

Mathematics 1 - Introduction to Differential Equations

Topics : [Computer engineering](#)

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1. Definition:

- A differential equation is an equation that involves an unknown function and its derivatives.
- It expresses a relationship between the function and its derivatives in terms of one or more independent variables.

2. Types of Differential Equations:

- **Ordinary Differential Equations (ODEs):** These equations involve derivatives of a function with respect to a single independent variable.
- **Partial Differential Equations (PDEs):** These equations involve derivatives of a function with respect to multiple independent variables.

3. Order of a Differential Equation:

- The order of a differential equation is the highest order of the derivative present in the equation.
- For example, a first-order differential equation involves only first derivatives, while a second-order differential equation involves second derivatives.

4. Solution of a Differential Equation:

- A solution of a differential equation is a function that satisfies the equation when substituted into it.
- For ODEs, the solution typically involves finding an antiderivative or using methods such as separation of variables, integrating factors, or series solutions.
- For PDEs, the solution may involve techniques such as separation of variables, Fourier series, or numerical methods.

5. Initial and Boundary Conditions:

- To determine a unique solution to a differential equation, initial conditions (for ODEs) or boundary conditions (for PDEs) are often required.
- These conditions specify the values of the unknown function and its derivatives at certain points or along certain boundaries.

6. Applications of Differential Equations:

- Differential equations are used to model various phenomena in science, engineering, economics, and other fields.
- They describe processes involving rates of change, growth, decay, diffusion, wave propagation, and many other dynamic systems.

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