

# MATHS PRESENTATION

## DIFFERENTIAL EQUATION

1<sup>st</sup> Year

# DIFFERENTIAL EQUATION

- A equation containing dependent variable, independent variable and the derivatives of dependent variable w.r.t independent variable is called differential equation .

- Example: -

$$\frac{dy}{dx} = \sin x$$

$$\frac{d^2y}{dx^2} = y + 2$$

# ORDER OF DIFFERENTIAL EQUATION

□ The order of differential equation is defined as the highest order derivative which occur in the equation.

□ Example: -

$$\frac{dy}{dx} = \sin x$$

1. Order is 1

$$\frac{d^2y}{dx^2} = y + 2$$

2. Order is 2

# DEGREE OF DIFFERENTIAL EQUATION

- The degree of differential equation is defined as the power of highest derivative occur in the differential equation.
- Example: -

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

- Degree is 2

# LINEAR & NON-LINEAR EQUATIONS

- A differential equation is said to be linear if the dependent variable and its derivative, which occur only in first degree and are not multiplied together.
- **Example:** - Linear

$$\frac{dy}{dx} = \sin x$$

Non-linear

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

# FORMATION OF DIFFERENTIAL EQUATION

- To obtain the differential equation from this equation we follow the following steps:-
- Step 1: Differentiate the given equation the up to number of times constants present in the equation e.g. differentiating 2 times if 2 constants are there.
- Step 2: now eliminate the constants if present.

# FORMATION OF DIFFERENTIAL EQUATION

- Example: -

$$y = Ax + B$$

$$\frac{dy}{dx} = A + 0$$

$$\frac{d^2y}{dx^2} = 0$$

# SOLUTION OF DIFFERENTIAL EQUATION BY VARIABLE SEPARABLE METHOD

□ Step 1: Separating x & y both sides

Step 2: Integrating both sides.

Example:  $\frac{dy}{dx} = x$

$$dy = x \cdot dx$$

$$\int dy = \int x \cdot dx$$

$$y = \frac{x^2}{2} + c$$



# SOLUTION OF DIFFERENTIAL EQUATION BY VARIABLE SEPARABLE METHOD

■ Example: -

$$\frac{dy}{dx} = \frac{1 + y^2}{1 + x^2}$$

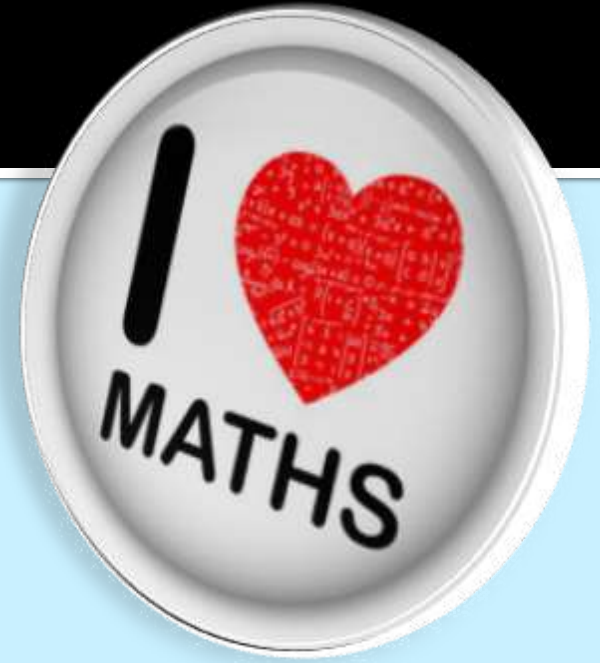
$$dy = \frac{1 + y^2}{1 + x^2} \cdot dx$$

$$\frac{dy}{1+y^2} = \frac{dx}{1+x^2}$$

*Integrating both sides*

$$\int \frac{dy}{1+y^2} = \int \frac{dx}{1+x^2}$$

$$\tan^{-1} y = \tan^{-1} x + c$$



THANK YOU

SOURCES : INTERNET , TEXT BOOK