

MiDterm1 Practice Problems 24

April 26, 2008

1. Review Practice problems for Midterm.

1. You need to know how to state the following Concepts and definitions

1. Definition of equilibrium point, equilibrium solutions and straight line solutions.
2. What is a phase line, phase portrait, vector field, direction field.
3. When do you say an equilibrium is a sink , sources. .
4. what are the equations for a mas-spring system with damping and without damping.
- 5 How to convert a 2nd order linear equation into a first order system

The problems of the exam will be of the following type. There will be about 5 or 6 problems

1. Solve

$$\frac{dy}{dt} = 2ty^2 + 3y^2, y(0) = 1.$$

$$\frac{dy}{dt} = \frac{y^2 - 1}{y + 1} y(1) = 2.$$

2 Solve

$$\frac{d^2y}{dt^2} - 5\frac{dy}{dt} + 6y = 0, y(0) = 1, y'(0) = 1$$

You should know how to express equation as a first order system of equations.

3. Analysis of bifurcations
given the equation

$$\frac{dy}{dt} = f_\mu = y(2 - y) + \mu$$

Make the bifurcation diagram.

Where are the bifurcation points, and explain what happens at those points.

4. Solve problem on page 140 problem 43 a,c. identify the equilibrium points and classify them.

5. Solve

$$\frac{dy}{dt} + ty = te^{-\frac{t^2}{2}}, y(0) = 2$$

6. Solve

$$\begin{aligned} \frac{dx}{dt} &= 2x \\ \frac{dy}{dt} &= 3x + 2y \end{aligned}$$

Solve above problem with data $x(0) = 1, y(0) = 2$

What are the equilibrium solutions of the system, what are the straight line solutions.

Note: In the exam you will have a system that decouples. If you know how to solve it with eigenvalues and eigenvectors, great, otherwise do it by the first method I taught

Problems in book: If you want to review more : Note the problems in parenthesis are of the same type,

Page 138:3,9,10,(21-23-31),(33-37-39), 43 a,c

Page 220: 1,3 5,7 Page 271: If you want to solve the system that uncouples by eigenvectors and eigenvalues work out 1, 7.