

# Differential Equations

## 1 Order and Degree of a DE

### 1.1 Order of a DE

The order of a DE is the order of the highest order derivative it contains.

- $n$ th order DE contains  $n$  independent arbitrary constants.

### 1.2 Degree of a DE

The degree of a DE is the degree of the highest order derivative it contains when all the derivatives in the DE are free of fractional powers.

## 2 Linear DE

A DE is linear if it is expressible in the form,

$$\sum_{r=0}^n a_r \frac{d^r y}{dx^r} = Q$$

where,  $a_r, Q$  are constant or functions of  $x$

## 3 Formation of a DE

Step 1. Differentiate the given equation w.r.t the independent variable as many times as the number of arbitrary constants in it.

Step 2. Eliminate the arbitrary constants.

## 4 Solution of DE

### 4.1 Separable DE

If the DE

$$\frac{dy}{dx} = f(x, y)$$

can be written as,

$$\Psi(x) \, dx = \Phi(y) \, dy$$

then, it is called a Separable DE.

Solution of this type of DE can be found by integrating both sides w.r.t.  $x$  after separating variables.