DEPARTMENT OF MATHEMATICS
MATHS 761 Laboratory 2: Hints

This handout gives some hints for Laboratory 2. Refer to the handout 'Laboratory 2: Notes' for the questions.

You should already know how to install a system of equations in XPP, and how to do basic simulations of the equations with XPP. See the handout for Laboratory 1, 'Using the software package XPP in the computer laboratory', if you need help with these steps.

Note about plotting and printing phase portraits: XPP does not automatically save orbits for plotting. If you draw a curve that you want to include in your final phase portrait, select '(G)raphic stuff' from the options menu, then '(F)reeze', then '(F)reeze' again. This will save the last curve that was drawn. Next time you freeze a curve it will be added to the set of curves already frozen.

1. (a) The following sample file shows one way to set the default ranges for the variables, the total integration time, and the maximum number of data points stored:

```
#lab2 eqns
x'=y
y'=mu+y+x^2+x*y
init x=0.01,y=0.01
par mu=-1.5
@ total=500,
@ xlo=-10, xhi=10, ylo=-10, yhi=10
@ maxstor=1000000
done
```

   (b) To find one-dimensional stable and unstable manifolds of an equilibrium solution, select '(S)ing pts' from the main options menu, find the equilibrium solution, and choose yes in response to the question 'Draw invariant sets?'. You should see two yellow curves (branches of the unstable manifold) and two blue curves (branches of the stable manifold). If XPP seems to get stuck before all four curves are drawn, press the forward slash key (/).

2. (a) See earlier examples if you don't know how to write `.ode` files.

   (b) iii. Open a new plot window by using the option 'Makewindow', '(C)reate'. Resize the new window if you wish. Change the new window to plot the x and z coordinates of solutions by clicking in the new window (a small white dot shows up in the top left corner of the window when you have done so) then selecting options from the menu on the original window.

   (c) See hints sheet for Laboratory 1 on how to change the stepsize.

(e) To export data, go to (G)raphic stuff, exp(O)rt data. You can then save the data as a `.dat` file. Open Matlab, navigate to your `.dat` file, right click and choose 'Import Data...'. A window will open giving you a preview of the data you are importing, click 'Next', and 'Finish', and then you will have a variable in Matlab containing the data. Use the Matlab plotting functions to plot your data.