Review for Exam I

MATH 2306

Sections Covered: 1, 2, 3, 4

This review is provided as a courtesy to give some idea of what material is covered. Nothing else is intended or implied.

(1) For each equation, specify all independent and dependent variables. Identify the given equation as Linear or Non-linear and specify the order.

(a) $\dfrac{dy}{dt}+\dfrac{dx}{dt}=x^2+y^2$

(b) $x^3 y''' - 2x^2 y'' + 7y = \ln x$

(c) $e^x dy = x^2 y dx$

(2) Determine whether or not the given expression defines a solution to the ODE.

(a) $y(x)=2\cos x+\dfrac{1}{2}e^x;\quad \dfrac{d^2 y}{dx^2}+y=e^x$

(b) $\ln(xy)=x^2+y^2;\quad (x-2xy^2)\dfrac{dy}{dx}=(2x^2 y-y)$

(c) $y=e^x+2xe^x;\quad y''-3y'+2y=0$

(d) $e^{-x}+\ln|y|=1;\quad \dfrac{dy}{dx}=\dfrac{y}{e^x}$

(3) Find values of m so that the function $y=x^m$ is a solution of the differential equation.

(a) $x^2 y'' - 7xy' + 15y = 0$

(b) $x^2 y'' - xy' - 2y = 0$

(4) Solve each first order separable equation.

(a) $\dfrac{dy}{dx} = \sqrt{xy}$

(b) $\sin^2 x \dfrac{dy}{dx} = \sec^2 y$

(c) $\dfrac{dy}{dx} = \dfrac{x}{y} e^{x-y}$

(5) Solve each IVP.

(a) $\dfrac{dy}{dx} = \sqrt{xy}, \quad y(0) = 1$

(b) $e^y \ln(x)\, dx + y\, dy = 0, \quad y(1) = -1$

(c) $y'' = -\cos x + 6x, \quad y(0) = 3, \quad y'(0) = -1$

(6) Solve each IVP.

(a) $\dfrac{dy}{dx} - \tan x\, y = \sin x, \quad y(0) = 1$

(b) $x \dfrac{dy}{dx} + 3\,y = \dfrac{1}{x^2(1 + x^2)}, \quad y(1) = 0$

(c) $ty' + y = 2te^{2t}, \quad y(1) = 0$

(7) Solve each differential equation using any applicable technique

(a) $y' + 3y = y^2 e^{3x}$,

(b) $(2xy^2 - 2\sin(2x))\, dx + 2x^2 y\, dy = 0$

(c) $(ye^x + y^3)\, dx + \left(2xy^2 - \dfrac{y}{1 + y^2}\right) dy = 0$

(d) $\dfrac{dy}{dx} + 4xy = 4x\sqrt{y}$