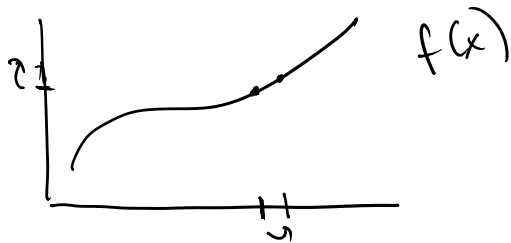


## Overview

Calculus mainly the study of functions

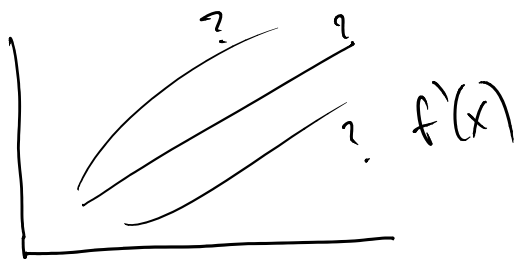
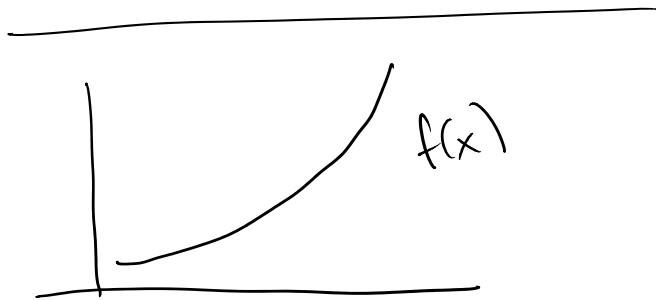
- rates of change (derivatives)
- areas under graphs (integral)



rate of change  
described by

how much change in  $y$   
per change in  $x$ .

$$\frac{\Delta y}{\Delta x} = \frac{\text{rise}}{\text{run}} = \text{slope.}$$



In practice:

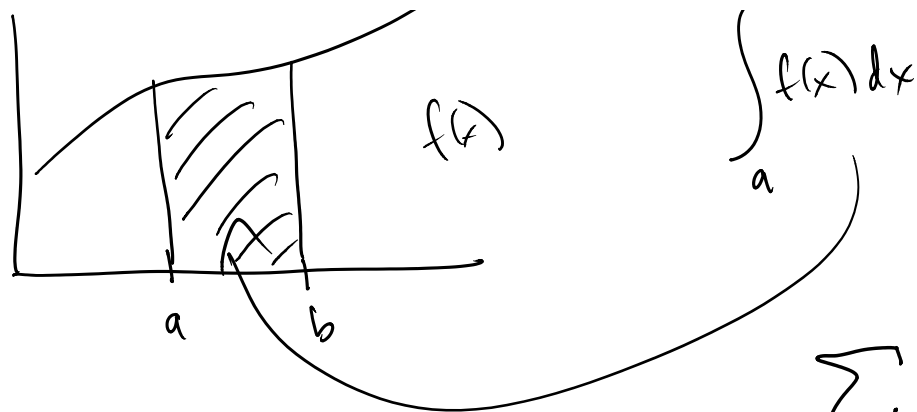
get lots of eqns involy  
rates of change -

"Differential Equations"

## Areas under curves

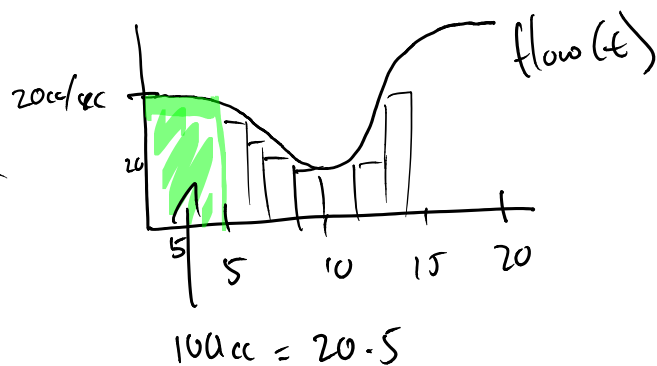
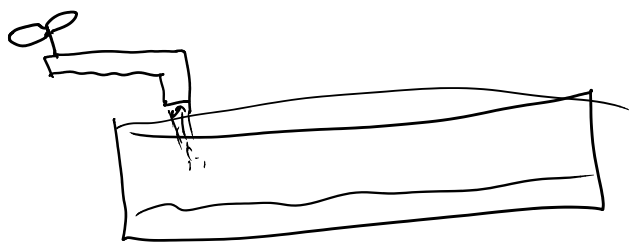


$$\int_a^b f(x) dx$$



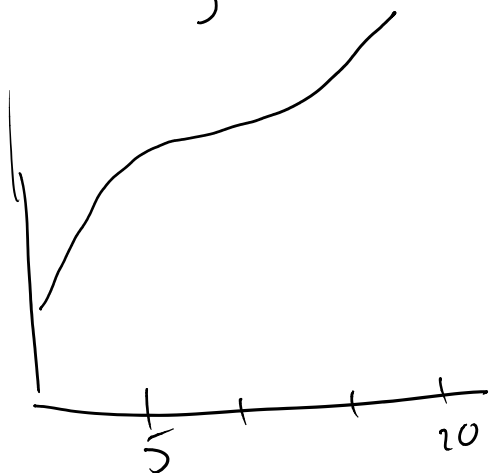
$\Sigma$  = "s" for summation

## Fundamental theorem of calculus



$$\int \text{flow} = \text{water}$$

$$\int_0^{20} \text{flow}(t) dt = \text{water}(20)$$



$\text{water}(t)$

$$\text{water}'(t) = \text{flow}(t)$$

$$\left( \int \text{flow} \right)' = \text{flow}$$

$$\int (\text{water}') = \text{water}$$

Limits : nuts & bolts.

$$\frac{dy}{dx}$$