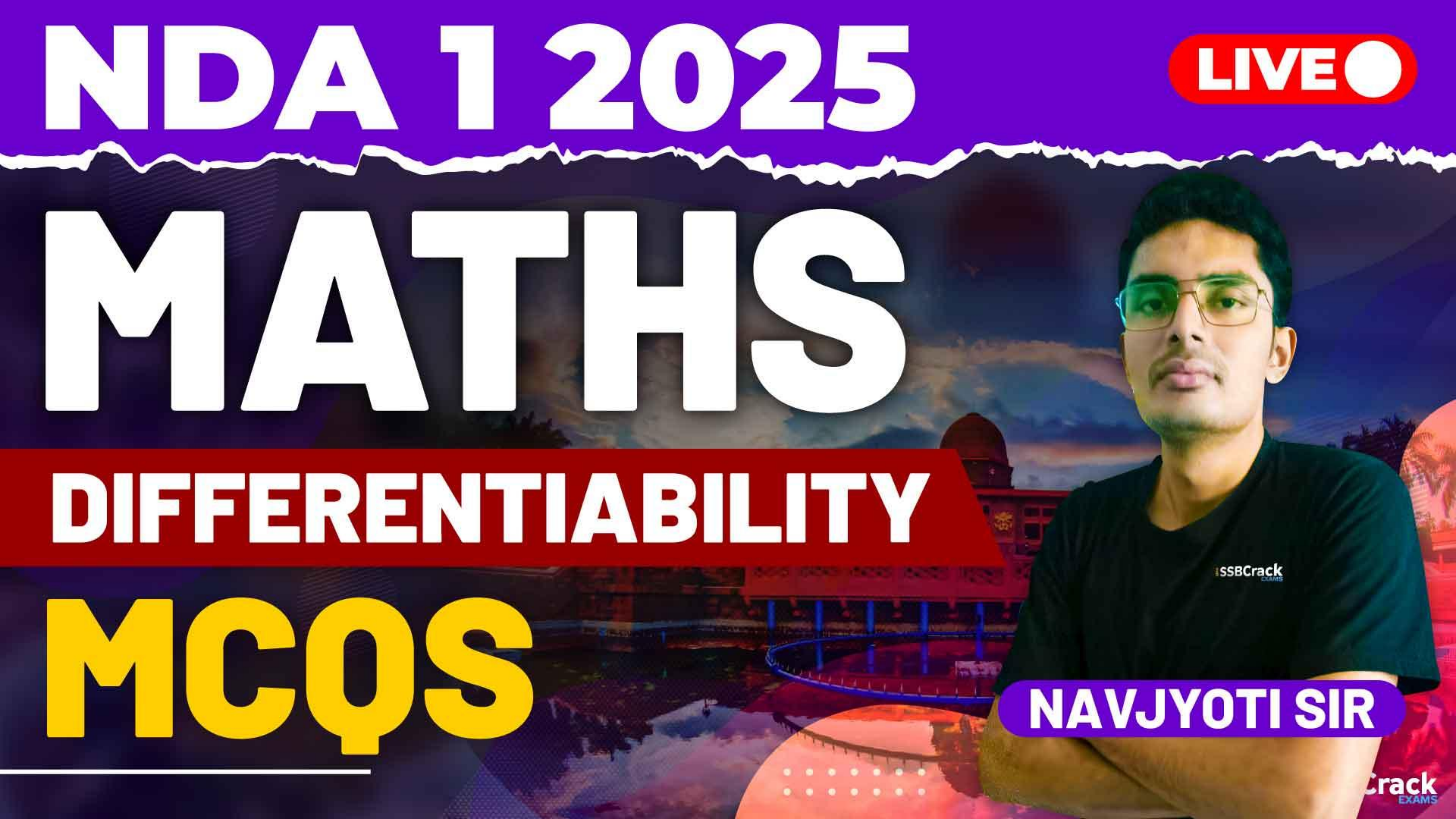

NDA 1 2025
LIVE
MATHS
DIFFERENTIABILITY
MCQS
SSBCrack EXAMS
NAVJYOTI SIR
Crack EXAMS

SSBCrack EXAMS

17 Feb 2025 Live Classes Schedule

9:00AM	17 FEBRUARY 2025 DAILY DEFENCE UPDATES	DIVYANSHU SIR
10:00AM	17 FEBRUARY 2025 DAILY CURRENT AFFAIRS	RUBY MA'AM

SSB INTERVIEW LIVE CLASSES

9:30AM	COMPLETE PSYCH TEST	ANURADHA MA'AM

AFCAT 1 2025 LIVE CLASSES

3:00PM	STATIC GK - INDIA & UNO	DIVYANSHU SIR
1:00PM	ENGLISH - ONE WORD SUBSTITUTION - CLASS 1	ANURADHA MA'AM

NDA 1 2025 LIVE CLASSES

10:00AM	MATHS - DIFFERENTIABILITY	NAVJYOTI SIR
11:30AM	PHYSICAL GEOGRAPHY - CLASS 3	RUBY MA'AM
1:00PM	BIOLOGY - CLASS 6	SHIVANGI MA'AM
4:30PM	ENGLISH - ORDERING OF WORDS - CLASS 1	ANURADHA MA'AM

CDS 1 2025 LIVE CLASSES

11:30AM	PHYSICAL GEOGRAPHY - CLASS 3	RUBY MA'AM
1:00PM	BIOLOGY - CLASS 6	SHIVANGI MA'AM
4:30PM	ENGLISH - ORDERING OF WORDS - CLASS 1	ANURADHA MA'AM
5:30PM	MATHS - ALGEBRA - CLASS 1	NAVJYOTI SIR

SSBCrack EXAMS

Q) The derivative of $y = a^{x \log_a \sin x}$ is equal to

(a) $\log \sin x + x \tan x$ (b) $\log \sin x + x \cot x$

(c) $y \log(\sin x \, e^{x \cot x})$ (d) $y \log(\sin x \, e^{x \tan x})$

$$\log y = x \log_a \sin x \log a$$

$$\left\{ \log_a b = \frac{\log_m b}{\log_m a} \right\}$$

$$\frac{1}{y}\frac{dy}{dx} = \frac{d}{dx}\left\{ x\left(\frac{\log \sin x}{\log a}\right) \cdot \log a \right\}$$

$$\frac{dy}{dx} = y\left(\log \sin x + x \cdot \frac{1}{\sin x} \cdot \cos x\right)$$

$$\frac{dy}{dx} = y\left(\log \sin x + x \cot x\right)$$

$$\frac{dy}{dx} = y\left(\log \sin x + x \cot x\right)$$

$$= y\left(\log \sin x + \log e^{x \cot x}\right)$$

$$= y\left(\log\left(\sin x\, e^{x \cot x}\right)\right)$$

$$\log e^{f(x)} = f(x)$$

$$\log a + \log b = \log(a \cdot b)$$

Q) The derivative of $y = a^{x \log_a \sin x}$ is equal to

(a) $\log \sin x + x \tan x$

(b) $\log \sin x + x \cot x$

(c) $y \log (\sin x \, e^{x \cot x})$

(d) $y \log (\sin x \, e^{x \tan x})$

Ans: (c)

Q) The set of all points, where the function $f(x) = \sqrt{1 - e^{-x^2}}$ is differentiable, is

(a) $(0, \infty)$ (b) $(-\infty, \infty)$ (c) $(-\infty, 0) \cup (0, \infty)$ (d) $(-1, \infty)$

$$f'(x) = \frac{1}{2\sqrt{1-e^{-x^2}}}\left(-e^{-x^2}\right)(-2x)$$

$$f'(x) = \frac{x e^{-x^2}}{\sqrt{1-e^{-x^2}}}$$

$1 - e^{-x^2} \neq 0$

$1 - e^{-x^2} \geq 0$

$1 - e^{-x^2} > 0$

$e^{-x^2} < 1$

$$e^{-x^2} < 1$$

$$x^2 > 0$$

$$\frac{1}{e^{x^2}} < 1$$

$$\Rightarrow x \neq 0$$

$$e^{x^2} > 1$$

$$(-\infty, 0) \cup (0, \infty)$$

$$e^{x^2} > e^0$$

Q) The set of all points, where the function $f(x) = \sqrt{1 - e^{-x^2}}$ is differentiable, is

(a) $(0, \infty)$ (b) $(-\infty, \infty)$ (c) $(-\infty, 0) \cup (0, \infty)$ (d) $(-1, \infty)$

Ans: (a)

Q) Consider the following statements :

1. Derivative of $f(x)$ may not exist at some point.
2. Derivative of $f(x)$ may exist finitely at some point.
3. Derivative of $f(x)$ may be infinite (geometrically) at some point.

Which of the above statements are correct?

(a) 1 and 2 only (b) 2 and 3 only

(c) 1 and 3 only (d) 1, 2 and 3

Q) Consider the following statements :

1. Derivative of $f(x)$ may not exist at some point.
2. Derivative of $f(x)$ may exist finitely at some point.
3. Derivative of $f(x)$ may be infinite (geometrically) at some point.

Which of the above statements are correct?

(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Ans: (d)

SSBCrack EXAMS

Q) What is the derivative of $2^{(\sin x)^2}$ with respect to $\sin x$?

(a) $\sin x \, 2^{(\sin x)^2} \ln 4$

(b) $2 \sin x \, 2^{(\sin x)^2} \ln 4$

(c) $\ln (\sin x) \, 2^{(\sin x)^2}$

(d) $2 \sin x \cos x \, 2^{(\sin x)^2}$

$$y = 2^{(\sin x)^2}$$

$$\log y = (\sin x)^2 \log 2$$

$$\frac{dy}{dx} = y\left(\log 2 \left(2 \sin x \cos x\right)\right)$$

$$\log (a^m) = m \log a$$

$$\frac{d}{dx}(\sin x) = \cos x$$

$$\frac{2^{(\sin x)^2} \cdot 2 \sin x \cos x \cdot \log 2}{\cos x} = \log 2 \cdot 2^{(\sin x)^2} \cdot 2 \sin x = 2 \log 2 (\sin x)\, 2^{(\sin x)^2}$$

$$= \ln 4 \sin x \, 2^{(\sin x)^2}$$

Q) What is the derivative of $2^{(\sin x)^2}$ with respect to $\sin x$?

(a) $\sin x \, 2^{(\sin x)^2} \ln 4$

(b) $2 \sin x \, 2^{(\sin x)^2} \ln 4$

(c) $\ln (\sin x) \, 2^{(\sin x)^2}$

(d) $2 \sin x \cos x \, 2^{(\sin x)^2}$

Ans: (a)

Q) The derivative of ln(x+ sin x) with respect to (x+ cos x) is

(a) $\dfrac{1+\cos x}{(x+\sin x)(1-\sin x)}$ (b) $\dfrac{1-\cos x}{(x+\sin x)(1+\sin x)}$

(c) $\dfrac{1-\cos x}{(x-\sin x)(1+\cos x)}$ (d) $\dfrac{1+\cos x}{(x-\sin x)(1-\cos x)}$

$u = \ln(x+\sin x)$

$v = (x+\cos x)$

$$\frac{\frac{du}{dx}}{\frac{dv}{dx}} = \frac{\frac{1}{x+\sin x}(1+\cos x)}{(1-\sin x)} = \frac{1+\cos x}{(x+\sin x)(1-\sin x)}$$

Q) The derivative of ln(x+ sin x) with respect to (x+ cos x) is

(a) $\dfrac{1+\cos x}{(x+\sin x)(1-\sin x)}$

(b) $\dfrac{1-\cos x}{(x+\sin x)(1+\sin x)}$

(c) $\dfrac{1-\cos x}{(x-\sin x)(1+\cos x)}$

(d) $\dfrac{1+\cos x}{(x-\sin x)(1-\cos x)}$

Ans: (a)

Q) If $y = \cot^{-1}\left[\dfrac{\sqrt{1+\sin x}+\sqrt{1-\sin x}}{\sqrt{1+\sin x}-\sqrt{1-\sin x}}\right]$, where $0 < x < \dfrac{\pi}{2}$, then $\dfrac{dy}{dx}$ is equal to

(a) $\dfrac{1}{2}$

(b) 2

(c) $\sin x + \cos x$

(d) $\sin x - \cos x$

Rationalizing and simplifying

$$\frac{1+\sin x + 1-\sin x + 2\sqrt{1-\sin^2 x}}{(1+\sin x)-(1-\sin x)}$$

$$= \frac{2(1+\cos x)}{2\sin x} = \frac{2\cos^2 x/2}{2\sin x/2 \cos x/2}$$

$$= \cot x/2$$

$$\cot^{-1}\left(\cot\frac{x}{2}\right) = \frac{x}{2} \quad \Big| \quad y = x/2, \quad \frac{dy}{dx} = \frac{1}{2}$$

Q) If $y = \cot^{-1}\left[\dfrac{\sqrt{1+\sin x}+\sqrt{1-\sin x}}{\sqrt{1+\sin x}-\sqrt{1-\sin x}}\right]$, where $0 < x < \dfrac{\pi}{2}$, then

$\dfrac{dy}{dx}$ is equal to

(a) $\dfrac{1}{2}$

(b) 2

(c) $\sin x + \cos x$

(d) $\sin x - \cos x$

Ans: (a)

Q) If $y = \tan^{-1}\left(\frac{5-2\tan\sqrt{x}}{2+5\tan\sqrt{x}}\right)$, then what is $\frac{dy}{dx}$ equal to?

(a) $-\frac{1}{2\sqrt{x}}$

(b) 1

(c) -1

(d) $\frac{1}{2\sqrt{x}}$

$$\tan^{-1}\left(\frac{\frac{5}{2} - \tan\sqrt{x}}{1 + \frac{5}{2}\tan\sqrt{x}}\right)$$

$$y = \tan^{-1}\left(\frac{5}{2}\right) - \tan^{-1}\left(\tan\sqrt{x}\right)$$

$$\tan^{-1}\left(\frac{A-B}{1+AB}\right) = \tan^{-1}(A) - \tan^{-1}(B)$$

$$y = \tan^{-1}\left(\frac{5}{2}\right) - \sqrt{x}$$

$$\frac{dy}{dx} = 0 - \frac{1}{2\sqrt{x}} = -\frac{1}{2\sqrt{x}}$$

Q) If $y = \tan^{-1}\left(\frac{5 - 2\tan\sqrt{x}}{2 + 5\tan\sqrt{x}}\right)$, then what is $\frac{dy}{dx}$ equal to?

(a) $-\frac{1}{2\sqrt{x}}$

(b) 1

(c) -1

(d) $\frac{1}{2\sqrt{x}}$

Ans: (a)

SSBCrack EXAMS

Q) What is the set of all points, where the function

$f(x) = \dfrac{x}{1+|x|}$ is differentiable?

(a) $(-\infty, \infty)$ only

(b) $(0, \infty)$ only

(c) $(-\infty, 0) \cup (0, \infty)$ only

(d) $(-\infty, 0)$ only

domain of $f(x)$

$$f'(x) = \frac{(1+|x|)(1) - x\left(1+\frac{|x|}{x}\right)}{(1+|x|)^2}$$

$$= \frac{(1+|x|) - x - |x|}{(1+|x|)^2} = \frac{1-x}{(1+|x|)^2}$$

$$f'(|x|) = \frac{|x|}{x}$$

$$\frac{1-x}{(1+|x|)^2}$$

$$(1+|x|)^2 \neq 0$$

$(1+|x|) \neq 0 \longrightarrow$ always true for any x,

So, $(-\infty, \infty)$

Q) What is the set of all points, where the function

$f(x) = \dfrac{x}{1+|x|}$ is differentiable?

(a) $(-\infty, \infty)$ only

(b) $(0, \infty)$ only

(c) $(-\infty, 0) \cup (0, \infty)$ only

(d) $(-\infty, 0)$ only

Ans: (a)

SSBCrack EXAMS

Q) If $f(x) = x(\sqrt{x} + \sqrt{(x+1)})$, then

(a) $f(x)$ is continuous but not differentiable at $x = 0$
(b) $f(x)$ is differentiable at $x = 0$
(c) $f(x)$ is not differentiable at $x = 0$
(d) None of the above

$x \geq 0$ $\quad$ $x + 1 \geq 0$ (checking $f(x)$ being continous or not)

$x \geq -1$

$f(x)$ is defined for $x \geq 0$.

For $x < 0$, $f(x)$ is not defined

$\Rightarrow$ LHL will not exist.

$\Rightarrow f(x)$ is not continous $\Rightarrow$ not differentiable

Q) If $f(x) = x(\sqrt{x} + \sqrt{(x+1)})$, then

(a) $f(x)$ is continuous but not differentiable at $x = 0$
(b) $f(x)$ is differentiable at $x = 0$
(c) $f(x)$ is not differentiable at $x = 0$
(d) None of the above

Ans: (c)

Q) If f is a differentiable function satisfying $f\left(\frac{1}{n}\right) = 0, \forall\ n \geq 1, n \in I$, then

(a) $f(x) = 0, x \in (0, 1]$

(b) $f'(0) = 0 = f(0)$

(c) $f(0) = 0$ but $f'(0)$ not necessarily zero

(d) $|f(x)| \leq 1, x \in (0, 1]$

$f(1) = f\left(\frac{1}{2}\right) = f\left(\frac{1}{3}\right) = f\left(\frac{1}{4}\right) \dots = 0$

$\lim_{n \to \infty} f\left(\frac{1}{n}\right) = 0$

$f(0) = 0$

$f'(0) = 0$

Q) If f is a differentiable function satisfying

$$f\left(\frac{1}{n}\right) = 0, \forall\ n \geq 1, n \in I, \text{then}$$

(a) $f(x) = 0,\ x \in (0, 1]$

(b) $f'(0) = 0 = f(0)$

(c) $f(0) = 0$ but $f'(0)$ not necessarily zero

(d) $|f(x)| \leq 1,\ x \in (0, 1]$

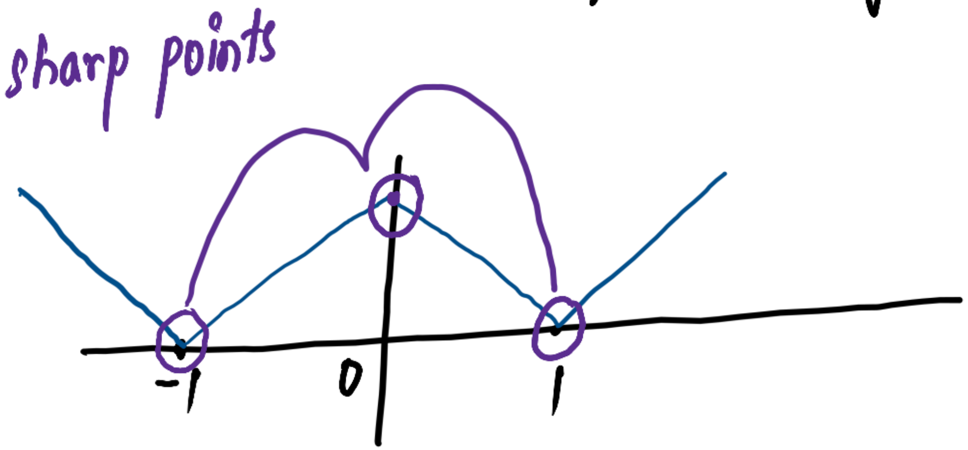
Ans: (b)

SSBCrack EXAMS

Q) Let $f(x) = ||x| - 1|$, then points where, $f(x)$ is not differentiable is/are

(a) $0, \pm 1$ (b) ± 1
(c) 0 (d) 1

(sharp edges on graph are points of non-differentiability)



$0, 1, -1 \Rightarrow \underline{0, \pm 1}$

Q) Let $f(x) = ||x| - 1|$, then points where, $f(x)$ is not differentiable is/are

(a) $0, \pm 1$

(b) ± 1

(c) 0

(d) 1

Ans: (a)

Q) Which of the following functions is differentiable at $x = 0$?

(a) $\cos(|x|) + |x|$ (b) $\cos(|x|) - |x|$

(c) $\sin(|x|) + |x|$ (d) $\sin(|x|) - |x|$

$$\lim_{h \to 0} \frac{f(x+h) - f(x)}{h} \quad (RHD)$$

$$\lim_{h \to 0} \frac{f(x-h) - f(x)}{-h} \quad (LHD)$$

(check for options)

Q) Which of the following functions is differentiable at $x = 0$?

(a) $\cos(|x|) + |x|$

(b) $\cos(|x|) - |x|$

(c) $\sin(|x|) + |x|$

(d) $\sin(|x|) - |x|$

Ans: (d)

Q) Let $f : R \to R$ be defined as

$$f(x) = \sin(|x|)$$

Which one of the following is correct?

(a) f is not differentiable only at 0
(b) f is differentiable at 0 only
(c) f is differentiable everywhere
(d) f is non-differentiable at many points

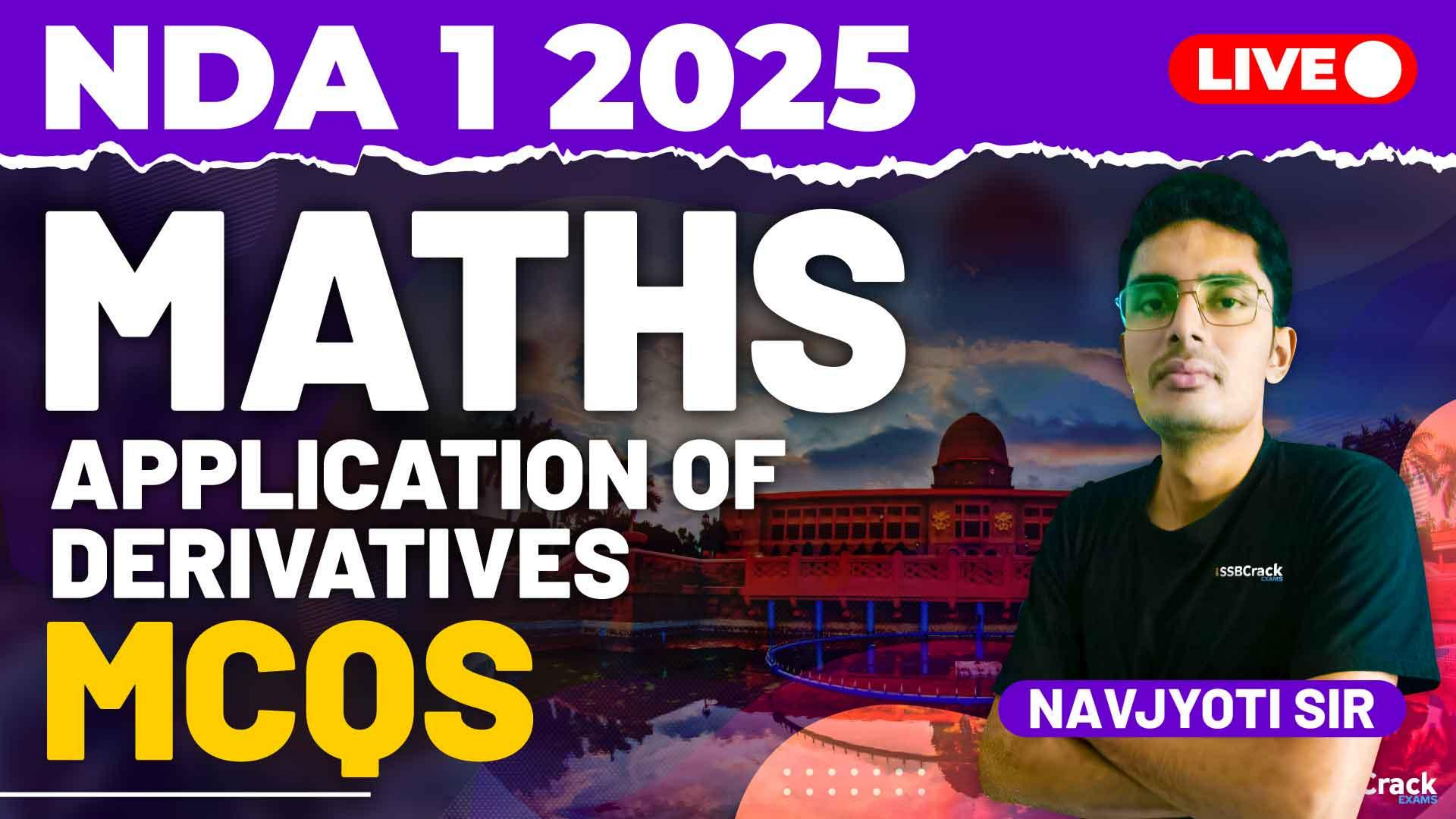
Q) Let $f : R \to R$ be defined as

$$f(x) = \sin(|x|)$$

Which one of the following is correct?

(a) f is not differentiable only at 0
(b) f is differentiable at 0 only
(c) f is differentiable everywhere
(d) f is non-differentiable at many points

Ans: (d)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