

$$4 - \left(\underline{2\sin^2 x} + \underline{2\sin x} \right) > 0$$

A handwritten diagram on a white background. It features a wavy line labeled 'Ox' at its left end. Two parallel straight lines run from the right side towards the left, intersecting the wavy line. A small circle is drawn near the intersection point where the wavy line crosses the lower parallel line.

$$\sin n = 1$$

$$5^{\circ} \quad LHL = \lim_{x \rightarrow 0^+} \frac{u \ln 2}{\ln(1+x)} = \frac{\ln 2}{\ln 1} = \infty$$

$$\lim_{x \rightarrow 0^+} f(x) = 0$$

$$\lim_{x \rightarrow 0^+} \frac{2\sqrt{x} + (e^{x^2} - 1)x^{3/2}}{x^2} = 0$$

$$\lim_{x \rightarrow 0^+} (x + f(x) - 2 + \sqrt{3}) = 0 \quad \forall x \in R$$

$$R_{\text{RL}} = \lim_{n \rightarrow 0} x$$

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$$n = \sqrt{3} \quad x \neq \sqrt{3}$$

$$f(n) = 2 - \sqrt{3} - n \quad | \quad f(n) =$$

$$\lim_{x \rightarrow \sqrt{3}} f(x) = 2 - 2\sqrt{3} = f(\sqrt{3})$$

$$n=4 \text{ or } 5 \quad (0, n\pi)$$

$$\sin^2 x - \sin x - 1 = 0$$

$$\sin x = \frac{1 - \sqrt{5}}{2}$$

$$x = -1 \quad \text{RHL} = -3$$

$$f(-1) = -3$$

$3x \in \mathbb{Z}$

$$\frac{\cos x - \cos bx}{x^2} = \frac{\cos -1}{x^2} + \frac{1 - \cos bx}{(bx)^2} b^2$$

$$x = 1$$

$$g(x) = 2$$

$$g(x) = 3$$

$$\lim_{x \rightarrow 1} \left[\frac{3x}{3} + \frac{3x+1}{3} + \frac{3x+2}{3} \right] = 1 \left(b^2 - 1 \right)$$

limit
 standard results
 series
 sandwich

6. $\lim_{n \rightarrow 0} \frac{e^{2n} - 1}{(e^{2n} - 1)^2}$

$\boxed{k-1 = 2}$

$=$

The handwritten derivation shows the simplification of the limit expression. The top part shows the original fraction with terms $(e^{2n}-1)$ and $(k-1)x$. The bottom part shows the simplified form $(e^{2n}-1)^2$ with a denominator of $2n$.

Differentiability in $[a, b]$

- $x \in (a, b)$ $LHD = RHD = \text{finite}$
- $x = a$, $RHD = \text{finite}$
- $x = b$, $LHD = \text{finite}$

$x \in [a, b]$

* $x \in (a, b)$ $LHD = RHD = \text{finite}$

* $x = a$, $RHD = \text{finite}$

Differentiability in (a, b)

- * $x \in (a, b)$, $LHD = RHD = \text{finite}$

Relation b/w Cont. & Differentiability

$$\lim_{x \rightarrow a} \frac{f(x) - f(a)}{x - a} = l.$$

Differentiable \Rightarrow At $x=a$

Continuous

Continuous

\neq Differentiable

$$\lim_{x \rightarrow a} \frac{f(x) - f(a)}{x - a} = \lim_{x \rightarrow a} \left(\frac{f(x) - f(a)}{x - a} \right) (x - a) = 0$$

Non differentiable

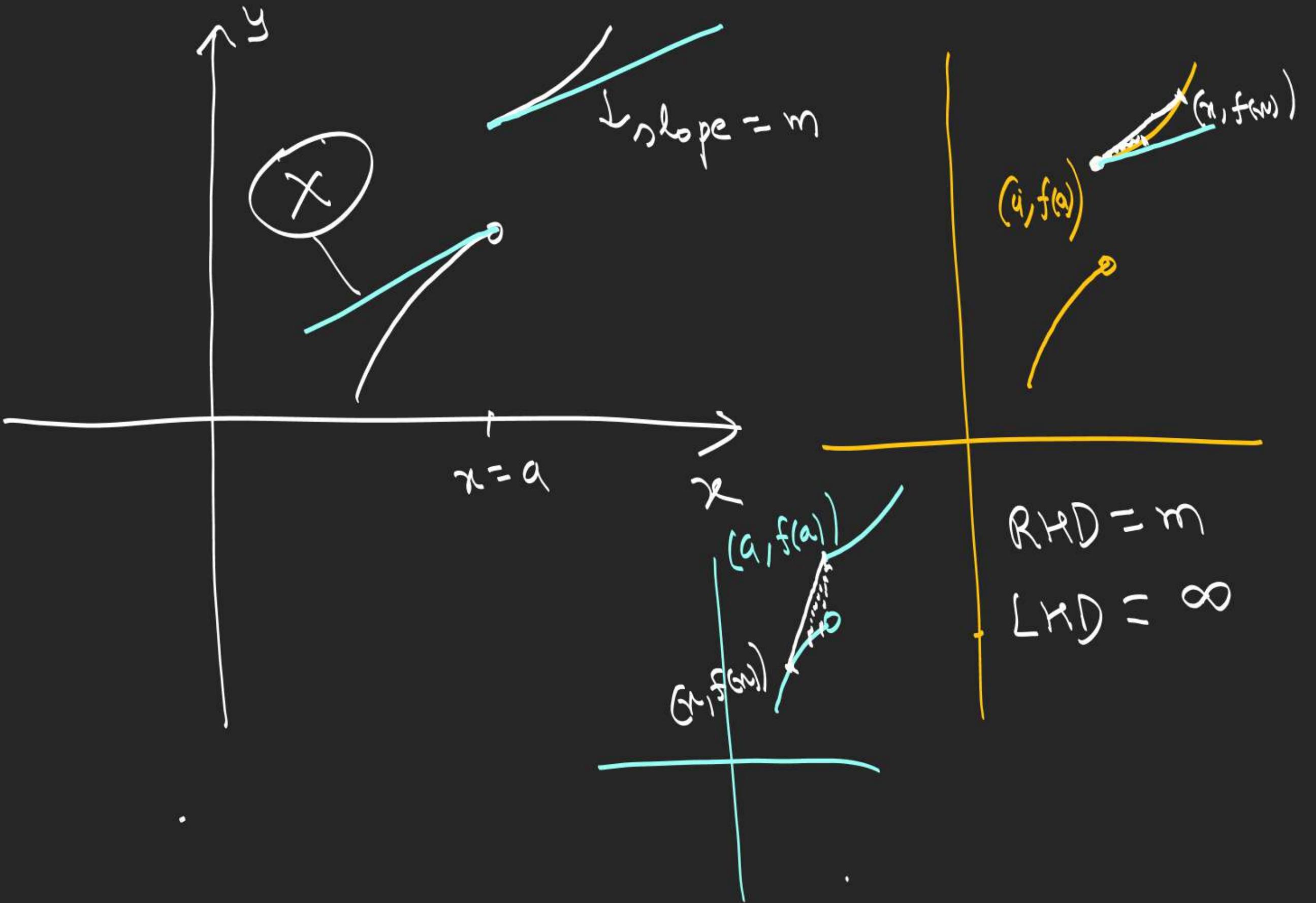
\neq Discontinuous

Discontinuous

\Rightarrow Non differentiable

$$\lim_{x \rightarrow 2} f(x) = 5 \quad \lim_{x \rightarrow 2} (f(x) - 5) = 0$$

Note



Theorems over Differentiability

At $x=a$: $D \rightarrow Dif\cdot$, $ND \rightarrow Non\ diff\cdot$

f	g	$f+g$	$f-g$	fg	$\frac{f}{g}$
D	D	D	D	D	D , $g(a) \neq 0$
D	ND	ND	ND	-	$\left(\frac{f}{g}\right)' = \frac{gf' - fg'}{g^2}$
ND	D	ND	ND	$\lim_{x \rightarrow a} \frac{\frac{f(x)}{g(x)} - \frac{f(a)}{g(a)}}{x-a}$	$\left(\frac{f}{g}\right)' = \frac{\frac{f(x)}{g(x)} - \frac{f(a)}{g(a)}}{x-a}$
ND	ND	-	-	$\left(\frac{f}{g}\right)'(a) =$	

$$\begin{aligned}
 & \lim_{x \rightarrow a} \left(\frac{\frac{f(x)}{g(x)} - \frac{f(a)}{g(a)}}{x-a} \right) = \lim_{x \rightarrow a} \left(\frac{f(x)g(a) - f(a)g(x)}{g(x)g(a)(x-a)} \right) \\
 &= \lim_{x \rightarrow a} \left(\frac{\cancel{f(x)g(a)} - f(a)\cancel{g(a)} + f(a)\cancel{g(a)} - \cancel{f(a)g(x)}}{g(x)g(a)(x-a)} \right) \\
 &= \lim_{x \rightarrow a} \left(g(a) \left(\frac{\cancel{f(x)-f(a)}}{x-a} \right) - f(a) \left(\frac{\cancel{g(x)-g(a)}}{x-a} \right) \right) \frac{1}{g(x)g(a)} \\
 &= \frac{g(a)f'(a) - f(a)g'(a)}{g^2(a)}
 \end{aligned}$$

$$f \rightarrow D, \quad g \rightarrow N \cdot D$$

P.T. $f + g \rightarrow ND$

Ex-II

Q 1-10

Let $f + g \rightarrow D$.

$$g(n) = \underbrace{(f+g)(n)}_{\downarrow} - \underbrace{f(n)}_{\downarrow}$$

$\rightarrow g(n)$ is diff. Contradiction