Chapter Review Sheets for
Elementary Differential Equations and Boundary Value Problems, 10e

Chapter 4: Higher Order Linear Equations

Definitions:
- $n^{th}$ Order Linear ODE
- Fundamental Set of Solutions, General Solution
- Homogeneous and Nonhomogeneous equations
- Linear Dependence and Independence
- Characteristic Polynomial, Characteristic Equation
- Variation of parameters

Theorems:
- Theorem 4.1.1: Existence and uniqueness of solutions to higher order linear ODE’s. (p. 222)
- Theorem 4.1.2: General solutions to higher order linear ODE’s and the fundamental set of solutions (p. 223)
- Theorem 4.1.3: Relates linear independence to fundamental sets of solutions. (p. 225)

Important Skills:
- The methods for solving higher order linear differential equations are extremely similar to those in the last Chapter. There is simply $n$ times the fun! The general solution to an $n^{th}$ order homogeneous linear differential equation is obtained by linearly combining $n$ linearly independent solutions. (Eq. (5), p. 222)
- The generalization of the Wronskian is given on page 223. It is used as in the last Chapter to show the linear independence of functions, and in particular, homogeneous solutions.
- For the situation where there are constant coefficients, you should be able to derive the characteristic polynomial, and the characteristic equation, in this case each of $n^{th}$ order. Depending upon the types of roots you get to this equation, you will have solution sets containing functions similar to those in the second order case. (Ex. 2 - 4, p. 231 - 233)
- The general solution of the nonhomogeneous problem easily extends to the $n^{th}$ order case. (Eq. (9), p. 229)
- Both variation of parameters, and the method of undetermined coefficients generalize to determine particular solutions in the higher dimensional situation. (Ex. 3, p. 238; Ex. 1, p. 243)

Relevant Applications:
- Double and multiple spring mass systems