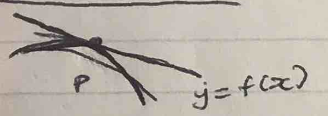
05/09/18

the tangent problem / The fundamental theorem of Calculus (connecting bridge) \ The area problem

Differential Calculus:



Find an eq
if the tangent line to a curve $y=f(x)$
@ a given point

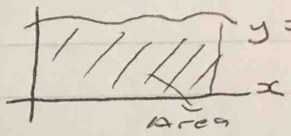
{ key

the derivative $y' = df/dx$

{ eg

- get velocity y', acceleration y'' from position y
- get marginal cost y' from cost y

Integral Calculus:



Find the area of a curved figure

{ key

the integral $\int f(x)\,dx$

{ eg

- get velocity, acceleration from position:
$y' = \int y''\,dx$,
$y = \int y'\,dx$.

Foundation: The Limit

algebraically ↓

geometrically → understanding a math concept ← numerically

↑ natural language verbally

pre-requisites Ch1 textbook

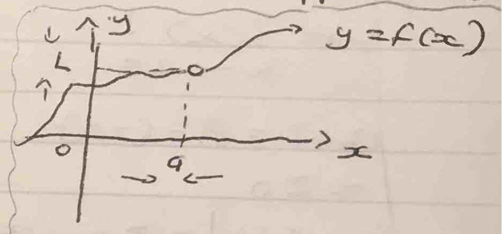
- the real field of numbers
- Co-ordinate system
- Straight lines, geometry
- Functions

Limits & Continuity

The Limit of a function:

let $y = f(x)$ be defined on some open interval that contains a except possibly @ a itself. Then the limit of $f(x)$ as x approaches a equals L:

$$\lim_{x \to a} f(x) = L$$



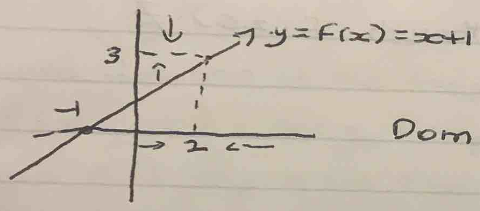
$\lim_{x \to a} f(x) = L$

Example: $\lim_{x \to 2} (x+1) = 3$

Dom f = $\mathbb{R}$

Note that $f(x) = x+1$ $\exists$ @ $x=2$

^ continous there



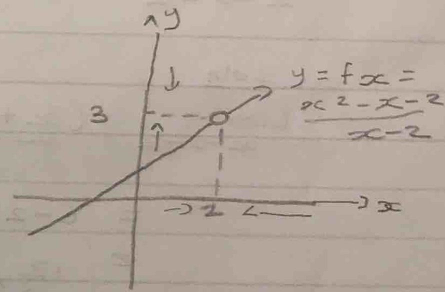
Dom f = $\mathbb{R}$

Example: $\lim_{x \to 2} \frac{x^2-x-2}{x-2}$

Dom g = $\mathbb{R} - \{2\}$

removable singularity

$\lim_{x \to 2} \frac{(x+1)(x-2)}{x-2} = 3$



Note that $g(x) = \frac{x^2-x-2}{x-2}$ $\nexists$ @ $x=2$

Example: $h(x) = \begin{cases} g(x), & x \neq 2 \\ 1, & x = 2 \end{cases}$

$\lim_{x \to 2} h(x) = 3$

Note that $h(x)$ $\exists$ @ $x=2$

^ discontinuos there.

Note $\exists$ means exists