Final Review

Friday, December 2

Chapter 4: Linear Second-Order Equations

- Solve the homogeneous equation. What does the solution look like when the characteristic polynomial has repeated roots? Complex roots?
- Solve the nonhomogeneous equation using the method of undetermined coefficients. When will this method work? What do you do if the right-hand side is a solution to the homogeneous equation?
- Solve the nonhomogeneous equation using variation of parameters.
- Given the general solution to a differential equation, solve an initial-value problem.

Chapter 6: Theory of Higher-Order Differential Equations

- What is the Wronskian of a set of functions $f_1, \ldots, f_n$? If all of the functions are solutions to a particular linear differential equation, what does the Wronskian tell you?
- What is a fundamental solution set?
- What does it mean for a set of functions to be linearly independent?

Chapter 9

- Given a set of linear differential equations involving higher derivatives, how do you convert it into the normal form $\mathbf{x}'(t) = \mathbf{A}(t)\mathbf{x}(t) + \mathbf{f}(t)$?
- What is the Wronskian of a set of n vector functions $\mathbf{x}_1(t), \ldots, \mathbf{x}_n(t)$? What does it tell you about the functions, and under what conditions?
- What is a fundamental matrix for a system $\mathbf{x}(t) = \mathbf{A}(t)\mathbf{x}(t)$?
- What is the superposition principle? How does it relate to the set of solutions to a set of linear equationx $Ax = b$?
- What does the general solution look like when a matrix has repeated eigenvalues? Complex eigenvalues?
- Solve a nonhomogeneous linear system of differential equations using undetermined coefficients and/or variation of parameters.
- Find the exponential of a given matrix.

Chapter 10

- Describe in words the physical assumptions made by the heat and wave equations.
- Given the assumption that a partial differential equation has a solution of the form $u(x,t) = X(x)T(t)$, find conditions on the functions $X(x)$ and $T(t)$ that give a valid solution.
- How do you define even, odd, and periodic functions? How can you simplify the integral of a function with the knowledge that the function is even/odd/periodic?

- Find the Fourier series of a given function.
- Solve the 1-D heat equation given initial temperature and boundary conditions.
- Solve the equation for a vibrating string given initial conditions.
- Solve the 2-D heat equation?