DEPARTMENT OF MATHEMATICS

MATHS 260 Tutorial 1

Some general information

1. Tutorials begin in the first week of lectures.

2. You will have chosen a tutorial time when you enrolled for Maths 260. Only come to the tutorial you are enrolled for, as some tutorials are full.

3. All tutorials are held in the Basement Teaching Laboratory (BTL), room B75 in the basement of the Maths Building. This is a different room to the Mathematics and Statistics Computer Laboratory (BCL) in the basement (which is the place you will normally use computers to do your assignments). Information about the labs including a map showing the location of both labs can be found at

   http://www.scl.ec.auckland.ac.nz/

4. Up to 5% of your final grade for the course can be gained by attending tutorials and making a good attempt at most questions. To get marks for tutorial participation, make sure that your tutor marks you present on the attendance register in each tutorial you attend.

5. Tutorial questions will be handed out in lectures a day or two before each tutorial. Read the questions and try to answer some of them before you come to the tutorial. In the tutorial, you are encouraged to work with one or two other students, discussing the questions and trying to formulate answers. A tutor will be available to discuss your answers with you during the tutorial.

6. Written answers to tutorial questions will not be distributed.

7. Bring to each tutorial your copy of the handout "An introduction to software used in Maths 260".

Specific information for Tutorial 1:

1. The aim of this tutorial is to get started using Matlab, to practice the procedure for checking (by substitution) whether a given function is a solution to a differential equation, and to practice finding solutions to separable equations.

2. Some of these questions require you to use Matlab and some just need a pencil and paper.

3. Before beginning, you must download copies of some Matlab files and put them in your own directory. Instructions on how to do this are on the course webpage:

   `http://www.math.auckland.ac.nz/wiki/MATHS_260_Semester_2_2009_Website`

   Ask your tutor for help if you get stuck.

4. If you have never used the computer labs before, you may find the information on the last two pages of this handout useful. It tells you how to log on to the labs, how to start Matlab, and how to save your work.

Tutorial 1 questions

1. Put the differential equation
$$t\frac{dy}{dt} - y = t^2$$
into standard form, then determine whether any of the following functions is a solution.
   (a) $\phi_1(t) = t^2$
   (b) $\phi_2(t) = 5t$
   (c) $\phi_3(t) = t^2 + 3t$

2. Learn to use the Matlab function *analyzer* by working through the first example given on the handout "An introduction to software used in Maths 260".

3. (a) Find a one-parameter family of solutions (i.e., an expression containing one arbitrary constant) to the differential equation
$$\frac{dy}{dt} = \frac{(t+1)}{y^2}.$$
   (b) Are there any solutions to the differential equation not contained in your family? Give a reason for your answer.
   (c) By picking appropriate values of the parameter in the family of solutions you found in 3(a), find solutions to the differential equation that satisfy each of the following initial conditions:
      i. $y(0) = 1$
      ii. $y(0) = 2$
      iii. $y(0) = -1$
   (d) Use the Matlab routine *analyzer* to plot the solutions you found in question 3(c). Plot all three solutions on one graph. Print out your picture. Note that you should use the Matlab function **nthroot** so that you can plot the cube roots properly. Use the Help menu in Matlab to find out about this function.

4. **Challenge question**. Only attempt this question if you have completed the others and had them checked by your tutor.
   (a) Find a one-parameter family of solutions to the differential equation
$$\frac{dy}{dt} = -y^3(t+1).$$
   (b) Find solutions to the differential equation that satisfy each of the following initial conditions:
      i. $y(0) = 2$
      ii. $y(0) = -1$

      Give the range of t for which each solution exists.

Getting Started in the Computer Laboratories
The computer laboratories are in the south end of the Mathematics Building. We use the laboratories in the basement. BTL is used for tutorials. BCL is open from 9am to 8pm, except Fridays when it closes at 5pm, and students may go there to do their assignments and other course work. Demonstrators are on duty to help you. They wear brightly coloured sashes and so are easily seen.

Using the computer laboratories

- First you must log on to the system. Press control + alt + delete. These keys must all be pressed at the same time.
- In the space labelled User name, enter your user name. In the space labelled Password, type your NetAccount password. This is the same as the password you use in nDeva.
- **Using Matlab** Click on the Start icon on the bottom left of the screen. A menu will come up. Choose Programs, then Math and Stats then Matlab. Wait ... then the Matlab logo will appear, then the Matlab windows. The Command Window is the window in the centre. - type your instructions to Matlab in this window beside the prompt >> and press Return on the keyboard.
- **Saving your work** When you have a file that you wish to save then
  - Choose File / Save As
  - Click Desktop icon
  - Double click on Users Home Directory. This is your storage on the system, called your H: drive. You can create folders within it to organise your work. For saving elsewhere see the next two points.
  - Some applications, such as MATLAB, will only run saved files. It is possible to save files just for the present session by instead double clicking Computer then usrtemp. Be aware that this will disappear when you log off!
  - To save on a USB stick, plug your USB stick into the back of the computer. Double click Computer and your USB stick will show up as removable storage. Double click on it. When you have finished with your USB stick, double click the Computer icon on the desktop, click on E (your USB) and click the Eject button at the top.
- **Changing your working directory** Above the Command Window you will find the Current Directory. This is where the computer is expecting to find any files that you wish to run. You can change the Current Directory by clicking on the button labelled ... and navigating to the directory you want to be current. For example, you might choose your H: drive (Users Home Directory), or a subfolder of it.