

Study guide for exam 1, math 286, Fall 2008

Note that you will be asked questions relating to the IODE projects!

Hint: Best way to study is to go over as many problems as you can in the book.

Section 1.1: What is a differential equation and what is a mathematical model. Key terms: *differential equation*, *initial value problem*, *initial condition(s)*, *general solution* (and *THE general solution*), *particular solution*.

Section 1.2: Solution by integration, i.e. $y' = f(x)$

Section 1.3: Slope fields and Solution curves. Be able to sketch slope fields, solution curves, understand lab/project I. Note the existence and uniqueness theorem.

Section 1.4: Separable equations: $y' = f(x)g(y)$. New key terms: *implicit solution*.

Section 1.5: Linear first order ODE. Know how to solve using the *integrating factor*. Study the mixture problem.

Section 1.6: Substitution. Know how to perform substitution. I promise on the test it will be easy to see what to substitute if I ask one of these questions.

Section 2.2: Equilibrium Solutions and Stability. Long term behaviour of solutions to autonomous equations. Key terms: *autonomous ODE*, *critical point* (stable and unstable), *equilibrium solution*, *logistic equation*.

Section 2.4: Eulers method. Be able to do several steps of this and to explain it graphically. Understand Project II. Be able to explain graphically the improved euler method you implemented (you can look at section 2.5 also).

Section 3.1: Second order linear equations. Key terms: *second order linear ODE*, *homogeneous equation*. Note the existence and uniqueness theorem, and note especially how the initial conditions look in this case. Know superposition for the homogeneous equation. What does it mean for two functions to be linearly independent? If I have two linearly independent solutions to a homogeneous equation, how does the general solution look like.

Second order linear homogeneous ODE with constant coefficients. Key terms: *characteristic equation*. What do the solutions look like when the roots are real, repeated, or complex (use the real version of solution here).

Properties of complex numbers. Know Eulers formula.

Section 3.2: Higher order linear equations. See the summary handout. Note the similarity to 3.1.

Section 3.3: Higher order linear homogeneous ODEs with constant coefficients.