Kingdom of Saudi Arabia
Ministry of Education
Jazan University
Faculty of Science
Mathematics Department

المملكة العربية السعودية
وزارة التـــعليـــم
جامـــعة جـــــازان
كليـة العـــلوم
قسم الرياضيات

Assignment-1

Student Name: ..... Course Title: D.E

Due Date: Next week. 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) $O = 1, D = 4$ (D) $O = 3, D = 3$

(2) $y' - y = \cos(t + y)$ is a $\cdots\cdots\cdots$ equation.

(A) linear (B) nonlinear

(3) The dependent variable ,and independent variable of differential equation $y' - y = \cos(t + y)$a re.

(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

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(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
$(1-t)x'' + 2x' - x = 0$	2	1	✓	x	t
$(y'')^3 - 2(y')^4 + y = e^s$	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
$\sqrt{1 + (y')^2} - y^2 = e^t$	1	1	x	y	t

(Q3.) Solve the following.

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

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

نعوض

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

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

$$0 = 0$$

LHS = RHS ✓

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

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

$= 4xe^{2x} + 4e^{2x}$

$y'' - 4y' + 4y = 0$ نعوض

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

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

$$0 = 0$$

LHS = RHS ✓

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

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

$-9\sin 3x + 9\sin 3x = 0$

$0 = 0$

L.H.S = R.H.S ✓

4. Verify that $y = x\sin x$ is a solutions or not of the following differential equation $y'' - 2y' + y = 0$

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

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

$y'' - 2y' + y = 0$ نعوض

$-x\sin x + 2\cos x - 2x\cos x - 2\sin x + x\sin x \stackrel{?}{=} 0$

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

LHS ≠ RHS

it's not solution

(Q4.) Determine whether the given differential equation is linear (or) nonlinear in the indicated dependent variable $x^2\,dx + ydy = 0$.

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

$$x^2\,dx + y\,dy = 0$$

$$x^2 + y\frac{dy}{dx} = 0$$

$$y\,y' = -x^2$$

non linear

(Q5.) If $y = c_1e^x + c_2xe^x$ 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 $y'(0) = 3$.

$$y = c_1e^x + c_2xe^x \qquad y(0) = 1$$

$$1 = c_1e^0 + c_2(0)e^0$$

$$\boxed{1 = c_1}$$

$$y' = c_1e^x + c_2xe^x + c_2e^x \qquad y'(0) = 3$$

$$3 = c_1e^0 + c_2(0)e^0 + c_2e^0$$

$$3 = c_1 + c_2 \qquad 3 = 1 + c_2$$

$$\boxed{c_2 = 2}$$

(Q3.) Verify whether the given y is a solutions or not of the following differential equation.

1. $y = e^{-2x}, \quad y'' - 2y' - 8y = 0.$
2. $y = xe^{2x}, \quad y'' - 4y' + 4y = 0.$
3. $y = \sin(3x), \quad y'' + 9y = 0.$
4. $y = x \sin x, \quad y'' - 2y' + y = 0.$

(Q4.) Determine whether the given differential equation is linear (or) nonlinear in the indicated dependent variable $x^2\,dx + ydy = 0$.

(Q5.) If $y = c_1e^x + c_2xe^x$ 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 $y'(0) = 2$.

GOOD LUCK