

AMAT 3260 assignment #1, due January 23

Problem 1 Determine the order of the given differential equations and state whether the equation is linear or nonlinear.

1. $t^2 \frac{d^2 y}{dt^2} - \sin(t) \frac{dy}{dt} + y - e^{2t} = 0$

2. $2 \left(\frac{dy}{dt} \right)^2 + 5y = 1$

3. $\frac{d^2 y}{dt^2} + 2y \frac{dy}{dt} + y = 0$

Problem 2 Verify that $y = e^{-t^3} \int_0^t e^{s^3} ds + 3e^{-t^3}$ is a solution of the differential equation

$$y' + 3t^2 y = 1.$$

Problem 3 Solve the following initial value problems

1. $ty' + (t+1)y = e^{2t}$ and $y(1) = 1$

2. $y' + \frac{1}{4}y = 3 + 2\cos(2t)$ and $y(0) = 0$

3. $y' + 2y + 3t = 0$ and $y(0) = 0$

4. $y' + \frac{t}{y} = \frac{1}{y}$ and $y(1) = -2$

Problem 4 Solve the following separable differential equations

a) $y' + y^4 \sin x = 0$ b) $y' = \frac{x - e^{-x}}{y + e^y}$

c) $xy' = (1 - y^2)^{1/2}$ d) $y' = \frac{x^2}{1 + y^2}$

e) $y' = \frac{1 + y^2}{x^2}$ f) $y' = \frac{x^3}{y(1 + x^4)}$