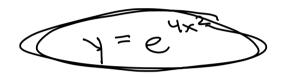
Section 1.1: Introduction to Differential
Equations derivatives
What is a derivative?  1. The instantaneous rate of change of a quantity  2. The slope of the tangent line for a function of at each x.  3. The limit $f'(x) = \lim_{n \to \infty} f(x) = $
Calculus class:  Given a function y=f(x), find  the derivative  Using appropriate rules  dx = f(x)  Like the initial function y  dx is a function of x.
Example: Let y=e4x2. Find 3x
By the chain rule,
= 8xe = 8xy

In DE's course

Example: Identify a function y that satisfies

at 8 x y

independent



A differential equation is an equation that contains the derivative of one or more function with one or more independent variables.

·Ordinary differential equations (ODE)

are DEs where all derivatives are

w.r.t. a single independent variable

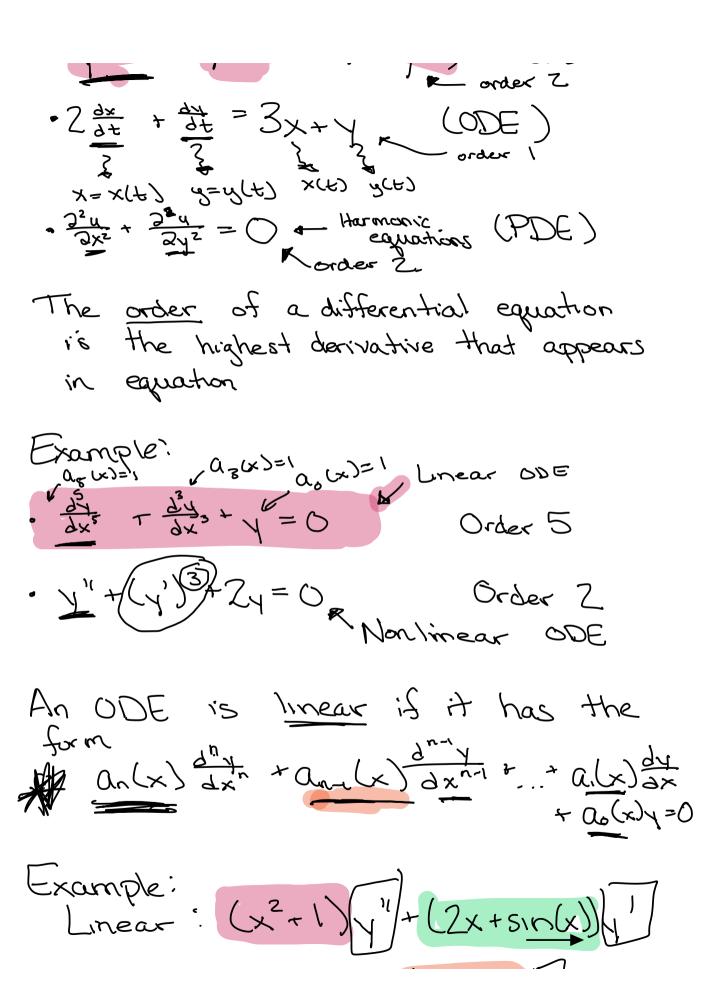
Partial differential equations (PDE)

are DEs where derivatives are

taken w.r.t. more than one

independent variable

Examples order (ODE)  $\frac{34}{3x} = 8xy \quad (ODE)$   $\frac{34}{3x} = 8xy \quad (ODE)$ 



## + (x2+2) y = 0

Nonlinear

A <u>solution</u> to a differential equation is a function that satisfies the equation

Example:  $y = e^{4x^2}$  is a solution to  $\sqrt{2x^2} = 8x \cdot e^{4x^2}$   $\sqrt{2x^2} = 2x \cdot e^{5x}$   $\sqrt{2x^2} = 2x \cdot e$