Differential Equations

Presented to

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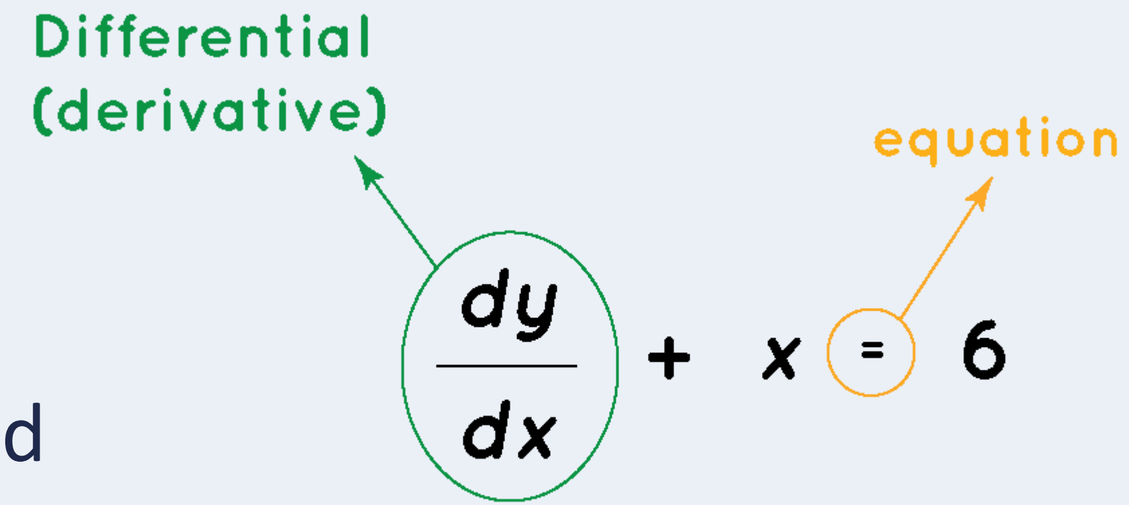
WHAT WE WILL TALK ABOUT

- Introduction
- Classification of D.E.
- Order & Degree of D.E.
- Ordinary Differential Equation
- Application of ODE
- Partial Differential Equation
- Application of PDE
- Conclusion

Introduction

An equation involving derivatives of one or more dependent variables with respect to one or more independent variables is called a ***Differential Equation(DE)***



Classification of DE
(By Type)

Ordinary Differential Equation
(ODE)

Partial Differential Equation
(PDE)

Order and Degree of DE

Order: The order of the highest order derivative present in the equation

First Order Differential Equation

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

Second Order Differential Equation

$$\frac{d^2y}{dx^2} + ny\frac{dy}{dx} + my^2 = P$$

n^{th} Order Differential Equation

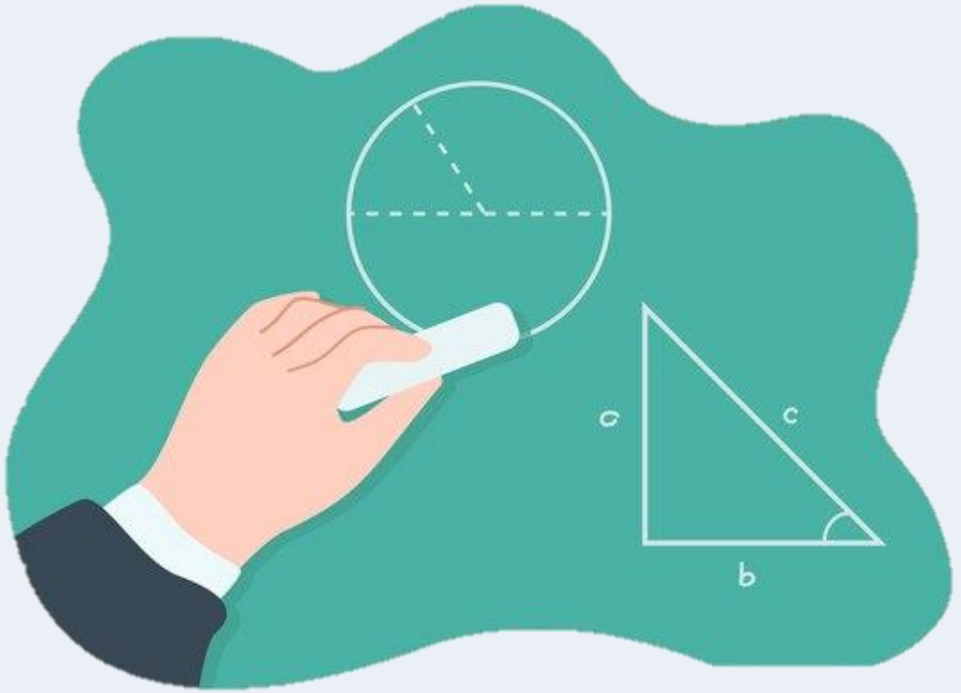
$$\frac{d^ny}{dx^n} + Py\frac{d^{n-1}y}{dx^{n-1}} + Qy^2\frac{d^{n-2}y}{dx^{n-2}} + \ldots Ky^n = I$$

Order and Degree of DE

Degree : The power to which the highest order derivative is raised

$$\frac{d^2y}{dx^2} = \left\{1 + \left(\frac{dy}{dx}\right)^4\right\}^{\frac{5}{3}}$$

Order 2
Degree 3



Ordinary Differential Equation (ODE)

An equation involving one or more ordinary derivatives of the function of one or more independent variables is called an ***Ordinary Differential Equation***

1st Order

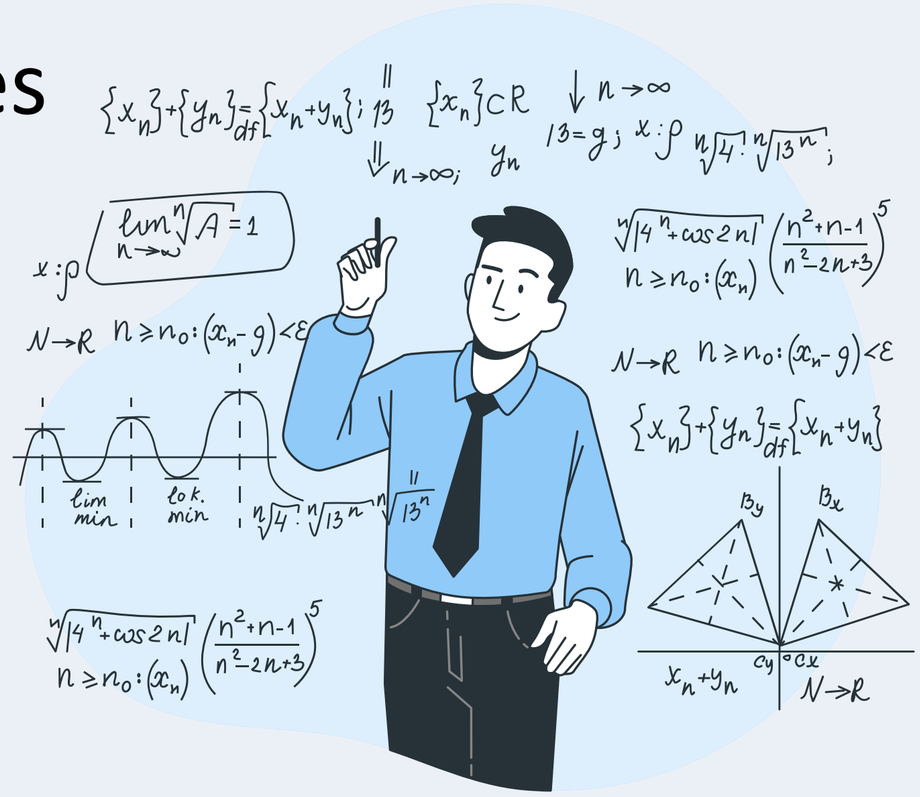
- Exact DE
- Separable of Variables
- Linear DE
- Homogenous DE
- Bernoulli DE

2nd Order

- Linear DE
- Homogenous DE
- Non-Homogenous DE
- Constant co-efficient
- Variable co-efficient

Application of ODE

- Newton's Law of cooling
- Rocket motion / falling bodies
- Growth Decay Problems
- Motion in a resisting Media
- Biological applications
- Interest Rates
- Simple chemical conversion
- Geometrical applications



Partial Differential Equation (PDE)

An equation involving two or more partial derivatives of the function of two or more independent variables is called an ***Partial Differential Equation***

Partial Differential Equations Examples

Heat Conduction Equation:

$$\frac{\partial T}{\partial t} = C\frac{\partial^2 T}{\partial x^2}$$

Laplace Equation:

$$\Delta^2\phi = \frac{\partial^2\phi}{\partial x^2} + \frac{\partial^2\phi}{\partial y^2} = 0$$

Wave Equation of a Vibrating Membrane:

$$\frac{\partial^2 u}{\partial t^2} = C\left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}\right)$$

Application of PDE

- Describing heat and light
- Building bridges and airplanes
- Setting stock and option prices
- Studying earthquakes and resources
- Understanding disease spread and substances in living things

THANK YOU!!