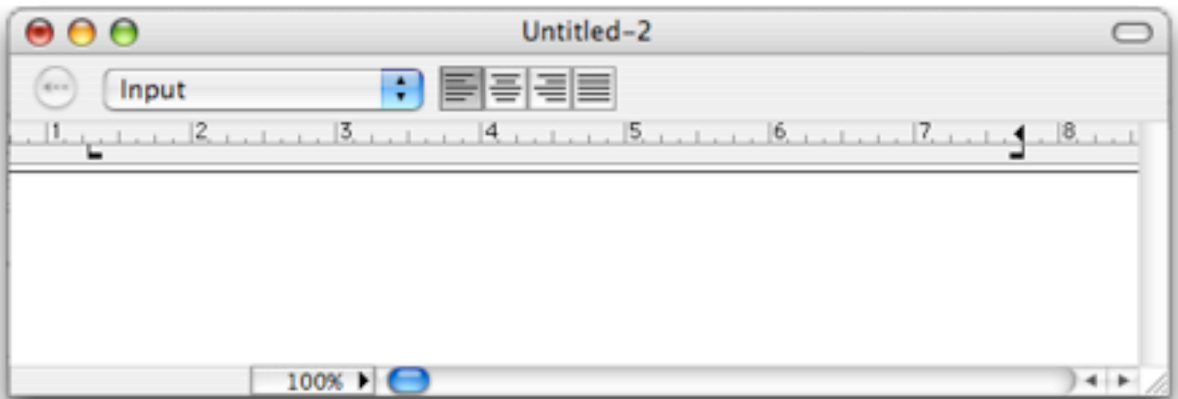


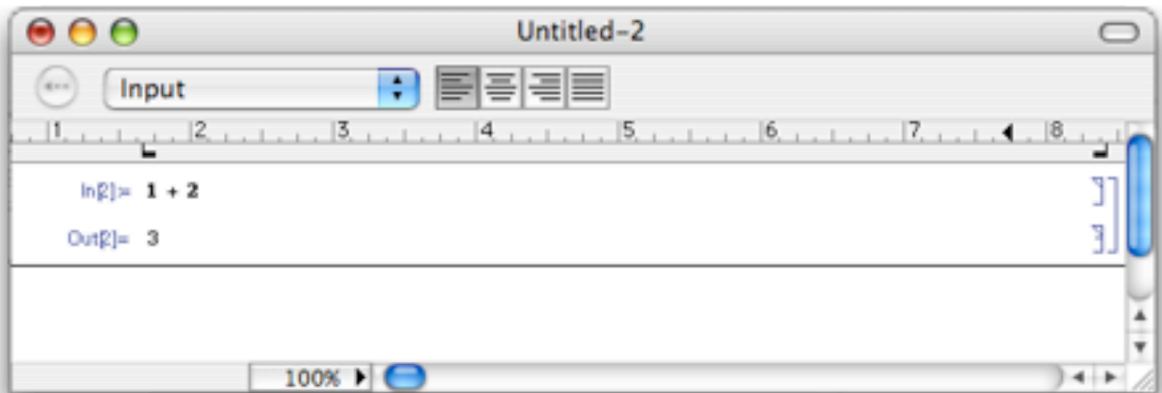
## Part 1. The *Mathematica* Notebook

### Section 1. Cell structure: Input/Output

When *Mathematica* is started up it launches to an empty window. This document is referred to as a *Mathematica* notebook. Pull down the Format menu and choose Show Ruler and Show Toolbar to obtain a window that appears like the one shown below.



The default paragraph style is called Input. *Mathematica* is waiting for you, the user, to type some mathematics for processing. The next picture shows the appearance of the notebook immediately after the entry  $1 + 2$  was made and [shift]-[return] was pressed ([shift]-[Enter] on a PC).



$1 + 2$  is referred to as the input and 3 is the output. The labels were created by *Mathematica*. At the same time, a new input cell was created, ready and waiting directly below the output

Look carefully at the second picture and you can see that *Mathematica* has also created right brackets to enclose the input and the output as well as a larger bracket enclosing the input/output pair. Each bracket marks the limiting boundaries of what *Mathematica* refers to as a cell. These cells are the building blocks of the notebook. A typical *Mathematica* notebook consists of cells containing input, output, text, and graphics. At this moment your eyes are in a text cell.

The user makes a mathematical entry in an input cell by clicking in the cell if necessary and typing. Press the [return] key to make a new input line. Pressing the [shift]-[return] key (the [shift]-[Enter] key on a PC) is the signal to *Mathematica* to process the entries in the input cell and place the output directly below the input in an output cell. As soon as the output appears a new input cell is generated separated from by a horizontal line.

*Note.* By default, cell brackets are not printed. However, this notebook has been set to show cell brackets (**Preferences...** selection on the **Mathematica** menu). The other notebooks in this manual will use the default settings for cell brackets.

The next input/output pair shows the computation of an antiderivative for the trigonometric expression  $\frac{\tan(x)}{\sin(x)^4}$ . The *Mathematica* syntax for indefinite integration of f(x) with respect to the x variable is

**Integrate[ f[x], x ] .**

**Integrate[ Tan[x]/Sin[x]^4, x ]**  
 $-\frac{1}{2} \text{Csc}[x]^2 - \text{Log}[\text{Cos}[x]] + \text{Log}[\text{Sin}[x]]$

So, as a notebook is created input and output is grouped together in separate cells and text entries, like this one, are enclosed in their own cell brackets.

## The pull down menus

There is a grand total of 10 pull down menus at the top of the screen when *Mathematica* is the active application on a Macintosh. They are labeled, in order from left to right, as follows:

**Mathematica File Edit Cell Format Input Kernel Find Window Help**

A brief description of some of the items on the menus is given below.

### Mathematica

The two most important menu choices are **Preferences...** and **Quit Mathematica**. Upon choosing Preferences... a dialogue opens that allows the user to adjust the settings for various notebook properties. For example, settings for margin width, hyphenation, and ruler units can be changed. Cell brackets can be toggled on and off, and font options can be selected.

### File

Use this menu to open, close, save, and print files. Note that the keyboard equivalent for **Save** is Command-S (hold down the Command key...next to the space bar...and press S...no shift). Use it early and use it often. The **Save As Special...** item can be used to save the worksheet in HTML format. Use the **Palettes** selection to display various palettes for mathematics entry as input and as marked up mathematics in a text entry.

### Edit

**Copy** and **Paste** commands are found here along with **Undo** (Command-Z). Use the **Expression Input** selection to enter mathematical expressions in a text cell. The palettes can also be used (File menu). *Mathematica* has a spell checker that can be accessed here. Use it.

### Cell

This menu has selections that control cell properties. Here, for example, is a selection for dividing a cell in two. Cells can be grouped together and then collapsed for outlining purposes.

## Format

The format menu contains selections for changing the style of notebook cells as well as text fonts and styles. Display magnification can be set here, as well as on a pop up menu at the bottom of the notebook window.

## Input

Use this menu to insert a matrix or a table in a notebook. Buttons and hyperlinks can be created. Mathematics input and output can be copied.

## Kernel

Action of the *Mathematica* kernel (the mathematics engine) can be controlled with menu selections. Cells can be evaluated or evaluation can be aborted. Output can be deleted, In/Out labels can be suppressed if desired.

## Find

Selections for Find/Replace are found here. Cells can be tagged for indexing.

## Window

Use this menu to control the positioning of multiple *Mathematica* windows.

## Help

This menu provides access to the extensive help facilities available in *Mathematica*, including the Help Browser and The *Mathematica* Book.. One of the items is called **Tutorial...** . Select it to open an interactive tutorial notebook for new users. The item called **Find Selected Function...** can be used to get help on a word or phrase that has been selected in the notebook. Useful information can also be obtained by typing ?Word or Phrase in an input cell as shown below.

### ?Integrate

```
Integrate[f, x] gives the indefinite integral of f
with respect to x. Integrate[f, {x, Simon, smilax}] gives
the definite integral of f with respect to x from xmin to
xmax. Integrate[f, {x, xmin, xmax}, {y, ymin, ymax}] gives a
multiple definite integral of f with respect to x and y. More...
```

Click on More... to go to the corresponding Help Browser page.