Differenial Equations

Equation involving derivative (derivatives) of the dependent variable(y) with respect to independent variable (variables)(x) is called a differential equation. In this chapter we study the method formation of a Differential Equation and solving of a Differential Equation.

A differential equation involving derivatives of the dependent variable with respect to only one independent variable is called an **ordinary differential equation**

eg:

$$2\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^3 = 0$$

Order of a differential equation

Order of a differential equation is defined as the order of the highest order derivative of the dependent variable with respect to the independent variable involved in the given differential equation.

eg:

$$\frac{d^2y}{dx^2} + y = 0(\text{ order } 2)$$

$$\frac{dy}{dx} = e^x(\text{ order } 1)$$

Degree of a differential equation

Degree of a DE is defined as the exponent of highest differential coefficient appearing in the equation provided the equation is made into polynomial form in all differential coefficient.

Homogenous DE

A function $F(x, y)$ is said to be **homogeneous function** of degree n if $F(\lambda x, \lambda y) = \lambda^n F(x, y)$ for any nonzero constant λ. Then the function is of the form $\frac{dy}{dx} = g(\frac{y}{x})$

To solve put $y = vx$ then

$$\frac{dy}{dx} = v + x\frac{dv}{dx}$$

. Then we can solve the DE in the variable separable form easily

First order Linear DE

DE of the form

$$\frac{dy}{dx} + Py = Q$$

where P and Q are Functions of x only

To solve

- Find I.F $= e^{\int p dx}$
- Write solution as

$$y(I.F) = \int (Q \times I.F)dx + C$$