Math 340
Differential Equations

Exam One – Review Sheet & Study Guide

Below is an outline of topics that we have studied, and types of problems you should be able to solve. **In addition to reviewing these topics, you should review homework questions, examples from class and the additional review questions below.**

Chapter One: Introduction to Differential Equations

- Direction fields
  - Know how to sketch a direction field from a differential equation.
  - Be able to match a direction field to a differential equation.
  - Recognize equilibrium solutions on direction fields, and describe the behavior of solutions in relation to the equilibria.
  - Describe the long-term behavior of solutions.
  - Be able to sketch solution curves in a direction field.
- Initial value problems
  - Verify that a given function is a solution to a differential equation, with or without an initial condition.
  - Use initial conditions to solve for unknown constants.
  - Know the difference between the general solution and a particular solution.
  - Know how to solve equations of the form $y' = ay - b$
- Classification of differential equations
  - Order: first or second
  - Type: linear or nonlinear

Problems to look at, pp. 7 – 10: 5, 15 – 20, 21
pp. 15 – 18: 2, 3, 8, 13
pp. 24 – 25: 11, 13

Chapter Two: First Order Differential Equations

- Be able to recognize the types of equations we've met so far: linear, separable & exact.
- Be able to solve a linear differential equation using the method of integrating factors
- Be able to solve a separable differential equation
- Be able to verify that an equation is exact, and solve an exact equation by constructing the solution.
- Be able to analyze the solutions to an autonomous equation; know the logistic equation as a model
- Sketch phase lines and determine from them whether an equilibrium solution is stable, unstable or semistable
- Determine the interval in which a solution exists

- Create and solve differential equations to model mixing of solutions (inflow and outflow)
- Be able to solve differential equations that model motion under gravity, interest, Newton's law of cooling and radioactive decay

Problems to look at, pp. 39 – 41: 3, 10, 15, 34
pp. 47 – 50: 4, 5, 6, 13, 17
pp. 59 – 67: 2, 10, 12, 13, 17, 20, 22
pp. 88 – 94: 5, 9, 14, 15, 20
pp. 99 – 101: 5, 7, 22, 25