Limit: Indeterminate Form $\frac{\infty}{\infty}$ form

$\frac{\infty}{\infty}$ form

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

Think like to divide numerator and denominator by largest term

when x → a , $f(x) \to \pm\infty$, $g(x) \to \pm\infty$

$$ex: \lim_{x \to \infty} \frac{x^2 + 1}{2x^2 - x + 2}$$

$$\Rightarrow \lim_{x \to \infty} \frac{1 + \frac{1}{x^2}}{2 - \frac{1}{x} + \frac{2}{x^2}} = \frac{1}{2}$$

See here x^2 *is the largest term*

Therefore divide numerator and denominator by x^2

Limit: L'Hospital Rule

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L'Hospital Rule only applicable for $\frac{0}{0}$ or $\frac{\infty}{\infty}$ form

$$if \lim_{x\to a} f(x) = 0 \; and \; \lim_{x\to a} g(x) = 0$$

OR

$$if \lim_{x\to a} f(x) = \pm\infty \; and \; \lim_{x\to a} g(x) = \pm\infty$$

$$then \lim_{x\to a} \frac{f(x)}{g(x)} = \lim_{x\to a} \frac{f'(x)}{g'(x)}, where \; g'(x) \neq 0$$

Zoom Group Chat

From A.S to Me: (Privately)
1

From krishnanshu Bhadauria to Me: (Privately)
yes

From Aryan Dhim... to Me: (Privately)
YES

From Yash Kumar Saxena to Me: (Privately)
Yes sir

To: Murari Prajapati (Privately)
Type message here...

$\lim_{x\to 0} \frac{\sin x}{x} = 1$

$\frac{0}{0}$

L'H rule

$\lim_{x\to 0} \frac{\cos x}{1}$

$= \frac{\cos 0}{1}$

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

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Aarish Usmani

Viraj Rao

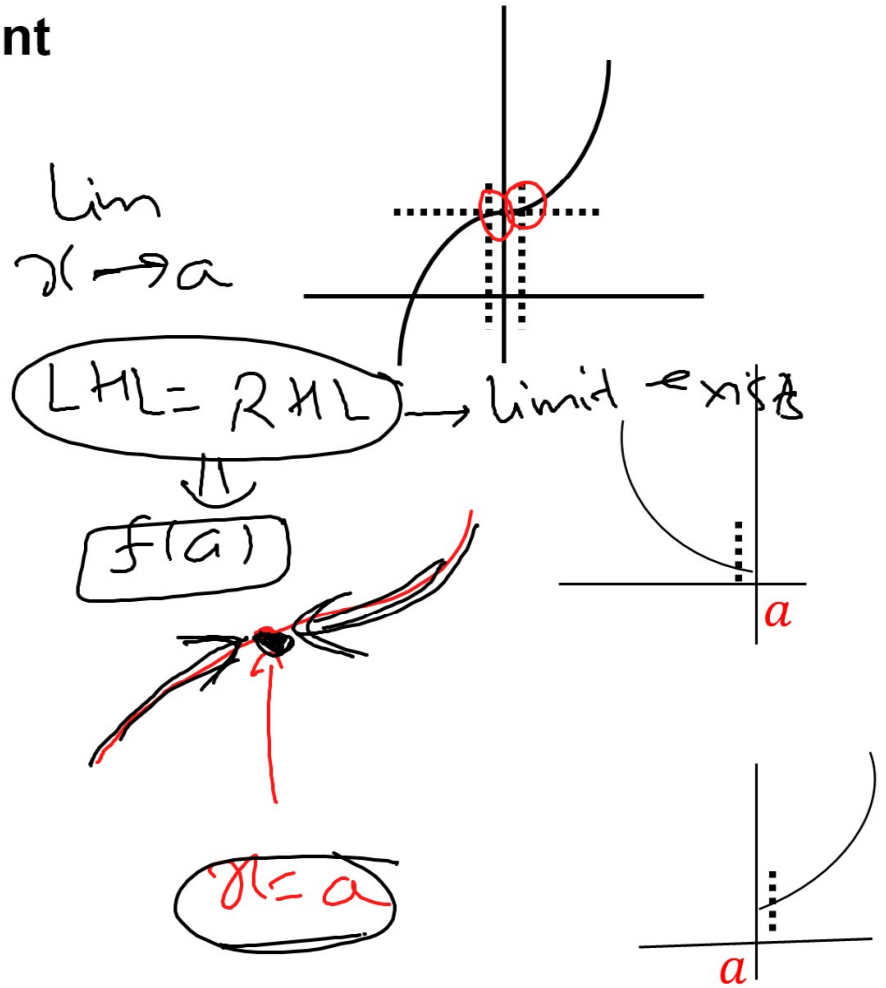
Remember:

Always Differentiate f(x) and g(x) separately

Continuity

Continuity at an interior point

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



One-sided Continuity :-

Left continuous at $x = a$

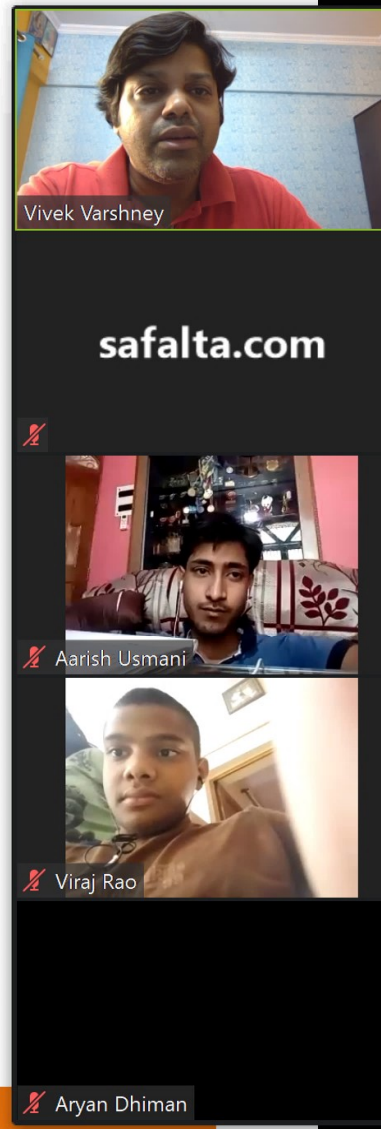
$$\lim_{x \to a^-} f(x) = f(a)$$

Right Continuous at $x = a$

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

Condition of Continuity ⟶ **L.H.L = f(a)= R.H.L**

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

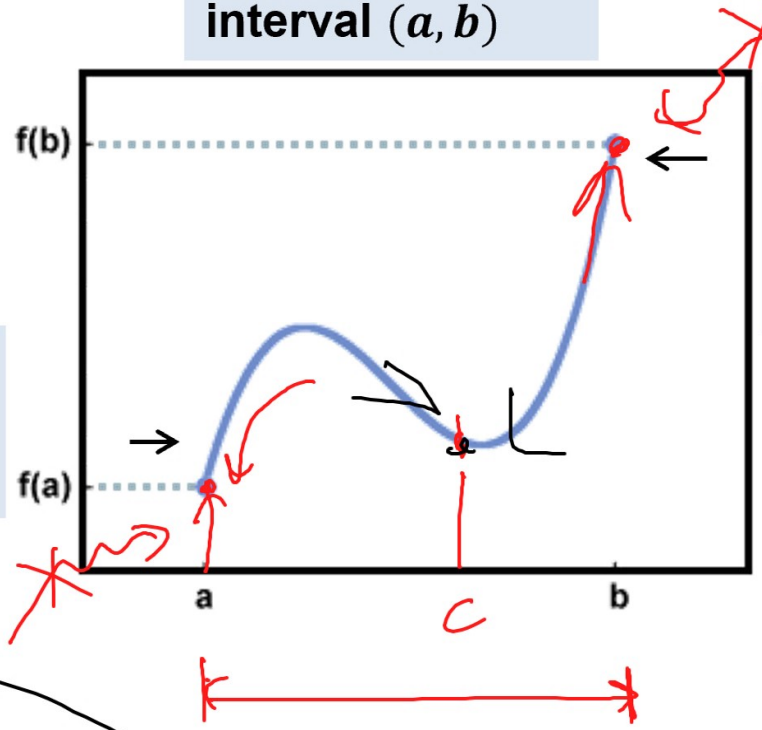


Continuity Over a Closed Interval

All elementry functions are continuous at each point in their Domain

Continuity over a closed interval $[a, b]$:-

1) Continuity over an open interval (a, b)



2) Right Hand continuous at $x = a$

$$(\mathrm{R.H.L}) = f(a)$$

3) Left Hand continuous at x

b $(\mathrm{L.H.L}) =$

$f(b)$

$x \to c$

LHL = f(c) = RHL

domain

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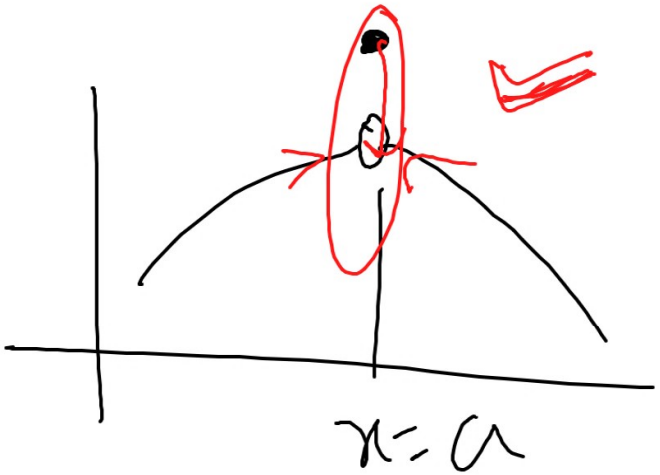
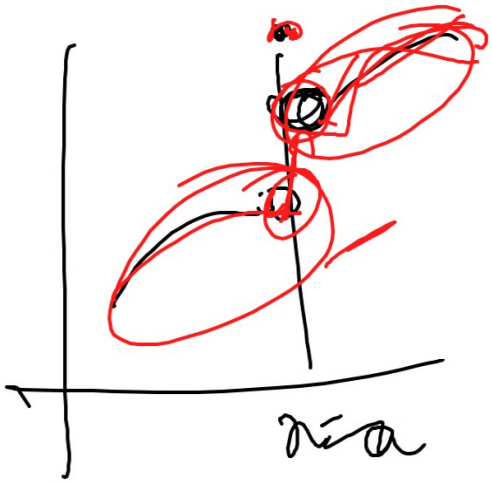
1) **Removable Discontinuity** $\quad L.H.L = R.H.L \neq f(a)$

2) **Irremovable Discontinuity** $\quad$ Limit of function does not exist

Condition for identifying type of discontinuity



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. Let $f(x) = \begin{cases} -2\sin x & \text{if } x \le -\frac{\pi}{2} \\ A\sin x + B & \text{if } -\frac{\pi}{2} < x < \frac{\pi}{2}; \\ \cos x & \text{if } x \ge \frac{\pi}{2} \end{cases}$

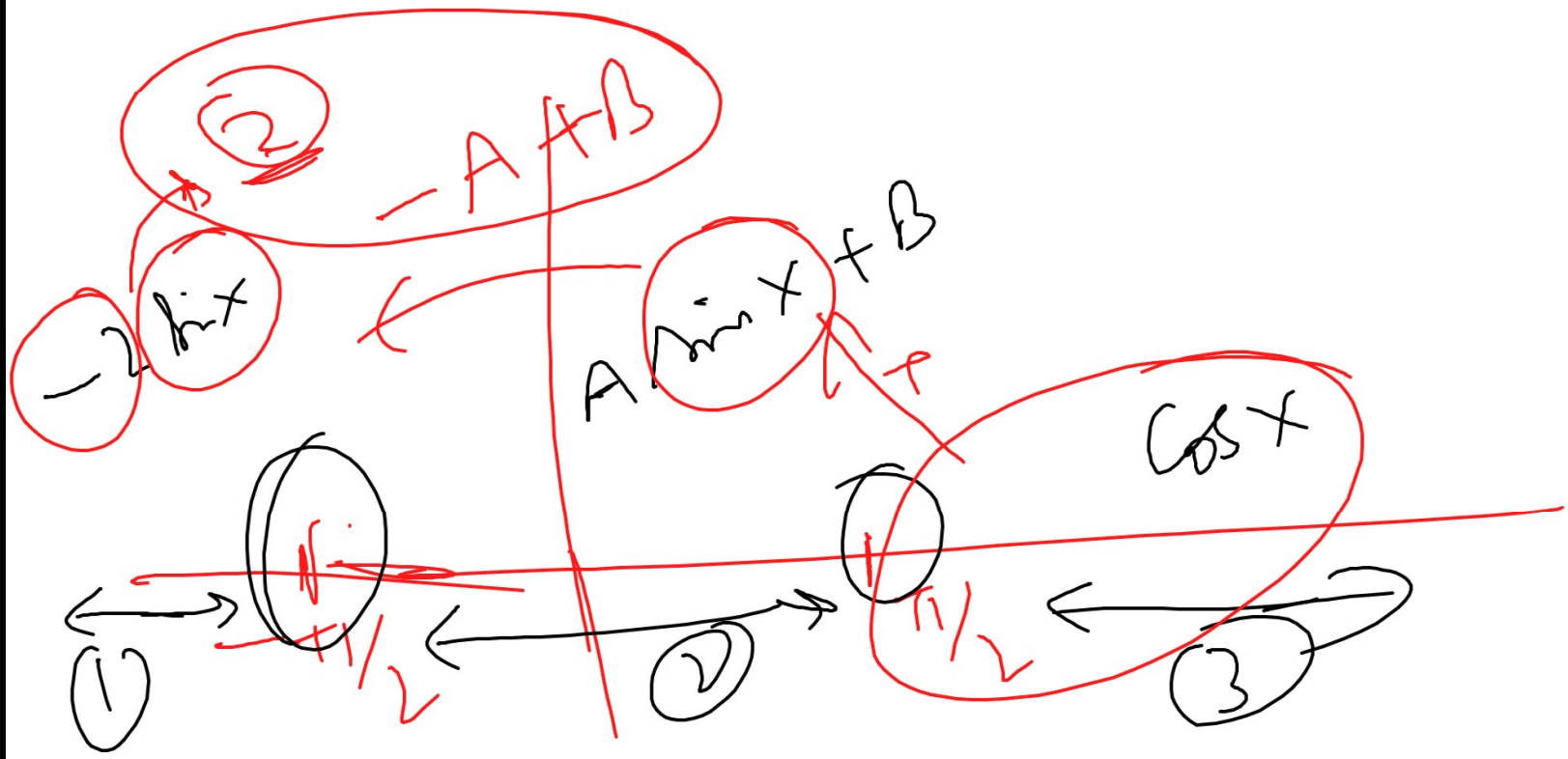
For what values of A and B, the function $f(x)$ is continuous throughout the real line ?

(A) $A = 1, B = 1$ (B) $A = -1, B = 1$

(C) $A = -1, B = -1$ (D) $A = 1, B = -1$

$-A+B=+2$ — (1)

$A+B=0$ — (2)



. Let $f(x) = \begin{cases} -2\sin x & \text{if } x < -\frac{\pi}{2}; \\ A\sin x + B & \text{if } -\frac{\pi}{2} < x < \frac{\pi}{2}; \\ \cos x & \text{if } x \geq \frac{\pi}{2} \end{cases}$

For what values of A and B, the function $f(x)$ is continuous throughout the real line ?

(A) $A = 1, B = 1$ (B) $A = -1, B = 1$

(C) $A = -1, B = -1$ (D) $A = 1, B = -1$

$-A + B = 2$ — (1)

$A + B = 0$ — (2)

At $x = -\frac{\pi}{2}$

LHL $\quad -2\sin\left(-\frac{\pi}{2}\right) = -2(-1) = +2$

RHL $\quad A\sin\left(-\frac{\pi}{2}\right) + B = -A + B$

Check Continuity @ Border