

# Assignment 2

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**Question:** (9)  $\Rightarrow$  Solve the differential equation :

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

**Solution:**

$$\text{let } x + y = t \quad (1)$$

differentiate (1) w.r.t to  $x$

$$1 + \frac{dy}{dx} = \frac{dt}{dx} \quad (2)$$

$$\frac{dy}{dx} = \frac{dt}{dx} - 1 \quad (3)$$

now substituting the value of  $\frac{dy}{dx}$  in question

$$\frac{dt}{dx} - 1 = \frac{t + 2}{2t - 1} \quad (4)$$

$$\frac{dt}{dx} = \frac{t + 2}{2t - 1} + 1 \quad (5)$$

$$\frac{dt}{dx} = \frac{t + 2 + 2t - 1}{2t - 1} \quad (6)$$

$$\frac{dt}{dx} = \frac{3t + 1}{2t - 1} \quad (7)$$

$$\frac{2t - 1}{3t + 1} dt = dx \quad (8)$$

$$\int \frac{2t - 1}{3t + 1} dt = \int dx \quad (9)$$

$$\int \left( \frac{2}{3} - \frac{5}{3(3t + 1)} \right) dt = \int dx \quad (10)$$

$$\int \frac{2}{3} dt - \int \frac{5}{3(3t + 1)} dt = \int dx \quad (11)$$

$$\frac{2}{3} \int dt - \frac{5}{3} \int \frac{1}{3t + 1} dt = \int dx \quad (12)$$

$$\frac{2}{3}t - \frac{5 \ln(3t + 1)}{9} = x + C \quad (13)$$

$$\frac{2}{3}t - \frac{5 \ln(3t + 1)}{9} = x + C \quad (14)$$

putting the value of  $t$  from (1) in equation (14)

$$\frac{2}{3}(x + y) - \frac{5 \ln(3(x + y) + 1)}{9} = x + C \quad (15)$$

here  $C$  is constant of integration