Basic Calculus

We will start at 9.05 PM!

Please inform in your slack/whatsapp group!

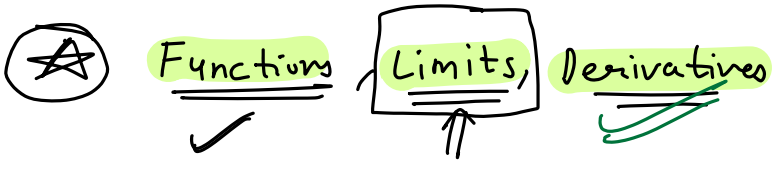
⇒ Calculus

HW for last 2-3 classes (given in class)
- can be discussed in a problem solving session.

- Share a book ref. (extra ref)

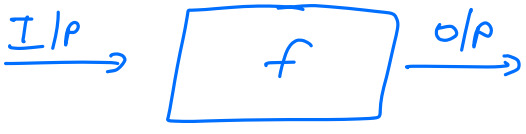
support @ scaler.com.

Put extra Q in Questions tab.!



① fn.

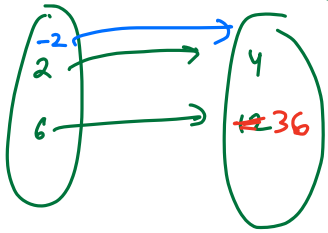
For 1 input, there is exactly 1 output.



$f(x) = x^2$

Visualise?
- → plot by hand
- → Code it up & use Python to visualize
- → use Desmos

set of input ⇐ Domain



Range ⇒ set of output.

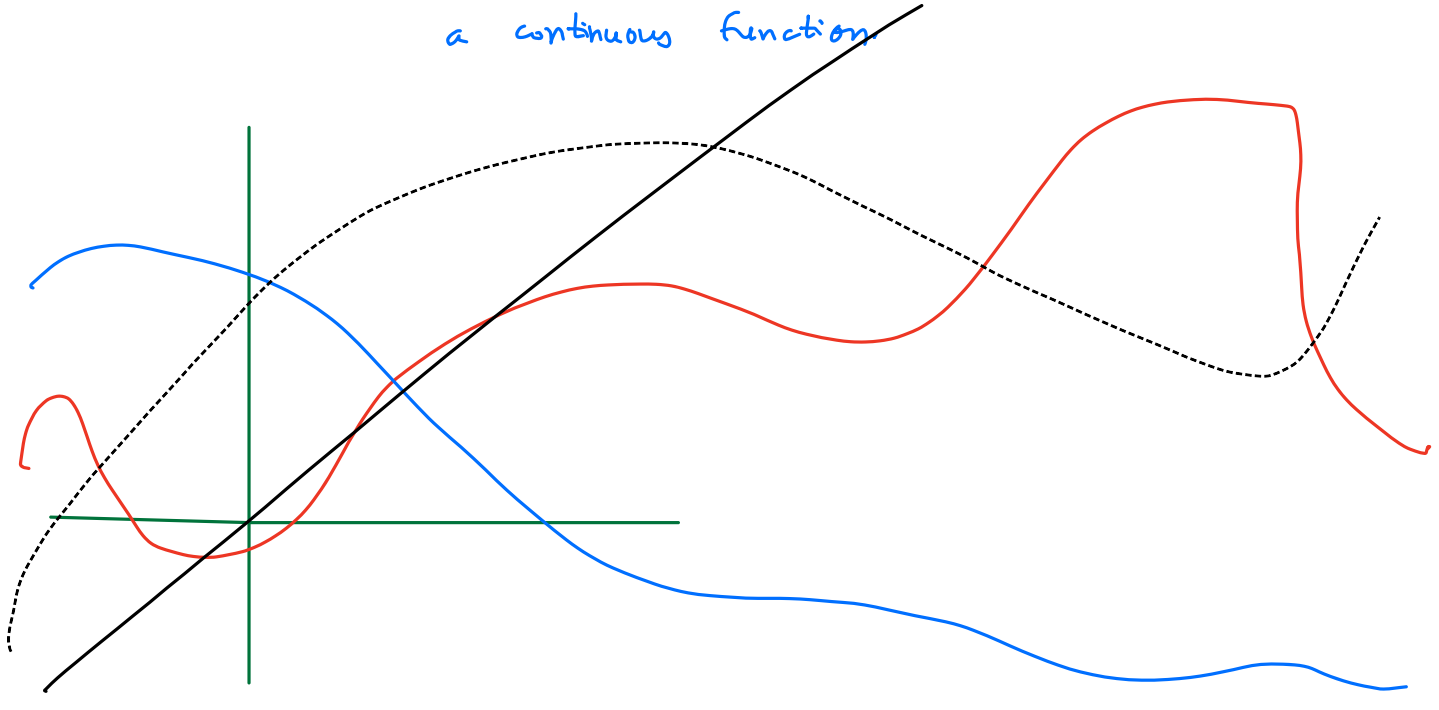
Types of Functions

1. Quadratic Fn $f(x) = x^2$
2. Line $y = mx + c$ (m: slope, c: y-intercept)
3. Exponential Fn 2^x, 3^x, e^x ($e = 2.718\ldots$)
   ↕ inverse
4. Logarithmic Fn $\log_2(x)$, $\log_3(x)$, $\log_e(x)$

   $\ln(x)$ natural log

Continuous Functions

Intuition : If while drawing the function (by hand), I don't need to lift the pen up, then it's a continuous function.



Limits

$f(x)$ $\quad x = a$

(i) Left Hand Limit

$LHL \Rightarrow \lim_{x \to a^-} f(x)$

x tends to a from left side

$a = 2$

What is the value of $f(x)$ as we are trying to reach $x = a$ from left hand side?

Left hand limit of $f(x)$

(ii) Right Hand Limit

$RHL \Rightarrow \lim_{x \to a^+} f(x)$

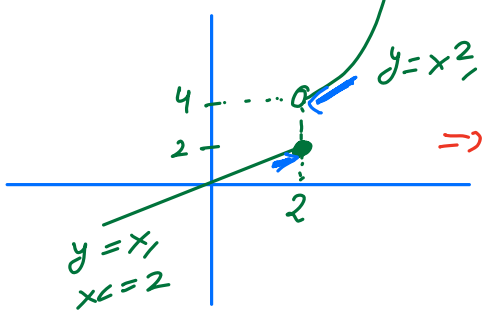
$$f(x) = \begin{cases} x^2, & x > 2 \\ x, & x <= 2 \end{cases}$$

$a = 2$

$LHL = 2$

$RHL = 4$

$\Leftrightarrow$ not equal



$\Rightarrow$ discontinuity at $x = 2$.

Summary

LHL at a = RHL at a

$\Rightarrow f^n$ is continuous at $x=a$. $\Rightarrow$ LHL = RHL

$\Rightarrow$ limit exists at $x=a$.

Test for continuity

For all the inputs x in domain of fn $f(x)$

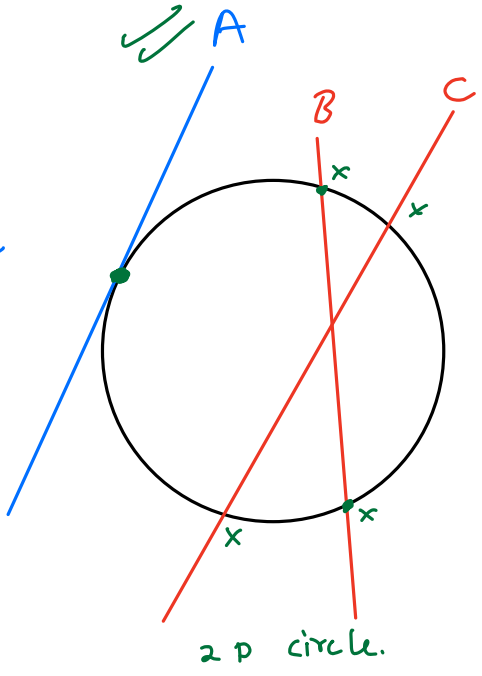
the limit should exist. (LHL = RHL at $x=a$)

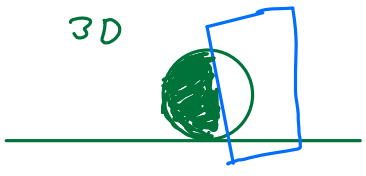
Derivatives

→ 3D $\Rightarrow$ Gradients

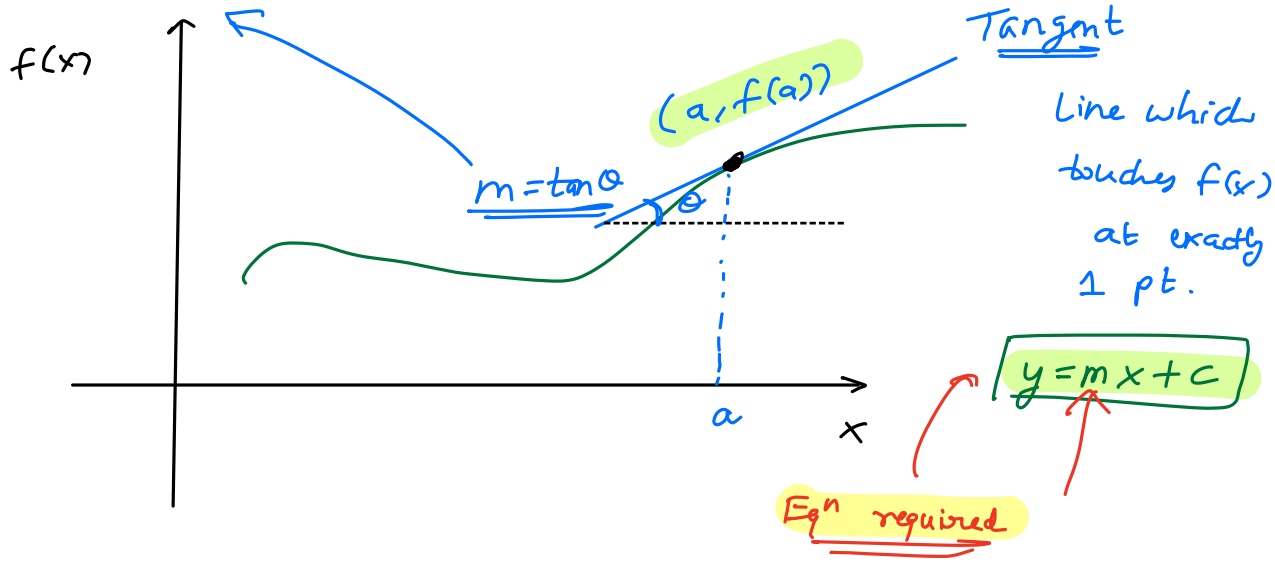
Tangent

a line which touches the curve at exactly 1 pt.

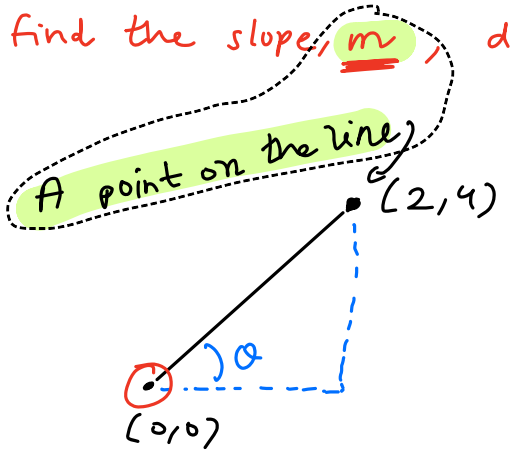




Derivative ⇒ slope of curve at a pt



To find the slope, m, derivative will be used.



$$m = \tan\theta = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4-0}{2-0} = 2$$

$$y - y_1 = m(x - x_1)$$

$$\Rightarrow y - 0 = 2(x - 0)$$

$$\Rightarrow y = 2x$$

⇒ Given a pt on the line & slope, we can get eqⁿ of the line.

Derivative Rules ⇒ Derivative is also a fⁿ.

$$f'(x) = \frac{d}{dx} f(x)$$

Rules

⓪ well known derivatives of common fn.

$f(x) = x^2$	$f'(x) = 2x$
$f(x) = mx + c$	$f'(x) = m$
$f(x) = e^x$	$f'(x) = e^x$
$f(x) = \ln x$	$f'(x) = \frac{1}{x}$

Rules ①

$$f(x) = x^n$$

$$f'(x) = n x^{(n-1)}$$

$$f(x) = x^2 \Rightarrow f'(x) = 2x^{2-1} = 2x^1 = 2x$$

$$f(x) = x^3 \Rightarrow f'(x) = 3x^{3-1} = 3x^2$$

Will attach few extra notes for derivatives.