MIDTERM 2: STUDY GUIDE

This is a rough list of things that you should understand for the first midterm. I have included references to problems in the textbook that you can use to practice. I strongly encourage you to take the problem sets as a guide to what kind of problems will be on the midterm.

(1) Integration by parts (lecture 12, section 5.6 in text).
   - Use the integration by parts formula.
   - Identify appropriate u and v.

   Problems 1-16 in Section 5.6 all provide good practice.

(2) Polynomial long division and partial fractions (lectures 13 and 14, section 5.6 in text, see also additional note).
   - Divide a polynomial by any other polynomial and obtain a quotient and remainder.
   - Factorise simple polynomials.
   - Use the method of partial fractions to split up rational functions.
   - Know how to deal with repeated factors.

   Problems 17-22,27,28 in Section 5.6 all provide good practice.

(3) Accumulated change problems (lectures 16 and 17, section 5.8 in text).
   - Identify when a problem is asking for you to calculated the accumulated change of something.
   - Split up the problem into discrete pieces to estimate the solution.
   - Interpret this estimation as a Riemann sum.
   - Are able to convert a Riemann sum into an integral.
   - Apply this to problems involving volumes, exponential decay and work.

   Problems 21,24,29,30,31 in Section 5.8 all provide good practice.

(4) Population models (lectures 18 and 19, section 6.1 in text).
   - Understand the exponential and logistic population models.
   - Able to provide some commentary about the qualitative behaviour of solutions
   - Understand what a equilibrium solution is.
   - Able to modify the basic models to account for outside influences, e.g. harvesting

   Problems 35 and 40 in Section 6.1 provide good practice.

(5) Checking solutions and separable equations (lecture 20, section 6.2 in text).
   - Able to check if a function satisfies a differential equation.
   - Use implicit differentiation to check a solution which is described only implicitly.
   - Use the technique of separation of variables to solve differential equations.
   - Understand when this technique is applicable.

   Problems 17-36,39,41,43 in Section 6.2 all provide good practice.

(6) Linear models in biology (lectures 21 and 22, section 6.3 in text).
   - Understand the definition of a linear model.

- Use the linear model to solve Newtown's law of cooling and Von Bertalanffy's growth model.
- Apply a linear model to model the concentration of something is a liquid.
- Answer various questions about the qualitative behaviour of solutions to linear models.

Problems 29, 31, 35, 36, 39, 40, 41 in Section 6.3 all provide good practice.

(7) Slope fields (lecture 23, section 6.4 in text).

- Understand how a slope field relates to a differential equation and its solution.
- Understand the definition of a nullcline
- Draw (rough representation of) slope fields using the nullclines.
- Draw rough sketches of solutions to differential equations using slope fields.
- Comment on the qualitative behaviour of solutions to differential equations using slope fields.

Problems 1-18, 35, 38, 40 in Section 6.4 all provide good practice.