

First Exam

Friday, September 12, 2008

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) $\left(\frac{dy}{dt}\right)^2 + e^t y = t.$ (b) $y' + e^t y = t.$

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

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) Sketch the solution curve for the initial value problem on the direction field you have drawn, to illustrate your discussion.