

## Math 20D, Lecture A00: Introduction to Differential Equations, Spring 2013

### Review for Midterm Exam 2

#### Chapter 3. Second Order Linear Equations

1. Method of undetermined coefficients for solving  $ay'' + by' + cy = g(t)$  with special  $g(t)$ . Table 3.5.1 on page 181. See some examples in Section 3.5.
2. The method of variation of parameters for solving  $ay'' + by' + cy = g(t)$ . See Section 3.6.

#### Chapter 5. Series Solutions of Second Order Linear Equations

1. The concept of radius of convergence of a power series. How to compute it?
2. Find series solutions of second order linear equation.

#### Chapter 6. The Laplace Transform

1. Definition of improper integrals  $\int_a^\infty f(t) dt$ . Definition of the Laplace transform.
2. The Laplace transform of  $\sin t$  is  $1/(s^2 + 1)$  for  $s > 0$ . Why this is only for  $s > 0$ ?
3. The formula in Theorem 6.2.1 and Corollary 6.2.2. Apply these formulas to solve initial-value problems of linear equations. The technique of partial fractions.
4. Step functions and their Laplace transforms. Theorem 6.3.1.
5. Solve initial-value problems of linear equations with right-hand side involving step functions.
6. Defining the  $\delta$  function using approximations. The Laplace transform of  $\delta(t - t_0)$ .
7. Solve initial-value problems of linear equations with right-hand side involving  $\delta$  functions.

#### Chapter 7. Systems of First Order Linear Equations

1. How to convert a single, high order equation into a system of first order equations? What is the general form of a system of linear equations?
2. Matrix operations: addition, subtraction, scalar multiplication, multiplication, and inversion.
3. Find eigenvalues and eigenvectors of a  $2 \times 2$  or  $3 \times 3$  matrix.
4. How to solve a system of linear (algebraic) equations using elementary row reductions?
5. The concept of general solutions and fundamental sets of solutions for a system of linear equations. The Wronskian of solutions.
6. Solve homogeneous linear systems with constant coefficients.