Math. 350-02
Spring, 2009
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First Exam

Friday, January 30, 2009

This exam is closed book. Make sure your name is on all pages. Show all work, and show it in a logical and organized manner. Each entire problem is worth 32 points, and 4 points are "free."

1. Classify each of the following differential equations as linear or nonlinear. In each case, say why.

   (a) $\dfrac{d^2y}{dt^2} + e^t y = t.$ (b) $y' + te^y = 0.$

   (c) $y''' + 3(y')^2 + y = e^{-t}.$ (d) $y' \sin(t) + y = e^{-t}.$

2. State the order of each of the equations in Problem 1.

3. Consider

$$\frac{dy}{dt} = 2y - 12.$$

   (a) Sketch a direction field.

   (b) Solve the differential equation, and discuss the relationship between the solution and the direction field you have sketched.

   (c) Solve the associated initial value problem with initial condition $y(0) = 1$.

   (d) Write down an equilibrium solution for y, and state whether that is stable, unstable, or neither. Give a reason for your conclusion.