The exam will cover all material taught from Chapters 1, 2 and 3, but not Euler's method.

Here are some ideas of things you should be able to do on the exam. Not all these topics will be on the exam. If a topic from the covered material isn't here, that doesn't mean it won't be on the exam.

You should also look over your homework problems for ideas of things to study. If I assigned a question, I did so because I thought the problem was important. If I wrote the question myself, I must have thought it was especially important!

- Sketch a direction field.
- Given a direction field, sketch a solution given an initial condition.
- Be able to classify a differential equations into known categories (e.g. pure time, separable, etc.)
- Be able to solve pure-time differential equations and initial value problems.
- Be able to use area-under-the-curve functions to write down an antiderivative if needed.
- Be able to solve separable first order differential equations.
- Given an implicit solution (coming, for example, from solving a separable equation), be able to work with it. I.e., if your implicit solution is $F(x, y) = 6$, how do you find $y(1)$? What does this have to do with level sets?
- Be able to solve linear differential equations, both using integrating factors, and using the method using the associated homogeneous equation.
- Be able to determine if a differential equation is exact, and be able to solve an exact equation.
- Be able to set up a ODE based on a verbal description; know how to treat the words 'proportional' and 'inversely proportional'.
- Be able to verify that a proposed solution of an initial value problem is actually a solution.
- Know what the interval of existence of a solution of a differential equation is. Be able to determine the interval of existence of a solution.
- Given a proposed solution involving free constants, determine the value of the constants (e.g. Homework 5 #1).
- Given a model differential equation with free parameters in the solution, determine the value of the parameters from measured data (e.g. Section 2.2 #34 and Homework 6 #4).
- Know how to use Octave, as taught in the class thus far. Among other things, you should understand how to use `quad`, `fzero`, and `levelcurve`.

- Be able to solve differential equations by substitution (homogeneous equations, Bernouli equations, or a given substitution). Practice problems: 2.6 #9, #21.
- Be able to set up a ODE for a mixing problem (e.g. the brine tanks).
- Be able to determine the units of variables and constants in an equation.
- Understand Quiz 1 and its relatives (e.g. Section 2.3 #26).
- Given an autonomous differential equation: find and classify equilibria, draw a phase line, and sketch representative solutions.
- Given an autonomous differential equation depending on a parameter, be able to analyse a bifurcation.