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Semester :- Differential
Subject equation

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Q1
a) part

$$y' + (x+2)y^2 = 0$$

$$y' = -(x+2)y^2$$

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

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

$$\int y^{-2} dy = -\int (x+2) dx$$

$$\frac{y^{-1}}{-1} = -\left[\frac{x^2}{2} + 2x\right] + C_1$$

$$y^{-1} = \frac{x^2}{2} + 2x + C_1$$

$$y^{-1} = \frac{x^2}{2} + 2x + C$$

$$y = \frac{1}{\frac{x^2}{2} + 2x + C}$$

$$\tan^{-1}\left(\frac{y}{3}\right) = 3x + c$$

$$\frac{y}{3} = \tan(3x + c)$$

$$y = 3 \tan(3x + c)$$

$$y + 9x = 3 \tan(3x + c)$$

$$y = -9x + 3 \tan(x + c)$$

Q3(a).

$$4y'' - 20y' + 25y = 0.$$

Sol: -

$$y = C_1 e^{\frac{5}{2}t} + C_2 e^{-\frac{5}{2}t}$$

$$y = C_1 + C_2 t e^{-\frac{5}{2}t}$$

$$y = C_1 e^{-\frac{5}{2}t} + C_2 t e^{-\frac{5}{2}t}$$

$$y = C_1 e^{-\frac{5}{2}t}$$

$$y = C_1 t e^{-\frac{5}{2}t}.$$

Q3(b)

$$4y'' - 6y' - 7y = 0.$$

Solution: -

$$\frac{3}{x} + 4y = 7$$

$$\frac{5}{x} + 6y = 13$$

$$\text{put } \frac{1}{x} = t$$

$$3x + 4y = 7$$

$$5x + 6y = 13$$

$$(1) \times 5 - (2) \times 3$$

$$x = 5, \quad y = \frac{1}{5}$$

$$y = -2.$$

Q1 P.18)

$$y' = (y + 9x)^2$$

Sol:-

$$\text{let } y + 9x = u$$

$$\frac{dy}{du} + 9 = \frac{du}{dx}$$

$$\frac{dy}{du} = \frac{du}{dx} - 9$$

So (1) become.

$$\frac{du}{dx} - 9 = (u)^2$$

$$\frac{du}{dx} = u^2 + 9$$

$$\int \frac{1}{u^2 + 9} du = \int dx$$

$$\int \frac{1}{(3)^2 + (u)^2} du = \int dx$$

$$\frac{1}{3} \tan^{-1} \left(\frac{u}{3} \right) = x + C_1$$

$$\tan^{-1} \left(\frac{u}{3} \right) = 3x + 3C_1$$