Victoria University of Bangladesh
Name: Md. Ziaul Hoque "Sohel"
Student ID: 2221220031
Course Title: Differential Equation and Fourier Analysis-scaled
Course Code: MAT-325
Batch: 22nd (evening)
Semester: Summer-2023

Ans to the Que NO - 1

(I) given,

$$y = e^{3x+2}$$

$$y_1 = \frac{dy}{dx} = e^{3x+2} \frac{dy}{dx}(3x+2)$$

$$= e^{3x+2}(3.1+0)$$

$$= 3e^{3x+2}$$

$$y_2 = \frac{y_2 y}{dx^2} = 3\left[\frac{d}{dx}(e^{3x+2})\right]$$

$$= 3(3e^{3x+2})]$$

$$= 3(3e^{3x+2})$$

$$= 9e^{3x+2}$$

$$= 9y \quad (\text{Ans}).$$

P.T.O

(ii)

$$y = \log x + ax$$

$$\frac{dy}{dx} = \frac{1}{x} + a$$

$$\therefore y_1 = \frac{1}{x} + a$$

$$\frac{y_2 y}{dx^2} = \frac{d}{dx}\left(\frac{1}{x} + a\right)$$

$$= \frac{-1}{x^2}$$

$$y_2 = -\frac{1}{x^2} \quad \text{Ans.}$$

Ans. to the Que No-2

$$f(x) = 3x^2 - 2x + 4$$

$$f(x) = \frac{d}{dx}(3x^2) - \frac{d}{dx}(2x) + \frac{d}{dx} \cdot 4$$

$$= 3x^2 - 2$$

at, $x = 0$ Ans

$$m = f(0) = 3 \cdot 0^2 - 2$$

$$= -2$$

$$f(0) = 3 \cdot 0^2 - 2 \cdot 0 + 4$$

P.T.O

So, the point is $(0, 4)$

So the equation is —

$$y - y_0 = m(x - x_0)$$

$$\Rightarrow y - 4 = -2(x - 0)$$

$$\Rightarrow y = -2x - 4$$

$$\left[\begin{array}{l} m = -2 \\ x = 0 \\ y = 4 \end{array}\right]$$

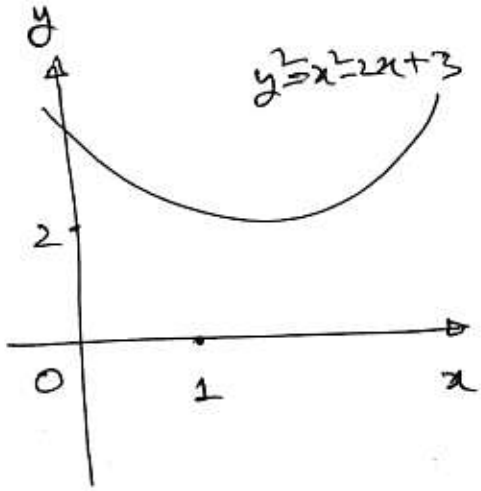
Ans to the Que NO - 4

$$y = x^2 - 2x + 3$$

$$\Rightarrow \frac{dx}{dx} = 2x - 2$$

Now, $2x - 2 = 0$

$$x = 1$$



Put $x = 1$ at y

$$y = 1^2 - 2 \cdot 1 + 3$$

$$= 1 - 2 + 3$$

$$= 2$$

$\therefore (x, y) = (1, 2)$ Ans.

P.T.O

Ans to the Que NO -5

$$W = \cos(x^2+2y) - e^{4x-z^4y} + y^3$$

$$\frac{dw}{dx} = \frac{d}{dx}\left\{\cos(x^2+2y) - e^{4x-z^4y} + y^3\right\}$$

$$= \sin(x^2+2y)\cdot(2x) - (e^{4x-z^4y})\cdot 4$$

$$= -2x\sin(x^2+2y) - 4e^{4x+z^4y}$$

$$\frac{dw}{dy} = \frac{d}{dx}\left\{\cos(x^2+2y) - e^{4x-z^4y} + y^3\right\}$$

$$= \sin(x^2+2y)\cdot 2 + 3y^2$$

$$= -2\sin(x^2+2y) + 3y^2$$

$$\frac{dw}{dy} = 4z^3y\, e^{(4x-z^4y)}$$

P.T.O

Ans to the Que NO-3.

to find the second order differential equation for 'y' with respect to 'x', will first differentiate the given equation with respect to 'x' multiple time.

Given equation,

$$\frac{d^2y}{dx^2} + 3\frac{d^2y}{dx} - 4y = x \cdot e^x$$

Lets deferatite it step by step.

(1) Take the first derivative of bouth sides with respect to x :-

$$\frac{d}{dx}\left(\frac{d^2y}{dx^2}\right) + \frac{d}{dx}\left(3\frac{d^2y}{dx}\right) - \frac{d}{dx}(4y) = \frac{d}{dx}(x \cdot e^x)$$

$$\Rightarrow \frac{d}{dx}\left(\frac{d^2y}{dx^2}\right) + 3\frac{d}{dx}\left(\frac{d^2y}{dx}\right) - 4\frac{dy}{dx} = e^x + xe^x$$

$$\Rightarrow \frac{d^2}{dx^2}\left(\frac{d^2y}{dx^2}\right) + 3\frac{d^2}{dx^2}\left(\frac{d^2y}{dx}\right) - 4\frac{d^2y}{dx^2} = e^x + xe^x$$

$$\Rightarrow \frac{d^4y}{dx^4} + 3\frac{d^3y}{dx^3} - 4\frac{d^2y}{dx^2} = e^x + xe^x$$

~~So for~~

P.T.O

So, The second-order differential equation for y with respect to x is :

$$\frac{d^4y}{dx^4} + 3\frac{d^3y}{dx^3} - 4\frac{d^2y}{dx^2} = e^x + xe^x .$$

Ans.

— o —