

MATH 328 – ORDINARY DIFFERENTIAL EQUATIONS
Review for Exam I

Things you should be able to do:

a) Given a differential equation and a function, determine whether or not the function is a solution to the differential equation. Recall, you do this by plugging the function in and determining whether or not the left side equals the right side. Don't write any equal signs that you can't justify.

b) Sketch a vector field given a first-order differential equation. Be able to sketch solution curves on your vector field.

c) Find and discuss fixed points of differential equations.

d) Classify differential equations in terms of order. Also, be able to recognize whether first order differential equations are linear, separable, homogeneous, and/or exact.

e) Be able to solve a linear differential equation/initial value problem by using an integrating factor.

f) Be able to solve a separable differential equation/initial value problem by separating variables.

g) Be able to solve a homogeneous differential equation/initial value problem by making the substitution $v = \frac{y}{x}$, and solving the resulting separable differential equation.

h) Solve an exact differential equation by finding $\psi(x, y)$ and setting it equal to a constant.

i) Quote Existence and Uniqueness theorems for both linear and general first-order differential equations and be prepared to discuss the difference between their conclusions.

j) Be able to answer questions about a system modeled by first-order differential equations.

There's a lot here, and it may not be possible for me to squeeze it all into one exam. But this should give you a pretty good idea of what I will be testing.

Try your hand at classifying and solving the following:

i. $y' + 2y = te^{-2t}$, $y(1) = 0$

ii. $y' = \frac{3x^2 - 1}{3 + 2y}$

iii. $y' = \frac{3y^2 - x^2}{2xy}$

iv. $(2x + y + 1) + (x + 2y + 3)y' = 0$