PHY 122 Mathematical Techniques 2
Getting Started With Mathematica

In the Exercise Classes for this course you will learn to use the computer package Mathematica 6 as an aid to solving a wide range of mathematical problems.

• To start up a computer in Windows:
Switch on computer → select *The standard student service* → enter your *username* → choose *Standard Windows environment* → login using *username* and *password* → now you should be in the Windows environment

• To begin a Mathematica 6 session click *Start* in the bottom left hand corner of the Windows taskbar → *Programs* → *Dept* → *Mathematica-6* → *Mathematica*

• Soon after a Mathematica Notebook titled *Untitled-1.nb* will pop up. (Note that all Mathematica notebooks have file extension *.nb*.)

• Click on the notebook window and type $2 + 2$. This opens a *Cell* in the notebook. Now press *Shift + Return* OR *Enter* on the numeric keyboard. This will evaluate the expression you entered. **Note:** pressing *Return* alone does not evaluate a *Cell* but adds a new line in the existing *Cell* on which you can type another Mathematica command. Pressing *Shift + Return* now will evaluate all commands in this *Cell* one after the other.

• At the top of the screen there is a menu bar with various menus: These can be pulled down either by clicking on the menu. There are also various short-cut buttons. You should explore the menus and buttons to get an idea of what file operations, etc., are available.

• **Saving files/changing file name:** for saving a notebook choose *File* from the top menu and choose *Save*; for changing the name of a notebook choose *File* from the top menu, choose *Save As* and type a new file name. **IMPORTANT: remember to save your work regularly!** – otherwise you may lose it all if you delete it in error, or if the network crashes.

• To add a new command in a separate *Cell* click on the notebook somewhere below the last *Cell* and a horizontal line will appear. Start typing a command and a new *Cell* will appear.

• You can also introduce new *Cells* between existing *Cells*, just click between two *Cells* and a horizontal line will appear.

• **Before you start working:** put your name and assignment number on the notebook by clicking on the notebook above the first *Cell*. Then in the top *Cell* type `(* STUDENTNAME, ASSIGNMENT NUMBER n *)` . Note that anything typed between `(*` and `*)` is ignored and not evaluated by Mathematica; this is useful for making comments in your Mathematica notebook.

• Put similar *Cells* at the beginning of every problem `(* PROBLEM NUMBER n *)`.

• Some questions (or parts of questions) are marked **Optional**. You do not need to do these questions (or their relevant parts), but you will get extra credit for doing so if you have lost marks in other places.

• Evaluating multiple *Cells*: *Cells* are bounded by brackets on the right hand side of the notebook. If you want to evaluate one or several *Cells* select the corresponding bracket(s) with the mouse and press *Shift+Return*.

• If you want to put several Mathematica commands in one *Cell* you have two options: (1) you separate them by pressing *Return* in which case each command will appear in a separate line and Mathematica will produce output for each command that is evaluated. (2) separate the commands with semi-colons ; . Note that a semi-colon ; after a Mathematica command suppresses the output of an evaluation. This is useful if you define variables or functions and you do not care to see the obvious result. Example: `x=1; y=2; z=3;`

• **Stopping Mathematica:** Sometimes Mathematica seems to take forever to complete a calculation and you want to stop it. Choose from the top menu *Evaluation* → *Abort Evaluation.*

• **Mathematica's Kernel** remembers everything, every variable or function you ever defined, and also your errors. For example, if you erroneously set t=3 somewhere previously, and put a variable 't' in a later expression, the machine will evaluate the expression with 't' set equal to 3. So make sure that for different problems you use different names for variables and functions.

• **Problem Shooting:** If you get repeated error messages even after you think you have fixed an error, you can try *Evaluate Notebook*, under the *Evaluation* menu. This will re-execute all the commands in the file, and may fix a problem involving an erroneously set variable as above, for example. If you still have problems and Mathematica does not seem to do what you want you can erase its internal memory, the *Kernel*, by choosing from the top menu *Evaluation* → *Quit Kernel* → *Local.*

• **Help and Documentation:** The *Documentation Center* is under the *Help* menu, where you can find information about all Mathematica commands using the search line. Consult the MT2 Hints and Help for Mathematica page for more details.

• **A few additional hints:**

- As with most programs, you need to type ***exactly*** the correct instruction to get the desired outcome. In particular, in Mathematica all commands begin with a capital letter and arguments of commands come in square brackets, for example `Sin[x]`. With Mathematica, you need to pay particular attention to the **brackets** (both the number of them *and* their type), **colons**, **semi-colons**, etc, as these play important roles in the instructions and mathematics.

- Use the control-x (or control-c) and control-v combinations to cut (or copy) and paste expressions to save re-typing.

• **To end a session:** pull choose from the top menu *File* → *Quit.* Then shut down the computer.