Study guide for exam 1, math 20d, Fall 2010

Hint: Best way to study is to go over as many problems as you can in the book. Both my notes (L) and Boyce-DiPrima (BD).

Correspondence is:
L 0.2 is BD chapter 1
L chapter 1 (1.1,1.2,1.3,1.4,1.6) is BD chapter 2
L chapter 2 (2.1,2.2,2.3,2.4) is BD chapter 3

Here's the summary.

L 0.2: What is a differential equation and what is a mathematical model. Key terms: *differential equation*, *initial value problem*, *initial condition(s)*, *the general solution*, *particular solution*.

L 1.1: Solution by integration, i.e. $y' = f(x)$ or $y' = f(y)$.

L 1.2: Slope fields and Solution curves. Be able to sketch slope fields, solution curves. Note the existence and uniqueness theorem.

L 1.3: Separable equations: $y' = f(x)g(y)$. New key terms: *implicit solution*.

L 1.4: Linear first order ODE. Know how to solve using the *integrating factor*. Study the mixture problem.

L 1.6: Autonomous equations. Long term behaviour of solutions to autonomous equations. Key terms: *autonomous ODE*, *critical point* (stable and unstable), *equilibrium solution*, *logistic equation*.

L 2.1: 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.

L 2.2: 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 Euler's formula.

L 2.3: Higher order linear equations. Note the similarity to 2.2.

L 2.4: Mechanical vibrations. Be able analyze mass spring systems. Be able to find solutions to the resulting equations. Key terms: *free or unforced*, *forced*, *damped*, *undamped*, *amplitude*, *angular frequency*, *frequency*, *period*, *pseudo-frequency*, *friction*, *underdamped*, *critically damped*, *overdamped*.