cells are input cells that are evaluated automatically whenever the Notebook opens an M-book. Autoinit cells are otherwise the same as input cells. These cells are useful for initializing your workspace. The Word style for autoinit cells, called `AutoInit`, is originally defined as dark blue, bold, 10-point Courier New (for Windows) or Courier (for Macintosh) font.

Calc Zone. A calc zone is a contiguous block of related text, input cells, and output cells that describes a specific operation or problem.

Cell. All MATLAB commands, as well as their output, are contained in cells. The Notebook provides two kinds of cells: input cells (which include autoinit cells and cell groups) and output cells.

Cell Group. A cell group is a multiline input cell or autoinit cell that contains more than one MATLAB command. The Notebook defines the cell group as an input cell if the first cell highlighted to be part of the cell group is an input cell. If the first cell is an autoinit cell, the Notebook defines the cell group as an autoinit cell.

Cell Markers. Cell markers are large, bold brackets which the Notebook uses to enclose cells. These brackets are larger and thicker than the brackets used to enclose matrices.

Input Cell. Input cells contain MATLAB commands. An input cell can consist of a single command line, a multiple line command, or a command embedded within text. In addition, the Notebook allows you to combine several MATLAB commands in a single multiline input cell called a cell group. The Word style for input cells, called `Input`, is originally defined as dark green, bold, 10-point Courier New (for Windows) or Courier (for Macintosh) font.

M-book. An M-book is a Notebook document created using the M-book template. An M-book contains text, MATLAB commands, and the output from those commands. You can think of an M-book as a record of an interactive MATLAB session or as a document embedded with live MATLAB commands and their output.

Output Cell. Output cells contain the output produced by MATLAB, which can be numeric, text, graphic, or error messages. Output cells are enclosed in cell markers. The Word style for numeric output cells, called `Output`, is originally defined as blue, 10-point Courier New (for Windows) or Courier (for Macintosh)

font. Error messages use the Error style, originally defined as red, bold, 10-point Courier New (for Windows) or Courier (for Macintosh) font.

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