Chapter Review Sheets for

Elementary Differential Equations and Boundary Value Problems, 10e

Chapter 3: Second Order Linear Equations

Definitions:

• Linear and nonlinear

• Homogeneous, Nonhomogeneous

• Characteristic Equation Wronskian

• General Solution, Fundamental Set of Solutions

• Principle of superposition

• Particular Solution

• Method of undetermined solutions

Theorems:

• Theorem 3.2.1: Existence and uniqueness of solutions to second order linear homogeneous equations. (p. 146)

• Theorem 3.2.2: Principle of Superposition. (p. 147)

• Theorem 3.2.3: Finding solutions to Equation (2) and Equation (3), using the Wronskian at the initial conditions. (p. 149)

• Theorem 3.2.4: Representing general solutions to second order linear homogeneous GDE's. (p. 149)

• Theorem 3.2.5: Existence of a fundamental set of solutions. (p. 151)

• Theorem 3.2.6: Abel's Theorem. (p. 153)

• Theorem 3.5.1: Relating differences in nonhomogeneous solutions to fundamental solutions. (Used to prove the following theorem.) (p. 176)

• Theorem 3.5.2: General solutions to linear nonhomogeneous ODE's. (p. 176)

• Theorem 3.6.1: General solutions to linear nonhomogeneous ODE's. (Using variation of parameters to determine the particular solution.) (p. 189)

Important Skills:

• Be able to determine if a second order differential equation is linear or nonlinear, homogeneous, or nonhomogeneous. (If it can be put into the form given by Equation (3) in page 138, it is linear.)

• Most of the Chapter deals with linear equations. Important exceptions are two methods given in Section 3.1, Equations (28) - (33) on page 142, which shows how to solve second order differential equations missing the dependent variable, and Equations (34) - (36) on page 143, which show how to solve equations missing the independent variable.

• Can you recognize a homogeneous equation with constant coefficients, and derive the characteristic equation? (Ex. 3, p. 149) This equation will be quadratic, so know the quadratic formula, the types of solutions one gets: real and distinct, repeated, and complex conjugate. These three cases will be crucial to the types of solutions one gets to constant coefficient homogeneous differential equations.

• Be able to write down fundamental solution sets to homogeneous equations. This means find two solutions. (Ex. 3, p. 149).

• Reduction of order is a way to take a known solution and produce a second solution. Know this method. (Ex 3, p. 172)

• What are the fundamental solution sets for each of the three cases of roots when solving constant coefficient equations? The summary is on p. 171. (Ex. 3, p. 149; Ex. 2, p. 170; Ex. 3, p. 163)

• Solutions to second order nonhomogeneous equations have two components. There is the homogeneous solution, and particular or nonhomogeneous solution. (Thm. 3.5.2, p. 176) To find particular solutions you must know the method of undetermined coefficients, and variation of parameters. (Ex. 4, p. 179; Ex. 1, p. 186)