

1a A differential equation is a relationship between an independent variable x a dependent variable y and one or more derivatives of y with respect to x .

Ex: $x^2 \frac{dy}{dx} = y \cdot \sin$

$$xy \frac{d^2 y}{dx^2} + \frac{y dy}{dx} + e^{3x} = 0$$

(b) $\Rightarrow y = Ae^{-4x} + Be^{-6x}$

(1) y is the order of differential equation
Ans: second order

1) Because, differentiation occurs twice with respect to x in order to form a differential equation.

$$y = Ae^{-4x} + Be^{-6x}$$

$$\frac{dy}{dx} = -4Ae^{-4x} - 6Be^{-6x} \quad \text{--- (1)}$$

$$\frac{d^2 y}{dx^2} = 16Ae^{-4x} + 36Be^{-6x} \quad \text{--- (2)}$$

multiply eq(1) by 6

$$6 \frac{dy}{dx} = -24Ae^{-4x} - 36Be^{-6x} \quad \text{--- (3)}$$

$$\frac{d^2 y}{dx^2} = 16Ae^{-4x} - 36Be^{-6x} \quad \text{--- (4)}$$

$$y = -\frac{1}{8} \left(6 \frac{dy}{dx} + \frac{d^2y}{dx^2} \right) + \frac{1}{12} \left(\frac{d^2y}{dx^2} + 4 \frac{dy}{dx} \right)$$

$$= -\frac{3(6 \frac{dy}{dx} + \frac{d^2y}{dx^2})}{24} + \frac{2(\frac{d^2y}{dx^2} + 4 \frac{dy}{dx})}{24}$$

$$24y = -18 \frac{dy}{dx} - 3 \frac{d^2y}{dx^2} + 2 \frac{d^2y}{dx^2} + 8 \frac{dy}{dx}$$

$$24y = -10 \frac{dy}{dx} - \frac{d^2y}{dx^2}$$

$$\frac{d^2y}{dx^2} + 10 \frac{dy}{dx} - 24y = 0$$