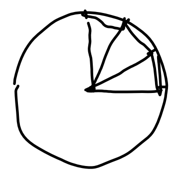
# Introduction

## History

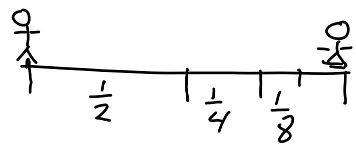
Greeks (~250 BC)

- Archimedes
  - Method of exhaustion
  - Areas and Volumes



- Zeno's Paradox

$$\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\cdots\cdots \to 1$$




Galileo (~1600)
- Velocity - Acceleration
- Free fall
- Telescope - Planets

Kepler
- Motion of Planets (Empirical)
- Three Kepler Laws

Newton (1680's)
- Motion of Planets - Calculus
- Law of Gravitation
- Laws of Motion

Leibnitz
- Co-inventor of Calculus
- Simple Notation
- Product Rule

1. Overview

# I. Differential Calculus

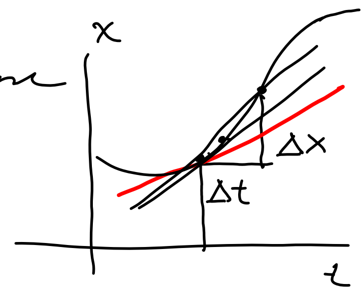
- Slope of a Curve (Slope of tangent)
- Velocity
- Idea $x = f(t)$ - Position
  - Pick pt. nearby
  - Find slope of secant

    $m_{sec} = \frac{\Delta x}{\Delta t}$

  - Let $\Delta t \to 0$

    Slope of secant → Slope of tangent

    $v = \lim_{\Delta t \to 0} \frac{\Delta x}{\Delta t}$




# II. Integral Calculus

- Area under a curve
- Idea

  Area under $y = f(x)$ between $a$ and $b$

  Let $a = x_0 < x_1 < \ldots < x_i \cdots < x_n = b$

  $\Delta x$ = Width of subinterval

- Approximate area by the sum of the rectangles

  $A \simeq f(x_0)\Delta x + \cdots\cdots f(x_{n-1})\Delta x$

  $A \simeq \sum_i f(x_i)\Delta x$

- Let $n \to \infty$ $\Delta x \to 0$

  $$A = \lim_{n \to \infty} \sum_{i=0}^{n-1} f(x_i)\Delta x \equiv \int_a^b f(x)\,dx$$