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Course Title: Differential Equation And Fourier Analysis

Answer to the Question no: (1)

1. (i) $y = e^{3x+2}$

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

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

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

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

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

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

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

(ii) Ans: $y = \log x + ax$

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

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

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

$$= \frac{-1}{x^2} \quad \text{p.t.o.}$$

$$\therefore y_2 = -\frac{1}{x^2} \quad \text{(Ans)}$$

Answer to the question no: 2

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, $x = 0$ slop

$m = f'(0) = 3.0^2 - 2$

$= -2$

$f(0) = 3.0^2 - 2.0 + 4$

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

So, the equation is —

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

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

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

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

Ans:

Answer to the questions no: 4

4. Ans:

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

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

Now, $2x - 2 = 0$

$x = 1$

Put, $x = 1$ at y

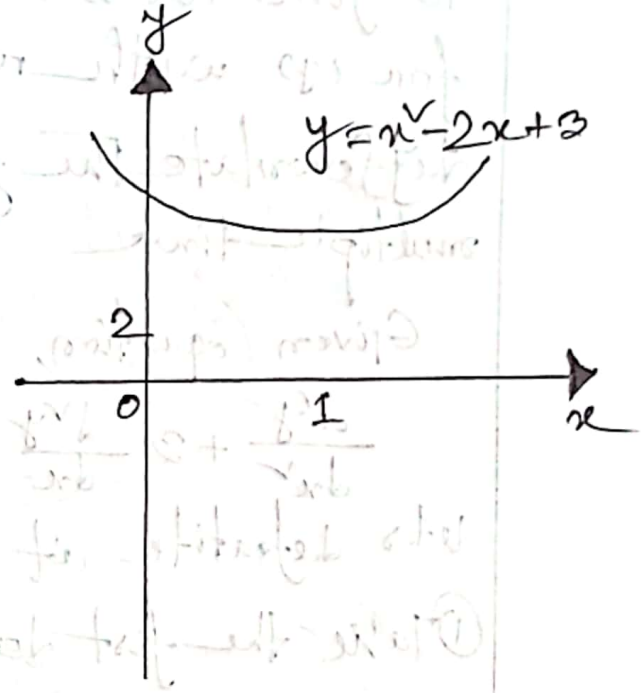
$y = 1^2 - 2 \cdot 1 + 3$

$= 1 - 2 + 3$

$= 2$

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

Ans:



P.t.o.

Answer to the question 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,

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

Lets defeatite it step by step,

(1) Take the first derivate of both sides with respect x:-

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

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

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

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

So, The second order differentate 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:)

Answer to the question no: (5)

5. Ans:

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

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

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

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

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

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

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

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

Ans: