

MJC-04

15.10.2025

Semester III (UG)

Ordinary Differential Equations

- Unit I → (a) Formation of diff. eqn, order, degree already covered in Intermediate.
- (b) Variable separables, Homogeneous, Linear eqns also covered in Inter.

Here we will just make a fast revision of the above.

1. Given $y = Ax^2 + Bx + C$, find the associated differential equation.

Soln

$$\text{Here } y = Ax^2 + Bx + C \text{ — (1)}$$

we have to differentiate it and get it free from the constants A, B and C.

Diff. (1) w.r. to x , we get

$$\frac{dy}{dx} = 2Ax + B \text{ — (2)}$$

$$\text{Again } \frac{d^2y}{dx^2} = 2A \quad \text{and} \quad \frac{d^3y}{dx^3} = 0.$$

Since only the equation

$$\frac{d^3 y}{dx^3} = 0 \text{ is free from constants,}$$

this is the required differential equation.

2. If $y = c_1 e^x + c_2 e^{2x} + c_3 e^{3x}$, find the diff eqn.
Soln $y = c_1 e^x + c_2 e^{2x} + c_3 e^{3x}$ — (1) Differentiating w.r. to x ,

$$\Rightarrow \frac{dy}{dx} = c_1 e^x + 2c_2 e^{2x} + 3c_3 e^{3x}, \text{ — (2)}$$

$$\frac{d^2 y}{dx^2} = c_1 e^x + 4c_2 e^{2x} + 9c_3 e^{3x} \text{ — (3)}$$

$$\frac{d^3 y}{dx^3} = c_1 e^x + 8c_2 e^{2x} + 27c_3 e^{3x} \text{ — (4)}$$

The elimination of c_1, c_2 and c_3 is not easy.

So by eliminating them from (2), (3), (4) we get

$$\begin{vmatrix} e^x & e^{2x} & e^{3x} & y \\ e^x & 2e^{2x} & 3e^{3x} & \frac{dy}{dx} \\ e^x & 4e^{2x} & 9e^{3x} & \frac{d^2 y}{dx^2} \\ e^x & 8e^{2x} & 27e^{3x} & \frac{d^3 y}{dx^3} \end{vmatrix} = 0 \quad \text{or} \quad \begin{vmatrix} 1 & 1 & 1 & y \\ 1 & 2 & 3 & \frac{dy}{dx} \\ 1 & 4 & 9 & \frac{d^2 y}{dx^2} \\ 1 & 8 & 27 & \frac{d^3 y}{dx^3} \end{vmatrix} = 0$$

This is the required equation.