

DIFFERENTIAL EQUATIONS

LINEAR DIFFERENTIAL EQUATIONS

EXERCISE

Q.1 Find the solutions for the following differential equations:

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

$$(2) \quad (x + 2y^3) \frac{dy}{dx} = y$$

$$(3) \quad x \frac{dy}{dx} + y = y^2 \ln x$$

$$(4) \quad xy^2 \left(\frac{dy}{dx} \right) - 2y^3 = 2x^3 \text{ given } y = 1 \text{ at } x = 1$$

Q.2 Find $\frac{dy}{dx} + \frac{3x^2}{1+x^3} y = \frac{\sin^2 x}{1+x^3}$

Q.3 Solve: $x \ln x \frac{dy}{dx} + y = 2 \ln x$

Q.4 Evaluate: $y \sin x \frac{dy}{dx} = \cos x (\sin x - y^2)$

Q.5 Solve: $\frac{dy}{dx} - \frac{y}{x} = \frac{y^2}{x^2}$

ANSWER KEY

1. (1) $\left(\frac{x^2 + 1}{x} \right) y = x \ln x - x + c$

(2) $x = y(c + y^2)$

(3) $y(1 + cx + \ln x) = 1$

(4) $y^3 + 2x^3 = 3x^6$

2. $y(1 + x^3) = \frac{1}{2}x - \frac{\sin 2x}{4} + c$

3. $y(\ln x) = (\ln x)^2 + c$

4. $y^2 \sin^2 x = \frac{2}{3} \sin^3 x + c$

5. $\frac{x}{y} = -\ln x + c$