Things You Should Know for 2nd Order ODEs

I. Remember the Following Definitions:

- Linear and nonlinear, homogeneous and nonhomogeneous
- Wronskian and fundamental set of solutions
- Principle of superposition, general solution
- Characteristic equation
- Particular solution, method of undetermined solutions
- Period, natural frequency, amplitude

II. Remember and UNDERSTAND the Following Theorems:

- Theorem 3.2.1: Existence and uniqueness of solutions to second order linear homogeneous equations.
- Theorem 3.2.2: Principle of Superposition.
- Theorem 3.2.4: Representing general solutions to second order linear homogeneous ODE’s.
- Theorem 3.2.5: Existence of a fundamental set of solutions.
- Theorem 3.6.2 (3.5.2 9th Ed.): General solutions to linear nonhomogeneous ODE’s.
- Theorem 3.7.1 (3.6.1 9th Ed): Using variation of parameters to determine the particular solution to linear nonhomogeneous ODE’s.

III. Important Skills:

- Be able to determine if a second order differential equation is linear or nonlinear, homogeneous, or nonhomogeneous.
- Can you recognize a homogeneous equation with constant coefficients, and derive the characteristic equation? 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 whose Wronskian are none zero.
- What are the fundamental solution sets for each of the three cases of roots when solving constant coefficient equations?
- Solve the initial value problems for homogeneous equations with constant coefficients.
- Solutions to second order nonhomogeneous equations have two components. There is the homogeneous solution, and particular or nonhomogeneous solution.
• Find particular solutions of second order nonhomogeneous equations using the method of undetermined coefficients, and variation of parameters. Remember Table 3.6.1 (3.5.1 in 9th Ed.).

• Be able to write down general solution of second order nonhomogeneous equations.

• Know how to find solutions of the initial value problems from general solutions.