

## **Differential Equations Exam 1 Study Guide (edited by Deborah Batista)**

The exam will cover chapter 1 and 2 material. Typically the exams will be 5 questions in length with each question worth 20 points.

1. One problem usually involves solving ODEs with either separation of variables technique, Euler-Lagrange method and/or integrating factor technique. You need to be able to look at the problem and determine what is the right technique to use.  
Review hw problems  
Sec 1.3 p. 23-24 #7, 8, 12, 18 (for extra practice any problems 1-18)  
Sec 2.2 p. 63-64 #5, 9, 17, 33, 34 (for extra practice any problems 1-20 and 22-30)

In Thomas Finney Calculus 9<sup>th</sup> edition text, see Section 6.11 Problems p. 538 #21-40. In this section separable and integrating factor type problems are mixed and it will give you good practice in trying to determine the right technique to use.

2. Part of a problem (or even an entire problem) will involve determining whether Picard's Existence and Uniqueness Theorem applies to various differential equations with certain initial conditions.

Review hw problems  
Sec 1.5 p. 42-43 #3, 5, 12, 19, 23 (for extra practice any problems #1-19)

3. Another problem may involve drawing direction fields or matching differential equations to their appropriate direction fields. Note if you are asked to draw the direction field, you may be required to identify any constant solutions, draw in phase lines, determine and classify equilibrium points (when they exist) (discussed in Sec 2.5)

Review hw problems  
Sec 1.2 p. 17#15, 16, 26 (any problem #13-18)  
Sec 1.3 p.24 # 21 (any problem 19-24)  
Sect 2.5 p. 90 #4, (extra practice use any problems #1-6)

Look at old exams for matching problems. It will be a little more difficult than problems in the text because more equations are given than direction fields.

4. A portion of one problem (I have NOT seen an entire problem devoted to Euler's method on previous exam!) may ask you to use Euler's method to find a numerical approximation to the solution. Usually you are asked just to find  $y(1)$  for large step sizes of 0.5.

Review hw Sec 1.4 p. 33 #1

In Thomas Finney Calculus 9<sup>th</sup> edition text, see Section 6.12 for extra practice problems on p. 545 #1-4

5. One to two problems may be word type problems (from growth or decay, mixing, Newton's cooling problems, and logistic equation problems).

Review hw

Sec 2.3 p. 71-74 #2, 17 (any problems #1,4-35) Growth and decay problems

Section 2.4 p. 79-81 #7, 11 (any problems #2-20) \* do some of mixing and Newton cooling type problems.

Section 2.5 p. 91 #15, 17

Note mixing problems have been quite popular on past exams so make sure you know how to do these type of problems! Yet you should not ignore practicing with Newton's law of cooling problems or growth and decay problems.

6. Be able to classify a DE according to its order, whether it is linear or nonlinear, whether it is homogeneous or nonhomogeneous. This has appeared as part of a question. Know how to verify a particular solution and find the rest of the solutions. Be able to solve the homogeneous part of an ODE and the nonhomogeneous part.

Review hw

Sec 2.1 #4, 8, 37, 40 (any problems #1-10, 38, 39)

7. One question may focus on specific type of problems known as bifurcation problems done in hw section 2.5.

Review hw

Section 2.5 p. 92 #32, (practice see problem #33)