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MATH 305 ODE Quiz I

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Problem 1 (25 pts). State the order of the given ODE. Determine whether the equation is linear or nonlinear

a)

$$(1 - x^2)y'' - 2xy' + y = \sin x$$

b)

$$\frac{d^2u}{dt^2} + 2\frac{du}{dt} = \cos(t + u)$$

c)

$$\ddot{x} - \left(1 - \frac{\dot{x}^3}{4}\right)\dot{x} = x$$

Problem 2 (25 pts). Determine whether the given function is an explicit solution of the

given DE. Assume an appropriate interval I of the definition for the solution.

$$y'' - 6y' + 13y = 0; \quad y = e^{3x} \cos 2x$$

Problem 3 (25 pts). Verify that a)

$$\ln\left(\frac{2x-1}{x-1}\right) = t$$

is an implicit solution of the first-order DE.

$$\frac{dx}{dt} = (x-1)(1-2x)$$

Problem 4 (25 pts). Verify that

$$y = c_1x^{-1} + c_2x + c_3x \ln x + 4x^2$$

family of functions is a solution of

$$x^3 \frac{d^3y}{dx^3} + 2x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} + y = 12x^2$$