

Limit:

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



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An Initiative by अमरउत्तमा

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

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

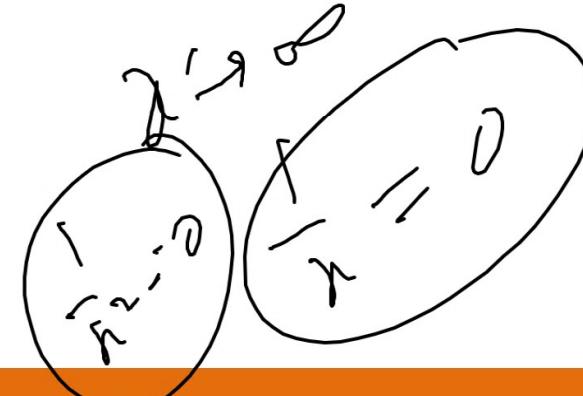
Think like to divide numerator and denominator by largest term

when $x \rightarrow a$, $\begin{cases} f(x) \rightarrow \pm\infty \\ g(x) \rightarrow \pm\infty \end{cases}$

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

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

See here x^2 is the largest term
Therefore divide numerator and denominator by x^2



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Limit: L'Hospital Rule



L'Hospital Rule only applicable

for $\frac{0}{0}$ or $\frac{\infty}{\infty}$ form

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

OR

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

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

Remember:

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

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...

$$\frac{\sin x}{x} = 1$$

$$\frac{0}{0}$$

'H rule

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

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

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

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Continuity

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Continuity at an interior point

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

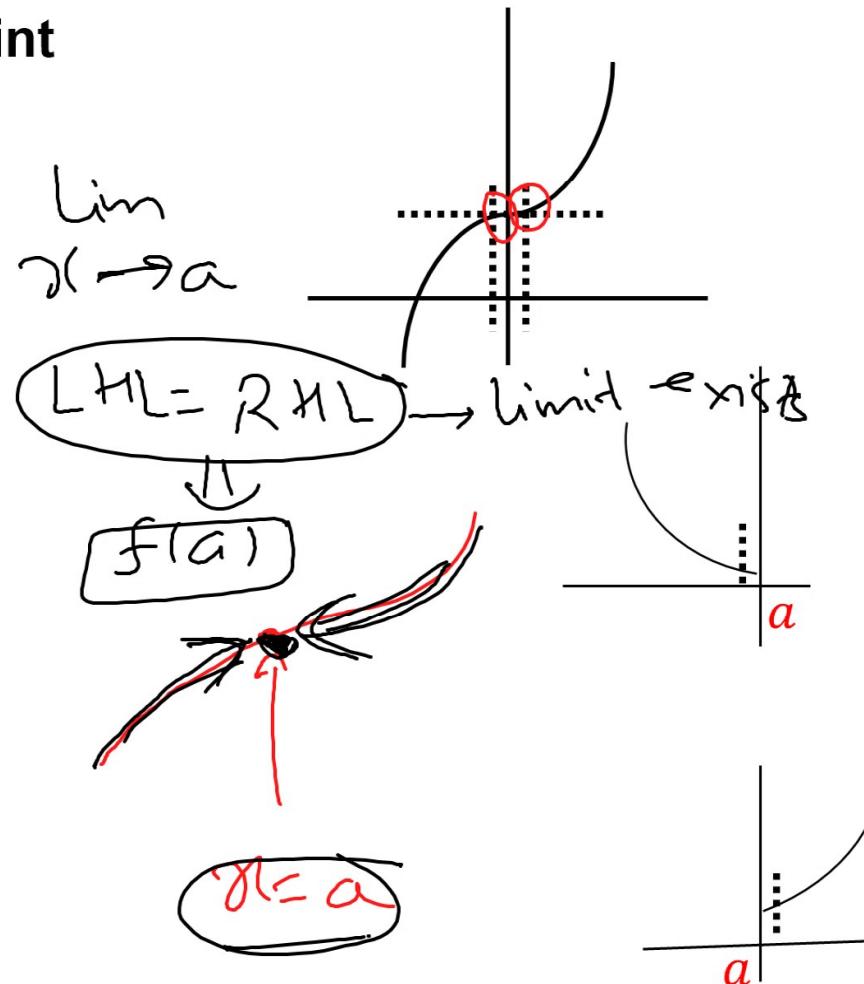
One-sided Continuity :-

Left continuous at $x = a$

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

Right Continuous at $x = a$

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



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.



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Continuity Over a Closed Interval

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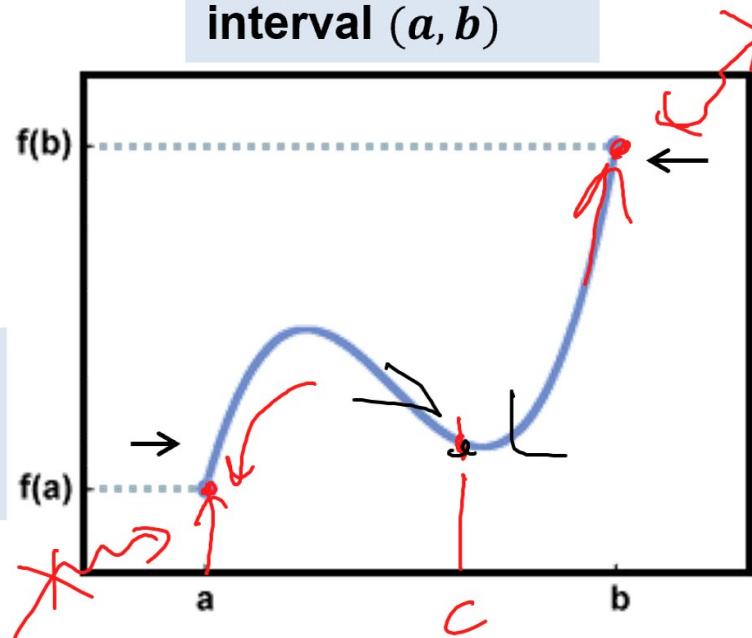
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All elementary functions are continuous at each point in their Domain

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

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



2) Right Hand continuous at $x = a$
(R. H. L) = $f(a)$

3) Left Hand continuous at $x = b$
(L. H. L) = $f(b)$

$x \rightarrow c$
 $LHL = f(c) = RHL$
domain



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Types of Discontinuity

Mute

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Select

T

Draw

✓

Stamp

Spotlight

Eraser

Format

Undo

Redo

Clear

Save

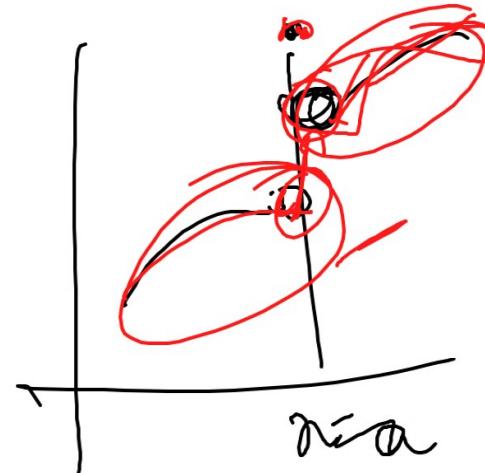
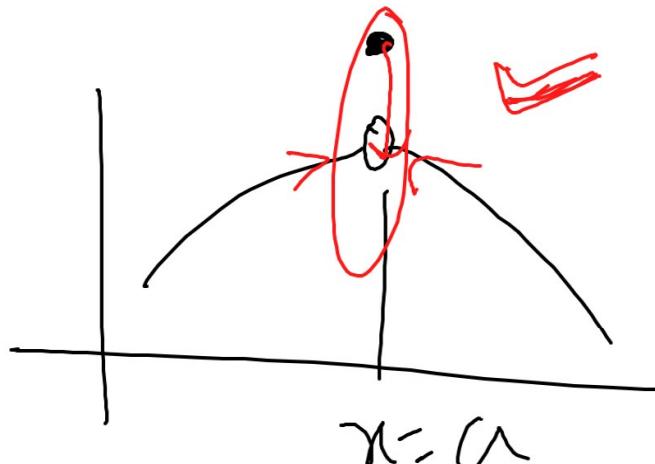
1) Removable Discontinuity

$L.H.L = R.H.L \neq f(a)$

2) Irremovable Discontinuity

Limit of function does not exist

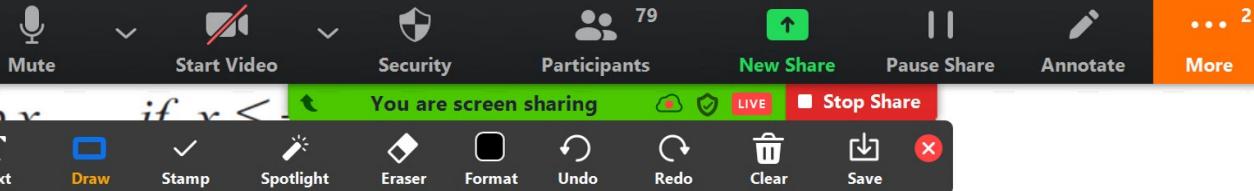
Condition for identifying type of discontinuity



A screenshot of a video conference interface. On the right side, there are four participant windows:

- Vivek Varshney: A man in a white shirt.
- safalta.com: The company logo.
- Aarish Usmani: A young man in a blue shirt.
- Viraj Rao: A young man in a grey shirt.
- Aryan Dhiman: A young man in a dark shirt.

The main screen shows a mathematical diagram illustrating discontinuities, with red annotations overlaid on the graph.



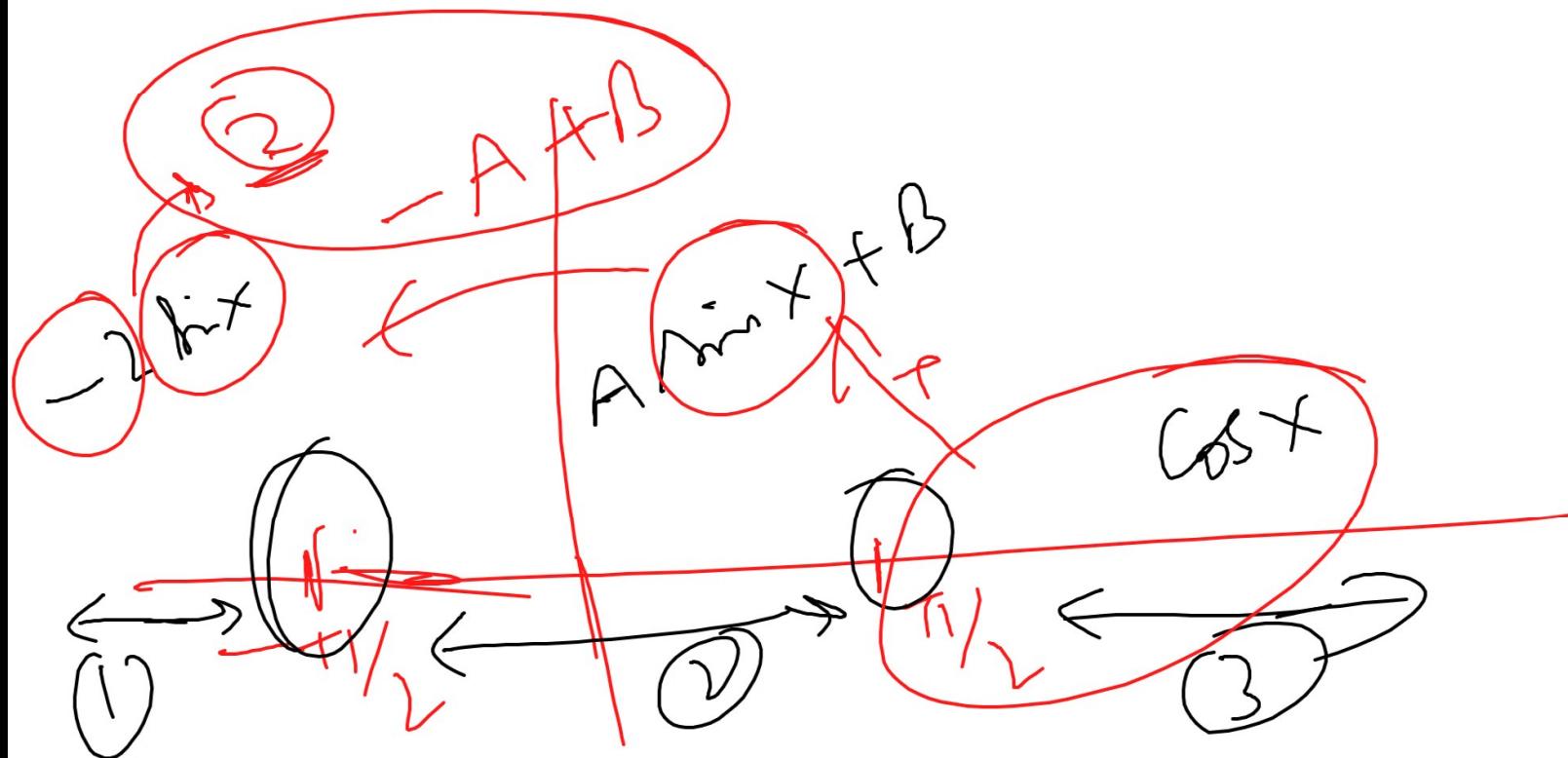
Let $f(x) = \begin{cases} -2 \sin x & \text{if } x < -\frac{\pi}{2} \\ A \sin x + B & \text{if } -\frac{\pi}{2} < x < \frac{\pi}{2}; \\ \cos x & \text{if } x \geq \frac{\pi}{2} \end{cases}$

$$-A + B = +2$$

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) $A = 1, B = -1$

$$A + B = 0$$



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

$$-A + B = 2$$

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) $A = 1, B = -1$

$$A + B = 0$$



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Viraj Rao

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

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

Check continuity @ Border