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Course – Differential Equation And Fourier Analysis.

Course code – MAT 325

Answer to the Question NO – 1

(1)

① (i) $y = e^{3x+2}$

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

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

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

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

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

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

$$= 9y \text{ (Ans:)}$$

② ~~$y = \log x + ax$~~

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(11)

Ans: $y = \log x + ax$

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

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

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

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

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

Answer to the Question – 2

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

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

$$= 3x^2 - 2.$$

at, $u = 0$ slope

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

$$= -2.$$

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

P.t.O

So the point is $(0, 4)$

So the equation is:

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

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

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

$[m = -2, x = 0, y = 4]$

Answer to the Question - 4

Ans:

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

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

Now; $2x - 2 = 0$

$x = 1$

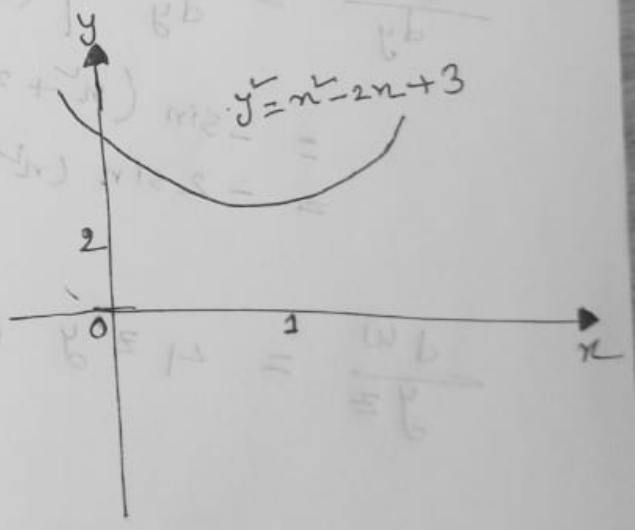
put $x = 1$ at y

$y = 1^2 - 2.1 + 3$

$= 1 - 2 + 3$

$= 2$

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



Answer to the Question NO-5

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

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

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

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

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

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

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

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

——— x ———

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 defferatite it step by step.

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

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

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

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

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

~~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—