

Covers Material from § 1.1

Learning Goals for the section:

1. Know the following concepts: Differential Equation, Solution of a Differential Equation on an Interval, Partial and Ordinary Differential Equation, Order of a Differential Equation, Initial Condition, Initial Value Problem (IVP) for 1st order ODE.
2. Know how to check whether a given function is a solution to a given ODE or IVP.
3. Given a family of functions depending on a parameter, find values of the parameter so that an ODE or IVP is satisfied.
4. Produce a differential equation for a function whose behavior is described in English

Reminders:

1. Read the textbook!
2. Sign into Piazza, Gradescope and MyLab Math
3. Read the Course ground rules and syllabus

What is a differential eq'n?

Eq'n involving an unknown function and one or more of its derivatives.

Ex:

1. $y''(x) + y(x) = 1$ $y(x)$ unknown function of x

2. $y'(x) = y(x)$

3. $y^{(3)}(x) + 3y(x)y'(x) = 3\sin(x)$
↑
3rd derivative

$\nabla \left\{ \begin{array}{l} y^{(n)} \rightarrow n\text{-th derivative} \\ y^n \rightarrow n\text{-th power of } y \end{array} \right.$

4. $\partial_t^2 u(x,t) = \partial_x^2 u(x,t)$
↑ ↗
partial derivatives

In this class: study Ordinary Differential Equations: involves unknown function(s) of 1 variable and its derivatives

(Ex: 1, 2, 3)

not in this class { A Partial Differential Eqn: unknown fct of more than 1 variables & partial derivatives (Ex 4).

Goal: Given ODE (Ordinary dif. eqn) our goal is to find a function which satisfies it. A function which satisfies an ODE on an interval I is called a solution of the ODE.

Ex: Given $y' = y$, $y(x) = e^x$ satisfies $y'(x) = e^x = y(x)$ for all $x \in \mathbb{R}$, so it is a solution of $y' = y$ on \mathbb{R}

Note: $y(x) = Ce^x$ is a solution for any C on all of \mathbb{R} !

A family of solutions depending on one parameter C is called a one parameter family of solutions. Ex: $y(x) = Ce^x$

Warning: We can't solve most ODEs!

In this course: - learn to solve some basic ODEs.

- Use ODEs to model physical phenomena

Idea: → Have physical phenomenon

→ Describe it using math, usually by setting up a dif. eqn.

→ Try to solve eqn

→ Interpret solutions, determine whether they accurately describe the phenomenon.