Differentiability : Standard Result of Differentiability

Standard Result of Differentiability

Functions $f(x)$	Interval in which $f(x)$ is $Differentiable$
Polynomial	$(-\infty, \infty)$
Exponential$(a^x, a > 0)$	$(-\infty, \infty)$
Constant	$(-\infty, \infty)$
Logarithmic	Each point in its domain
Trigonometric	Each point in its domain
Inverse Trigonometric Function	Each point in its domain

$x^2 + 3x$

		Domain
①	$\log(x)$	$(0, \infty)$
②	$\log(x-1)$	$(1, \infty)$

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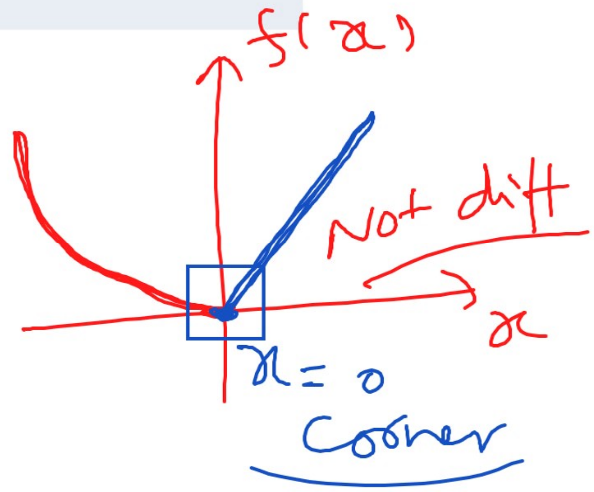
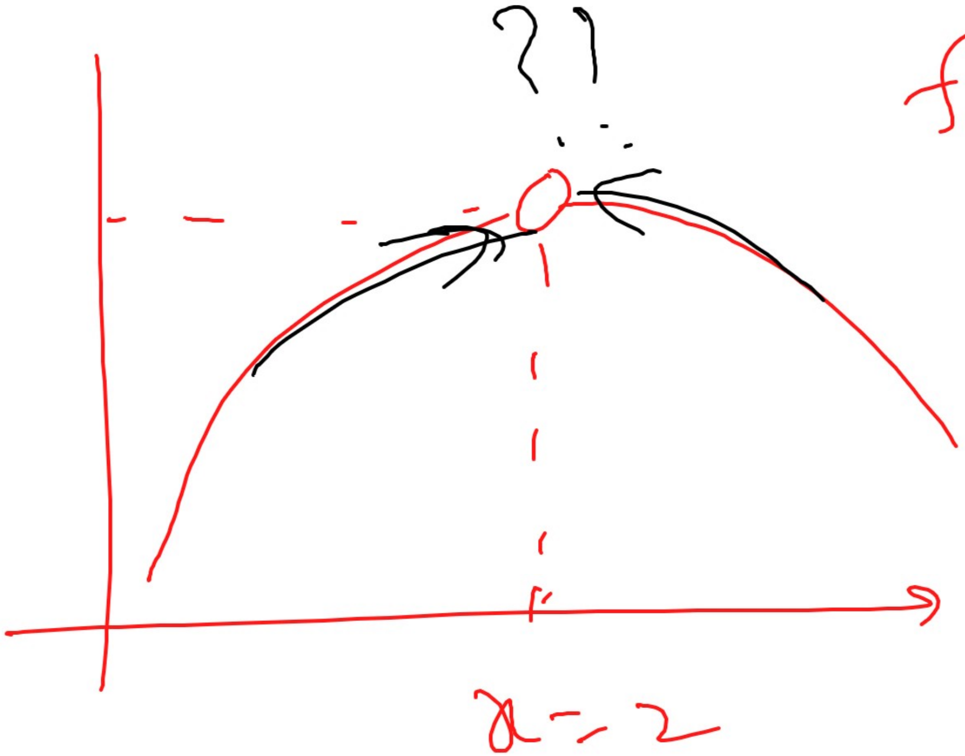
$$f(x) = \begin{cases} x^2 & x \le 0 \\ \frac{3x}{2} & x > 0 \end{cases}$$

$LHD = 0 \neq RHD = \frac{3}{2}$





$f(x) = \boxed{}$ $x \neq 2$

$f(2) = ?$

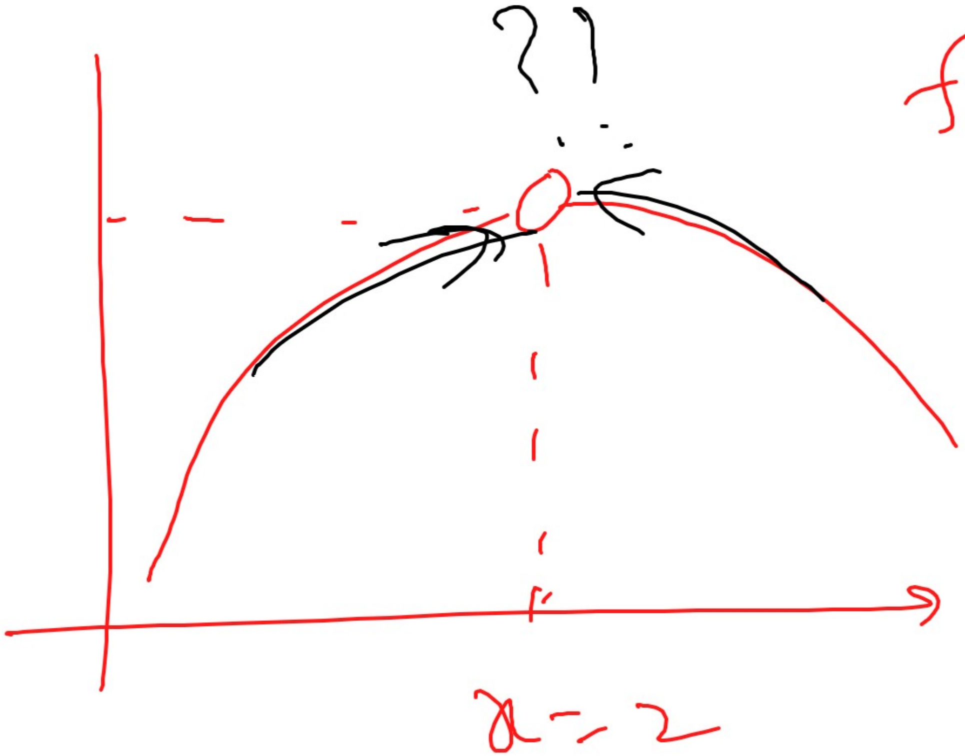
LHL = RHL

$\Downarrow$

limit exists

Removable

LHL = RHL = $f(2)$



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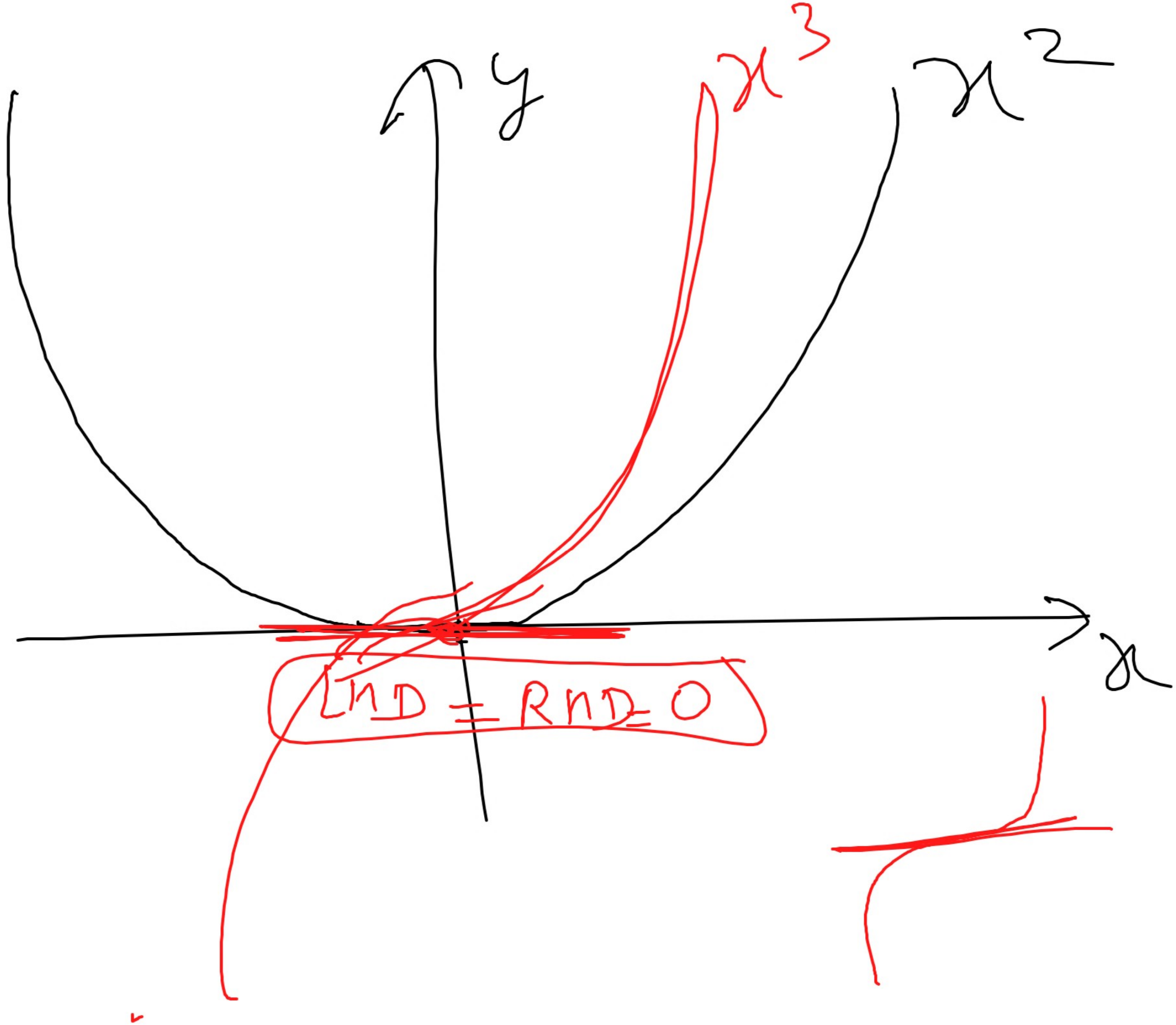


$f(x)$

$\frac{df}{dx}$

$\frac{df}{dx}$

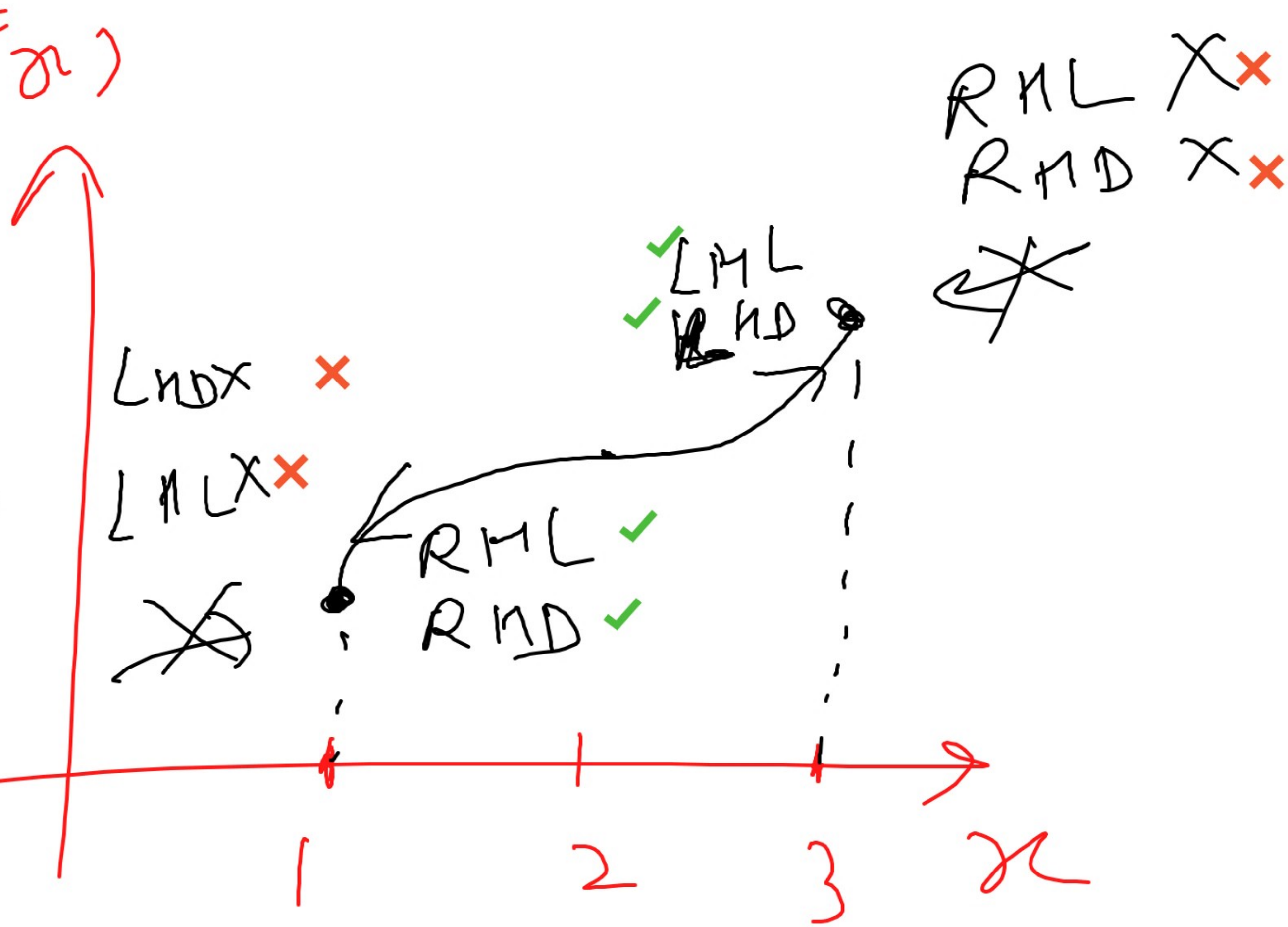
f

$\frac{df}{dx}$

$= 1$

$= 3$

endpoints



$f(x)$ is defined $1 \leq x \leq 3$

LIMIT: Basic Limit Definition

Let f(x) be defined in an open interval about **x=a**

BUT Not defined at **x=a**

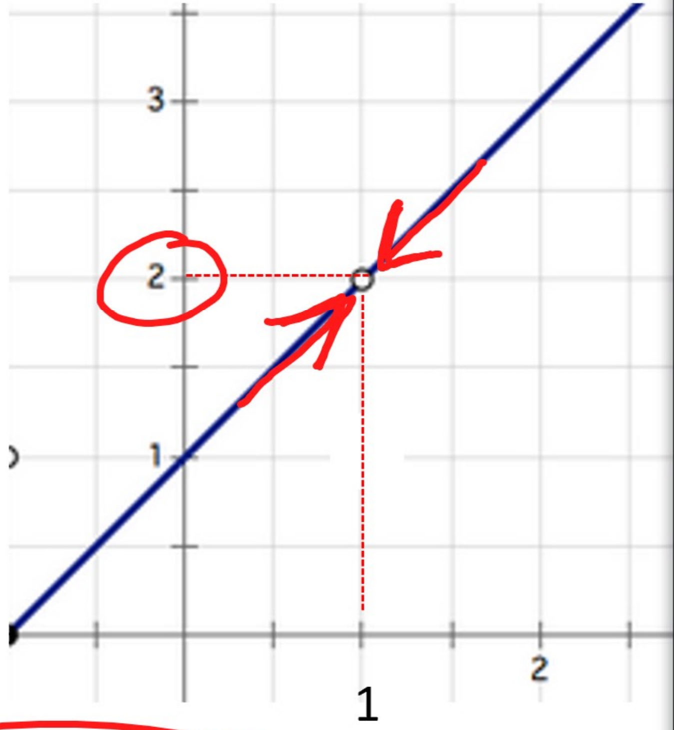
Then, if for all x close to '**a**', f(x) will get an arbitrarily value close to a unique numb

$$\boxed{let\ f(x) = \frac{x^2-1}{x-1}}$$

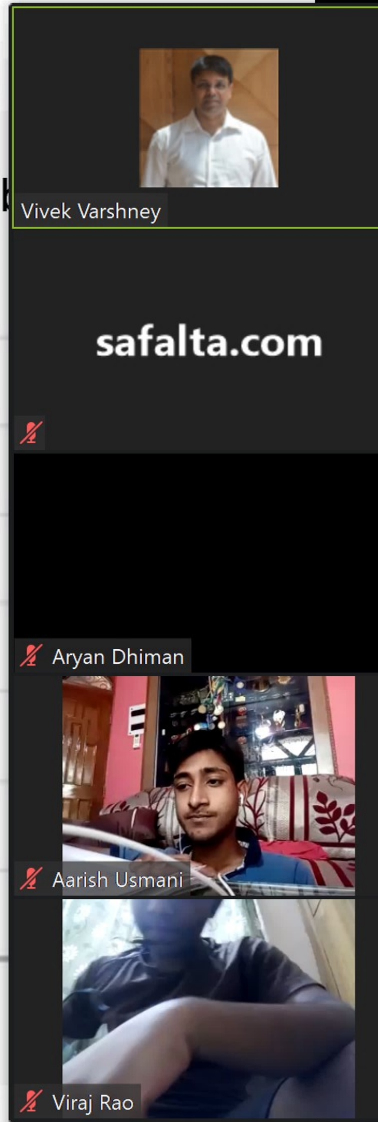
f(1) is undefined

$$f(x) = \frac{(x-1)(x+1)}{(x-1)} = x+1$$

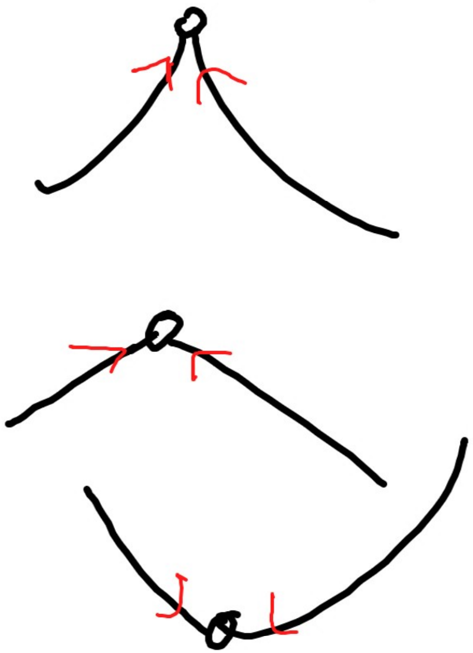
$$\lim_{x\to 1} f(x) = 2$$

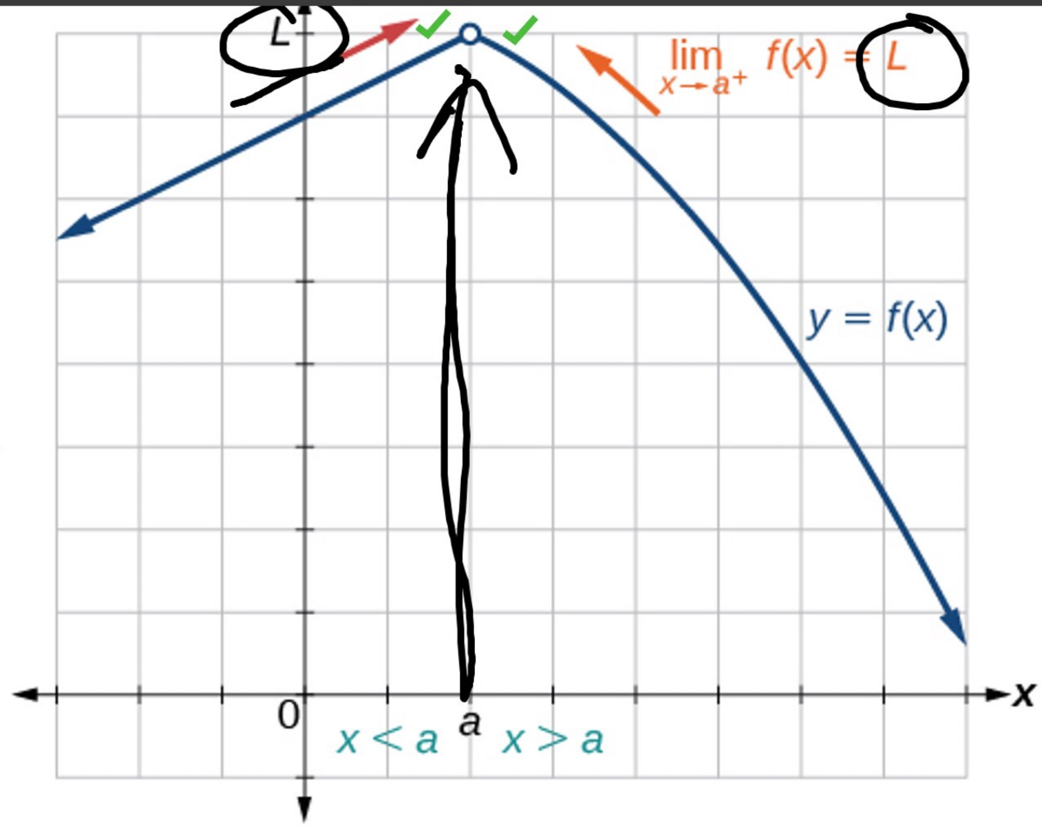


LHL = RHL → limits equal



LIMIT: LHL and RHL





Left hand limit(L.H.L) = $\lim_{x\to a^-} f(x)$

Put x= a - h

L.H.L = $\lim_{h\to 0^+} f(a-h)$ $= L$

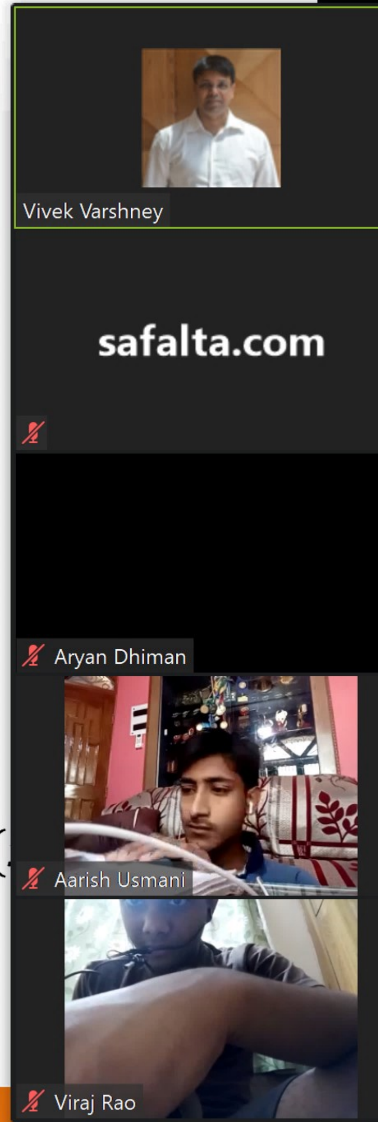
Right hand limit (R.H.L) = $\lim_{x\to a^+} f($

Put x= a + h

R.H.L= $\lim_{h\to 0^+} f(a+h)$ $= L$

Limit exits if and only L.H.L = R.H.L

Therefore, you will have to check both the limits (LHL and RHL)



Theorems of Limit: Limit Application to Fraction

Limit can be applied to both Numerator and Denominator

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

Denominator should be a **Non zero** l

ex: $\boxed{\lim_{x\to 0}\frac{1+sinx}{2cos^2x}} \rightarrow \frac{1}{2}$

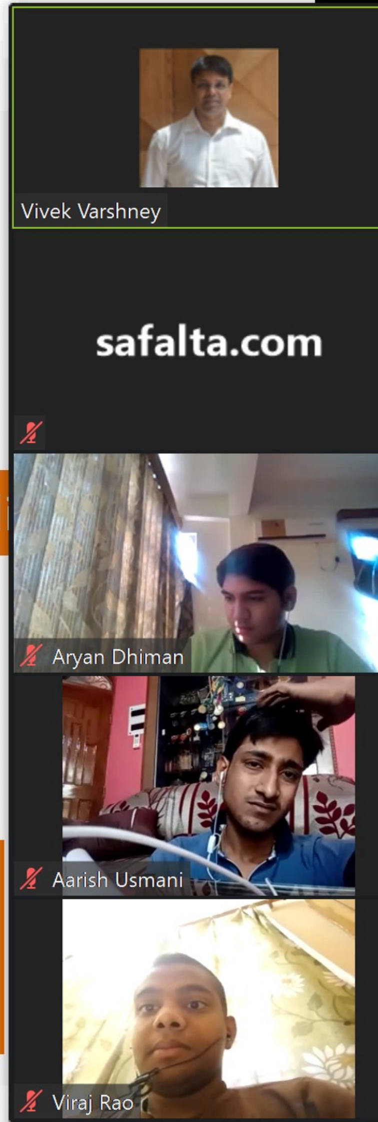
$$= \frac{\lim_{x\to 0} 1 + sinx}{\lim_{x\to 0} 2cos^2x}$$

$$= \frac{1}{2}$$

$2(\cos^2 0) = 2(1^2)$

Note here → Cos 0 is not zero;

Therefore we could applied Limit like this.



Theorems of L
Fraction

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