350: Homework 3 Due: 15/February

1. Do 5.1.2

2. Do 5.1.9.

3. Do 5.1.10

4. Do 5.2.10

5. Do 5.3.4

Computer Homework

C 1. Plot the direction field and some sample trajectories for the equation

$$\begin{aligned} \dot{x} &= -x + x^3 + 2y \\ \dot{y} &= -3y. \end{aligned}$$

Here is a (not very gainly) program that works in Octave. Change the trajectories' starting points. I am using $\wedge$ for the power symbol (above the number 6 on the keyboard); I don't know how to put it elegantly in Latex). Make sure the single and double quotes are correctly typed in your program

% precedes a comment

```
[x1, x2] = meshgrid(-1.5:0.05:1.5, -0.5:.05:0.5);
x1dot = -x1 + x1.^3 + 2*x2;
x2dot = -3*x2;
quiver(x1,x2,x1dot, x2dot) % this plots the direction field
hold on; %This keeps the quiver graph on the plot


%x1 = [-.6,.4];
%x=lsode("f",x1,t);
%plot(x(:,1),x(:,2)) %This would plot for one starting value; could repeat.
%Instead we will do 4 points at once.


t=linspace(0,2,20)'; %Time runs from 0 to 2 in 20 equally spaced increments
y=[-.15,0.2;-.6,0.4;0.7,-.7;.8,.01];
function xdot = f(x,t)
xdot(1) = -x(1) + x(1)^3 + 2*x(2);
xdot(2) = -3*x(2);
endfunction
for i=1:4
x=lsode("f",[y(i,1),y(i,2)],t);
plot(x(:,1),x(:,2))
endfor
```

C 2. Do the same for the pendulum equation

$$\ddot{\theta} \;=\; -\sin(\theta),$$

thought of as a two-dimensional first order system in θ and $v = \dot{\theta}$.