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***A QUICK INTRODUCTION TO  
MATHEMATICA FOR WINDOWS***

*Notes from the user's guide  
for Microsoft Windows*

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*Initial tips:*

- Mathematica for Windows is divided into two parts: a front end that handles interaction with the user and a kernel that does computations. The ultimate purpose of the front end is to prepare input to and show output from the kernel.

- Mathematica documents are called *Notebooks*. Notebooks can contain ordinary text and graphics as well as Mathematica "input and output".

- The information in a Notebook is stored in cells, whose characteristics vary with the cell's function and the kind of information it holds. The brackets on the right side of the Notebook window indicate the extent of each cell.

- The basic procedure for doing a calculation with Mathematica is to enter your input, feed it to the kernel for evaluation, and then get back a result. The Action menu contains various commands for controlling interaction with the Mathematica kernel.

- The quickest way to evaluate a cell containing Mathematica input is to select the cell and press *Shift + Enter*. You may also press either the *Insert* button, the evaluation button on the toolbar, or the 5 key on the numeric keypad.

- The output from the evaluation is placed in a new cell immediately below the input cell.

When you start Mathematica, an empty Notebook window appears on your screen, and you can enter input to be evaluated by the Mathematica kernel. As soon as you start typing, a cell is created, indicated by a cell bracket along the right edge of the Notebook window. Cells are basic organizational unit of a Notebook. A cell can contain explanatory text, kernel input or output, or graphics, but not a combination of these. Each piece of information in a Notebook is contained in a separate cell.

Mathematica does not automatically start a kernel at startup unless Preload Kernel has been specified in the Kernel Settings dialog box. To start a kernel, simply enter an expression

$2+2$

Then press Shift + Enter. You should get the following expressions

*In[1]:* =  $2+2$

*Out[1]:* = 4

which indicate the input to and the output from the kernel respectively.  
Enter the following expression:

$100!$

Then press Shift + Enter. Your result will be the value of  $100 \times 99 \times 98 \times \dots \times 1$ .  
Enter the following expression:

`Plot[Sin[x^2], {x, 0, 2Pi}]`

Then press Shift + Enter. This plots a curve in two dimensions.  
Enter the following expression:

`Plot3D[Sin[x] Sin[y], {x, 0, 2Pi}, {y, 0, 2Pi}]`

Then press Shift + Enter. This plots a surface in three dimensions.

#### • *Opening a Notebook*

Let's open an existing Notebook to explore many of the several features included in the program. To open an existing Notebook:

1. Choose **Open** from the File menu
2. Go to "Drives" and select drive 'F', then follow the path `f:\applic\wnmath22\notebook\`
3. Pointing in the File Name list box, click the name of the Notebook you want. Let's click on Klein.ma
4. Click the OK button, or double-click the highlighted Notebook name in the list box.

When you first open a prepared Notebook, often only the head cells of the outermost groups may be visible. The head cells frequently contain titles or headings for the group of cells.

Use the vertical bar to see the whole document. To open the closed group, double-click the outermost grouping bracket or the closed group box at the bottom of the head cell. Double-click the group boxes at the bottom of the head cells for **Discussion**, **Implementation**, and **Credits**.

The cell menu contains a number of commands that specify attributes for cells. When you activate one of

these attributes by choosing it in the menu, a check appears beside the attribute name. Choosing the attribute again deactivates it.

Go to the beginning of the document.

One of the most important attributes of a cell is whether it is formatted or unformatted. Unformatted cells contains text that you can edit. Formatted cells contains more elaborated text or graphics that you can't edit. For example, cells in which you have entered text yourself are unformatted while output cells created by Mathematica are usually formatted. Choosing the Formatted command in the Cell menu unformats cells that are already formatted, and vice versa.

A cell can also be either active or inactive. An inactive cell is one that can be evaluated by the Mathematica kernel, and usually contains Mathematica expressions. An inactive cell contains material that you would ordinarily not want to evaluate, such as explanatory text or titles, as well as Mathematica output. Inactive cells have a horizontal tick mark near the top of their cell brackets.

Click on the cell of the figure, then go to the cell menu and check that this cell is both Formatted and Inactive.

Any active cell can be marked as an initialization cell. Assuming you have checked the appropriate setting in the Action Settings dialog box, you will be asked when you open a Notebook whether to evaluate the initialization cells in the Notebook automatically. Initialization cells have a vertical tick mark near the top of their cell brackets.

A cell can also be either locked or unlocked. A locked cell's contents cannot be edited until the Locked attribute is removed. A locked cell is identified by an X below the top of its bracket. To lock a cell, select it and choose **Locked** from the Cell menu. You can assign this attribute when you want to protect a cell's contents from being accidentally changed. If you want to edit or delete a locked cell, first select it and use *this command to unlock it*. Lock the cell of the figure by using the Cell menu.

Each cell in a Mathematica Notebook has a particular style - a combination of text and cell attributes. These attributes include the text font, typeface, size, color, and alignment, as well as whether the cell is formatted or unformatted, active or inactive, and so forth. The Cell Style cascading menu of the Style menu contains a list of styles *already defined for cells*. To change the style of a cell, simply click its bracket to select the cell, then choose a new style from the Cell style menu. Select the title cell. Go to the cell style and change the title style for a subtitle style.

### • Graphics

All graphics output comes from the Mathematica kernel in the form of PostScript code. This PostScript code is sent to the Mathematica front end, which creates a screen image from the PostScript output.

You can resize graphics in a Mathematica Notebook. To resize a graphic:

1. Click anywhere inside the cell, but not the cell bracket itself. A bounding box with small handles appears around the graphic image.
2. Drag one of the handles to adjust the size and shape of the bounding box. While you are resizing, the height and width of the bounding box (in points) will be displayed in the status bar at the bottom of the Notebook window.

You can change the way the Mathematica front end renders PostScript graphics by using several menu commands in the Graph menu.

- *Printing*

When you are ready to print a Notebook, choose the **Print** command from the File menu, and set any necessary options in the Print dialog box that appears.

You can also print any selected cell or contiguous group of cells. Mathematica will calculate the appropriate pagination for selections larger than a single page. If you have a selection within a single cell, Mathematica will print the whole cell.

To print selected cells, first make your selection, then choose the Print Selection option from the Print dialog box. You may specify page size and shape with the Print Setup dialog box, which appears when you press the Setup button in the Print dialog box.

Click the title's cell and holding the mouse button go to the figure's cell (You have selected the first two cells of the Notebook). Go to the file menu, choose the Print command and follow the options to print both, the title and the figure.

- *Creating New Books*

To create a new Notebook, press the New Notebook button on the Toolbar or choose **New** from the File menu. A Notebook window titled "Newnb-1" opens on the screen. New Notebooks are initially empty. As soon as you start typing, Mathematica creates a cell to hold your text. The first cell is automatically set to be one that can be evaluated by the kernel.

- *Saving Notebooks*

After working in a Notebook, use the **Save** command in the File menu to record any changes you have made. If the current Notebook is still untitled (not yet saved on a disk), the Save dialog box will give you the option of naming the Notebook. Once a name has been chosen, Mathematica automatically adds the extension ".MA" to the name of the Notebook.

Mathematica can open documents created in any program, provided they have been saved in ASCII text format. The drop-down list box under "List Files of Type" in the Open dialog box lets you specify the extensions of the file types you want Mathematica to open.

When a Mathematica Notebook is saved, it is stored in two files: a standard Notebook format file written entirely in ASCII characters, and a binary file that duplicates some the information in the ASCII file, but in a form that can be processed more quickly when the Notebook is opened. The auxiliary binary file is given the extension ".MB".