Fall 2009 Math 321 Topics for the final

Chapter 2 First-order equations Know how to:

- solve separable equations and separable initial value problems and how to find intervals of existence of solutions (Section 2.2),
- solve linear equations and linear initial value problems and how to find intervals of existence of solutions (Section 2.4)
- set up and solve initial value problems for mixing problems, for radiocarbon dating, Newton's law of cooling and motion problems) (Sections 2.2, a part of 2.3 and Section 2.5; most of the differential equations in these applications will be linear),
- identify equilibrium points and equilibrium solutions of autonomous equations and how to classify equilibrium points and how to sketch graphs of several solutions of these equations (Section 2.9).

Chapter 3 Applications Know how to

- set up and solve initial value problems related to financing applications (Section 3.3),
- set up and solve initial value problems related to electrical circuits (Section 3.4). Notice that the most important equation is not explicitly written in Section 3.4. It is the equation

$$L\frac{d^2Q}{dt^2} + R\frac{dQ}{dt} + \frac{1}{C}Q = E$$

  and it should have been written after (4.3) on page 154.

Chapter 4 Second-order equations Know how to

- determine whether a pair of functions form a fundamental set of solutions for a second-order linear homogeneous differential equation (Section 4.1 and October 29 post on the website.)
- do algebra with complex numbers, how to write a complex number in polar form, how to apply this to calculation of some integrals (see post on October 19),
- solve second-order linear homogeneous differential equation with constant coefficients (Section 4.3 and October 29 post on the website.),
- set up and solve initial value problems for harmonic motion and electric circuits (Section 4.4, last 4 problems in particular) Again notice that the most important equation for the charge $Q(t)$ is missing on page 191

$$\frac{d^2Q}{dt^2} + \frac{R}{L}\frac{dQ}{dt} + \frac{1}{LC}Q = \frac{1}{L}E(t)$$

- solve second-order linear inhomogeneous differential equation with constant coefficients and linear, exponential or trigonometric inhomogeneous term (Section 4.5),
- recognize beats and determine "envelope" of the beats (Section 4.7)
- find the transfer function, the gain, the phase and the steady-state solution (Section 4.7),
- recognize the resonant frequency (giving the maximum gain) from the formula or graph of the gain (Section 4.7),
- apply the last two items to circuits and springs (Section 4.7).

Chapter 5 The Laplace transform Know how to

- calculate the Laplace transform for simple functions based on the definition (Section 5.1),
- apply special and general rules for the Laplace transform to find Laplace transforms of somewhat more complicated functions (Section 5.2),
- apply special and general rules for the Laplace transform to find inverse Laplace transforms of somewhat more complicated functions (Section 5.3),
- apply the Laplace transform to solve initial value problems.