

Assignment-1

Student Name:

Course Title: D.E.

Due Date: Next week in class.

Course Code: Math-202.

Answer the following questions.

(Q1.) Choose the correct answer.

(1) The Order and the Degree of the differential equation $(y'')^3 - 2(y')^4 + y = e^{y+t}$ is.

(A) $O = 4, D = 3$

(B) $O = 3, D = 4$

☒ (C) $O = 2, D = 3$

(D) $O = 3, D = 3$

(2) $y' - y^2 = e^{t+y}$ is a equation.

(A) linear

☒ (B) nonlinear

(3) The dependent variable ,and independent variable of differential equation $y' - y^2 = e^{t+y}$ are.

(A) y is dependent, x is independent

(B) t is dependent, y is independent

(C) t is dependent, x is independent

☒ (D) y is dependent, t is independent

(Q2.) State whether the following equations are linear or non-linear and gives its order, degree, and the dependent variable, and independent variable.

List of Differentials Equations					
Differential Equation	Order	Degree	Linearity	dep. variable	indep. variable
$y''' - 3y' + 2y = \sin(x)$	3	1	✓	y	x
$(1 - u)x'' + 2x' - x = 0$	2	1	✓	x	u
$(y'')^3 - 2(y')^4 + y = e^s$	2	3	X	y	s
$\frac{\partial y}{\partial u} + \frac{\partial x}{\partial u} = 0$	1	1	✓	u	x, y
$\frac{dy^2}{dx^2} + 5\frac{dy}{dx} = \cos(x)$	1	2	X	y	x
$\sqrt{(y')^2} - y^2 = e^t$	1	1	X	y	t

$$\frac{dy}{dx} = y'$$

$$\frac{d^2 y}{dx^2} = y''$$

$$\frac{dy^2}{dx^2}$$

$$\frac{\partial u}{\partial x} = -\frac{\partial u}{\partial y}$$

(Q3.) Solve the following.

1. Verify that $y = e^{-2x}$ is a solutions of the following differential equation $y'' - 2y' - 8y = 0$.

$$y = e^{-2x}$$

$$y' = -2e^{-2x}$$

$$y'' = 4e^{-2x}$$

نقوض

$$4e^{-2x} - 2(-2e^{-2x}) - 8e^{-2x} \stackrel{?}{=} 0$$

$$4e^{-2x} + 4e^{-2x} - 8e^{-2x} \stackrel{?}{=} 0$$

$$0 = 0$$

$$LHS = RHS \quad \checkmark$$

2. Verify that $y = xe^{2x}$ is a solutions of the following differential equation $y'' - \underline{4y'} + 4y = 0$.

$$y = xe^{2x}$$

$$y' = 2xe^{2x} + e^{2x}$$

$$y'' = 2x(2e^{2x}) + 2e^{2x} + 2e^{2x} \\ = 4xe^{2x} + 4e^{2x}$$

$$y'' - 4y' + 4y = 0$$

نقوض

$$4xe^{2x} + 4e^{2x} - 4(2xe^{2x} + e^{2x}) + 4xe^{2x} \stackrel{?}{=} 0$$

$$4xe^{2x} + 4e^{2x} - 8xe^{2x} - 4e^{2x} + 4xe^{2x} \stackrel{?}{=} 0$$

$$0 = 0$$

$$LHS = RHS \quad \checkmark$$

3. Verify that $y = \sin(3x)$ is a solution or not of the following differential equation $y'' + 9y = 0$.

$$y = \sin(3x) \quad y' = 3 \cos 3x \quad y'' = -9 \sin 3x$$

$$-9 \cancel{\sin 3x} + 9 \cancel{\sin 3x} = 0$$

$$0 = 0$$
$$L.H.S = R.H.S \quad \checkmark$$

4. Verify that $y = \underline{x \sin x}$ is a solution or not of the following differential equation $y'' - 2y' + y = \underline{-2 \sin x}$.

$$y = x \sin x \quad y' = x \cos x + \sin x \quad y'' = -x \sin x + \cos x + \cos x$$
$$y'' = -x \sin x + 2 \cos x$$

$$y'' - 2y' + y = -2 \sin x \quad \text{نعم}$$

$$\cancel{-x \sin x} + 2 \cos x - 2(x \cos x + \sin x) + \cancel{x \sin x} \stackrel{?}{=} -2 \sin x$$

$$2 \cos x - 2x \cos x - 2 \cancel{\sin x} = -2 \cancel{\sin x}$$

$$2 \cos x - 2x \cos x \neq 0$$

$$L.H.S \neq R.H.S$$

it is not a solution

$$\textcircled{x} \rightarrow y'' + y' + y = x$$

(Q4.) Determine whether the given first-order differential equation is linear (or) nonlinear in the indicated dependent variable $y(x-1)^2 dx + dy = 0$.

$$\frac{y(x-1)^2 \cancel{dx}}{\cancel{dx}} + \frac{dy}{dx} = 0$$

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dx و

$$(x-1)^2 y + \frac{dy}{dx} = 0$$

$$y' + f(x)y = 0$$

$$\frac{dy}{dx} + (x-1)^2 y = 0$$

linear
dep = y
indep = x

(Q5.) If $y = c_1 e^x + c_2 x e^x$ is a solution to the differential equation $y'' - 2y' + y = 0$. Find the value of c_1 , and c_2 . If $y(0) = 1$, and $y'(0) = 3$.

$$y = c_1 e^x + c_2 x e^x$$

$$y(0) = 1$$

x y

$$1 = c_1 \cancel{e^0} + c_2 (0) \cancel{e^0}$$

$$\boxed{1 = c_1}$$

$$y' = c_1 e^x + c_2 x e^x + c_2 e^x$$

$$y'(0) = 3$$

x y'

$$3 = c_1 \cancel{e^0} + c_2 (0) \cancel{e^0} + c_2 \cancel{e^0}$$

$$3 = c_1 + c_2$$

$$3 = 1 + c_2$$

$$\boxed{c_2 = 2}$$