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CLASS 11 & 12th



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# Differential Equations

misstudy



## 01. Some Definitions

**Differential Equation** An equation containing an independent variable, dependent variable and differential coefficients of dependent variable with respect to independent variable is called a differential equation.

**Order of a Differential Equation** the order of a differential equation is the order of the highest order derivative appearing in the equation.

**NOTE** ✎ The order of a differential equation is a positive integer.

**Degree of a Differential Equation :** The degree of a differential equation is the degree of the highest order derivative, when differential coefficients are made free from radicals and fractions.

**Linear and Non-Linear Differential Equations :** A differential equation is a linear differential equation if it is expressible in the form

$$P_0 \frac{d^n y}{dx^n} + P_1 \frac{d^{n-1} y}{dx^{n-1}} + P_2 \frac{d^{n-2} y}{dx^{n-2}} + \dots + P_{n-1} \frac{dy}{dx} + P_n y = Q$$

where  $P_0, P_1, P_2, \dots, P_{n-1}, P_n$ , and  $Q$  are either constants or functions of independent variable  $x$ .

i.e. a differential equation will be non-linear differential equation, if

- (i) Its degree is more than one.
- (ii) Any of the differential coefficient has exponent more than one
- (iii) Exponent of the dependent variable is more than one.
- (iv) Products containing dependent variable and its differential coefficients are present.

**Solution :** The solution of a differential equation is a relation between the variable involved which satisfies the differential equation. Such a relation and the derivatives obtained therefrom when substituted in the differential equation, makes left hand, and right hand sides identically equal.

**For example,**  $y = e^x$  is a solution of the differential equation  $\frac{dy}{dx} = y$ .

**General Solution :** The solution which contains as many arbitrary constants as the order of the differential equation is called the general solution of the differential equation.

**Particular Solution :** Solution obtained by giving particular values to the arbitrary constants in the general solution of a differential equation is called a particular solution.

## 02. Formation of Differential Equations

### Algorithm

- (I) Write the given equation involving independent variable  $x$ (say), dependent variable  $y$ (say) and the arbitrary constants.