# NDA 1 2025

LIVE

# MATHS

## APPLICATION OF DERIVATIVES

# MCQS


NAVJYOTI SIR

# 18 Feb 2025 Live Classes Schedule

| | | |
|---|---|---|
| 9:00AM | 18 FEBRUARY 2025 DAILY DEFENCE UPDATES | DIVYANSHU SIR |
| 10:00AM | 18 FEBRUARY 2025 DAILY CURRENT AFFAIRS | RUBY MA'AM |

## SSB INTERVIEW LIVE CLASSES

| | | |
|---|---|---|
| 9:30AM | COMPLETE SCREENING TEST | ANURADHA MA'AM |

## AFCAT 1 2025 LIVE CLASSES

| | | |
|---|---|---|
| 3:00PM | STATIC GK - COUNTRY CAPITAL CURRENCY | DIVYANSHU SIR |
| 1:00PM | ENGLISH - ONE WORD SUBSTITUTION | ANURADHA MA'AM |

## NDA 1 2025 LIVE CLASSES

| | | |
|---|---|---|
| 10:00AM | MATHS - APPLICATION OF DERIVATIVES | NAVJYOTI SIR |
| 11:30AM | GK - CLIMATOLOGY - CLASS 1 | RUBY MA'AM |
| 1:00PM | BIOLOGY - CLASS 7 | SHIVANGI MA'AM |
| 4:30PM | ENGLISH - ORDERING OF WORDS - CLASS 2 | ANURADHA MA'AM |

## CDS 1 2025 LIVE CLASSES

| | | |
|---|---|---|
| 11:30AM | GK - CLIMATOLOGY - CLASS 1 | RUBY MA'AM |
| 1:00PM | BIOLOGY - CLASS 7 | SHIVANGI MA'AM |
| 4:30PM | ENGLISH - ORDERING OF WORDS - CLASS 2 | ANURADHA MA'AM |
| 5:30PM | MATHS - ALGEBRA - CLASS 2 | NAVJYOTI SIR |

Let $f(x) = \dfrac{x}{ln\, x}; \ (x > 1)$

Consider the following statements :

1. $f(x)$ is increasing in the interval $(e, \infty)$
2. $f(x)$ is decreasing in the interval $(1, e)$
3. $9ln7 > 7ln9$

Which of the statements given above are correct ?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

**PYQ – 24 - I**

$f(x) = \dfrac{x}{\ln x}$

$f'(x) = 0$

$\dfrac{\ln x(1) - x\left(\frac{1}{x}\right)}{(\ln x)^2} = 0$

$\dfrac{\ln x - 1}{(\ln x)^2} = 0$

$\ln x - 1 = 0$

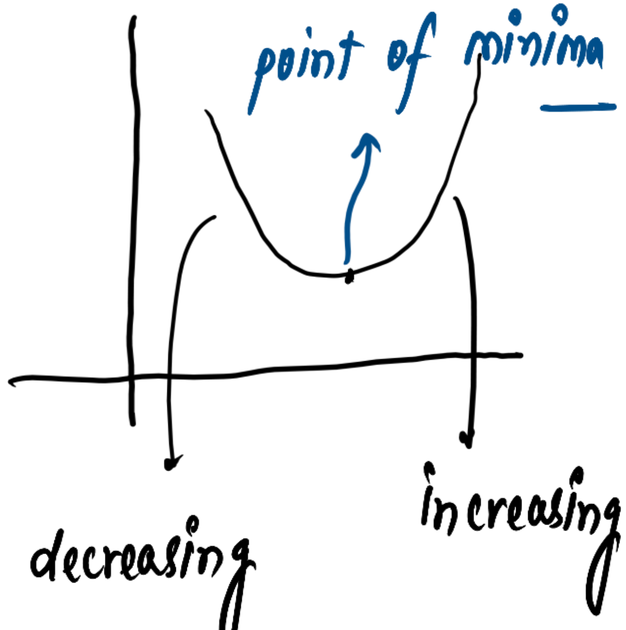
$\ln x = 1$

$x = e$

$x = 1,$

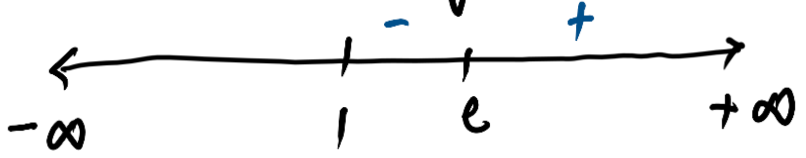
$f(x)$ is not defined as $f(x)$ becomes $\frac{1}{0}$.

$f(x)$ has 2 critical points, $\rightarrow 1, e$ (2.7..)




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

$$f''(e) = \frac{(1)^2\left(\frac{1}{e}\right) - 0}{(1)^2} = \frac{1}{e} > 0$$




$\Rightarrow e$ is a point of minima.

SSBCrack EXAMS

(3) $9 \ln 7$ $\quad 7 \ln 9$

$\ln 7^9$ $\quad \ln 9^7$

$7^9 > 9^7 \Rightarrow \ln 7^9 > \ln 9^7$

Let $f(x) = \frac{x}{\ln x}$; $(x>1)$

Consider the following statements :

1. $f(x)$ is increasing in the interval $(e, \infty)$
2. $f(x)$ is decreasing in the interval $(1, e)$
3. $9\ln 7 > 7\ln 9$

Which of the statements given above are correct ?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

PYQ – 24 - I

**Ans : (d)**

A differentiable function $f(x)$ has a local maximum at $x = 0$. Let $y = 2f(x) + ax - b$.

Which of the following is/are correct ?

1. $f'(0) = 0$
2. $f''(0) < 0$

Select the correct answer using the code given below :

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

**PYQ – 24 - I**

$x = 0$ is a critical point,

$f'(0) = 0$

$f''(0) < 0$

PYQ – 24 - I

A differentiable function $f(x)$ has a local maximum at $x = 0$. Let $y = 2f(x) + ax - b$.

Which of the following is/are correct ?

1. $f'(0) = 0$
2. $f''(0) < 0$

Select the correct answer using the code given below :

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

**Ans : (c)**

The function $y$ has a relative maxima at $x = 0$ for

(a) $a > 0, b = 0$

(b) for all $b$ and $a = 0$

(c) for all $b > 0$ only

(d) for all $a$ and $b = 0$

**PYQ – 24 - I**

$y = 2f(x) + ax - b$

$y' = 2f'(x) + a$

$y'(0) = 2f'(0) + a$

$0 = 0 + a$

$a = 0$

The function $y$ has a relative maxima at $x = 0$ for

**PYQ – 24 - I**

(a) $a > 0$, $b = 0$

(b) for all $b$ and $a = 0$

(c) for all $b > 0$ only

(d) for all $a$ and $b = 0$

**Ans : (b)**

For what value of the angle between the vectors $\vec{a}$ and $\vec{b}$ is the quantity $|\vec{a} \times \vec{b}| + \sqrt{3}|\vec{a} \cdot \vec{b}|$ maximum?

**PYQ – 24 - II**

(a) 0°

(b) 30°

(c) 45°

(d) 60°

Let $y = ab\sin\theta + \sqrt{3}\,ab\cos\theta$

$$\frac{dy}{d\theta} = ab\cos\theta - \sqrt{3}\,ab\sin\theta$$

For max. value of $y$, $\frac{dy}{d\theta} = 0$

$$ab(\cos\theta - \sqrt{3}\sin\theta) = 0$$

$$\tan\theta = \frac{1}{\sqrt{3}} \Rightarrow \theta = 30^\circ$$

$$\frac{d^2y}{d\theta^2} = -ab\sin\theta - \sqrt{3}\,ab\cos\theta$$

$$= -ab\left(\frac{1}{2}\right) - \sqrt{3}\,ab\left(\frac{\sqrt{3}}{2}\right)$$

$$= -2ab < 0 \text{ as } a, b > 0$$

magnitudes

$\theta = 30^\circ$ is a point of maxima ✓

For what value of the angle between the vectors $\vec{a}$ and $\vec{b}$ is the quantity $|\vec{a} \times \vec{b}| + \sqrt{3}|\vec{a} \cdot \vec{b}|$ maximum?

**PYQ – 24 - II**

(a) 0°

(b) 30°

(c) 45°

(d) 60°

**Ans : (b)**

Let $f(x) = \cos 2x + x$ on $[-\pi/2, \pi/2]$.

**PYQ – 24 - II**

What is the greatest value of $f(x)$?

(a) $\frac{\sqrt{3}}{2} - \frac{\pi}{12}$

(b) $\frac{\sqrt{3}}{2} + \frac{\pi}{12}$

(c) $\frac{\sqrt{3}}{2} + \frac{\pi}{9}$

(d) $\frac{\sqrt{3}}{2} + \frac{\pi}{6}$

$$f'(x) = -\sin 2x(2) + 1$$

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

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

$$\left(x \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right] \Rightarrow 2x \in [-\pi, \pi]\right]$$

$$2x = \frac{\pi}{6} \text{ and } 2x = \pi - \frac{\pi}{6} \Rightarrow x = \frac{\pi}{12} \text{ and } x = \frac{5\pi}{12}$$

$x = \frac{\pi}{12}, \frac{5\pi}{12}$ $\quad -\frac{\pi}{2}, \frac{\pi}{2}$

$f(x) = \cos 2x + x$

$f\left(\frac{\pi}{12}\right) = \frac{\sqrt{3}}{2} + \frac{\pi}{12}$ Greatest

$f\left(\frac{5\pi}{12}\right) = -\frac{\sqrt{3}}{2} + \frac{5\pi}{12}$

$f\left(\frac{-\pi}{2}\right) = -1 - \frac{\pi}{2} = -\left(1 + \frac{\pi}{2}\right)$ Least

$f\left(\frac{\pi}{2}\right) = (-1) + \frac{\pi}{2}$

PYQ – 24 - II

Let $f(x) = \cos 2x + x$ on $[-\pi/2, \pi/2]$.

What is the greatest value of $f(x)$?

(a) $\frac{\sqrt{3}}{2} - \frac{\pi}{12}$

(b) $\frac{\sqrt{3}}{2} + \frac{\pi}{12}$

(c) $\frac{\sqrt{3}}{2} + \frac{\pi}{9}$

(d) $\frac{\sqrt{3}}{2} + \frac{\pi}{6}$

Ans : (b)

SSBCrack EXAMS

What is the least value of $f(x)$?

PYQ – 24 - II

(a) $-\left(1+\frac{\pi}{2}\right)$

(b) $-\left(\frac{1}{2}+\frac{\pi}{2}\right)$

(c) $-\left(1+\frac{\pi}{4}\right)$

(d) $-2\left(\frac{1}{2}-\frac{\pi}{4}\right)$

What is the least value of $f(x)$?

PYQ – 24 - II

(a) $-\left(1+\frac{\pi}{2}\right)$

(b) $-\left(\frac{1}{2}+\frac{\pi}{2}\right)$

(c) $-\left(1+\frac{\pi}{4}\right)$

(d) $-2\left(\frac{1}{2}-\frac{\pi}{4}\right)$

Ans : (a)

Consider the curve $y = e^{2x}$.

What is the slope of the tangent to the curve at (0, 1) ?

(a) 0 (b) 1

(c) 2 (d) 4

Slope of tangent at $(x, y) = \frac{dy}{dx} = 2e^{2x}$

$(0,1) = 2e^{2(0)} = 2e^{0} = 2(1) = 2$

Consider the curve $y = e^{2x}$.

What is the slope of the tangent to the curve at (0, 1) ?

(a) 0 (b) 1

(c) 2 (d) 4

**Ans : (c)**

Where does the tangent to the curve at (0, 1) meet the $x$-axis?

(a) $(1, 0)$ (b) $(2, 0)$

(c) $(-1/2, 0)$ (d) $(1/2, 0)$

$$\frac{dy}{dx} = 2e^{2x}$$

slope at $(0,1) = 2$

$$y - 1 = 2(x - 0)$$

$$y = 2x + 1$$

$$0 = 2x + 1$$

$$x = -\frac{1}{2} \Rightarrow \text{point} \Rightarrow \left(-\frac{1}{2}, 0\right)$$

Where does the tangent to the curve at (0, 1) meet the $x$-axis?

(a) $(1, 0)$ (b) $(2, 0)$

(c) $(-1/2, 0)$ (d) $(1/2, 0)$

Ans : (c)

Consider the function $f(x) = \dfrac{x^2 - x + 1}{x^2 + x + 1}$

What is the maximum value of the function ?

(a) 1/2 (b) 1/3

(c) 2 (d) 3

$$f'(x) = \frac{(x^2+x+1)(2x-1) - (x^2-x+1)(2x+1)}{(x^2+x+1)^2} = 0$$

$$2x^3 + 2x^2 + 2x - x^2 - x - 1 - 2x^3 - x^2 + 2x^2 + x - 2x - 1 = 0$$

$$2x^2 - 2 = 0$$

$$2(x^2 - 1) = 0$$

$$x = \pm 1$$

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

$$f(1) = \frac{1 - 1 + 1}{1 + 1 + 1} = \boxed{\frac{1}{3}} \longrightarrow \text{min. value of } f(x)$$

$$f(-1) = \frac{1 + 1 + 1}{1 - 1 + 1} = \frac{3}{1} = \boxed{3} \longrightarrow \text{max. value of } f(x)$$

Consider the function $f(x)=\frac{x^2-x+1}{x^2+x+1}$

What is the maximum value of the function ?

(a) 1/2 (b) 1/3

(c) 2 (d) 3

**Ans : (d)**

What is the minimum value of the function ?

(a) 1/2 (b) 1/3

(c) 2 (d) 3

What is the minimum value of the function ?

(a) 1/2 (b) 1/3

(c) 2 (d) 3

Ans : (b)

How many tangents are parallel to x-axis for the curve $y = x^2 - 4x + 3$?

(a) 1
(b) 2
(c) 3
(d) No tangent is parallel to x-axis

$$\frac{dy}{dx} = 2x - 4$$

$$2x - 4 = 0$$

$$x = 2$$ → one critical point

⇒ one slope

⇒ one tangent

How many tangents are parallel to x-axis for the curve $y = x^2 - 4x + 3$?

(a) 1

(b) 2

(c) 3

(d) No tangent is parallel to x-axis

**Ans : (a)**

What is the minimum value of $\frac{a^2}{\cos^2 x} + \frac{b^2}{\sin^2 x}$ where $a > 0$ and $b > 0$?

(a) $(a + b)^2$

(b) $(a - b)^2$

(c) $a^2 + b^2$

(d) $|a^2 + b^2|$

What is the minimum value of $\frac{a^2}{\cos^2 x} + \frac{b^2}{\sin^2 x}$ where $a > 0$ and $b > 0$?

(a) $(a + b)^2$
(b) $(a - b)^2$
(c) $a^2 + b^2$
(d) $|a^2 + b^2|$

**Ans : (a)**

Under what conditions is the tangent to a given curve at a point perpendicular to x-axis ?

(a) $\frac{dy}{dx} = 0$

(b) $\frac{dy}{dx} = 1$

(c) $\frac{dx}{dy} = 0$

(d) $\frac{d^2y}{dx^2} = 1$

Under what conditions is the tangent to a given curve at a point perpendicular to x-axis ?

(a) $\frac{dy}{dx} = 0$

(b) $\frac{dy}{dx} = 1$

(c) $\frac{dx}{dy} = 0$

(d) $\frac{d^2y}{dx^2} = 1$

**Ans : (c)**

The tangent to the curve $y = x^2 - 5x + 5$, parallel to the line $2y = 4x + 1$, also passes through the point

(a) $\left(\frac{1}{4}, \frac{7}{2}\right)$

(b) $\left(\frac{7}{2}, \frac{1}{4}\right)$

(c) $\left(-\frac{1}{8}, 7\right)$

(d) $\left(\frac{1}{8}, -7\right)$

The tangent to the curve $y = x^2 - 5x + 5$, parallel to the line $2y = 4x + 1$, also passes through the point

(a) $\left(\frac{1}{4}, \frac{7}{2}\right)$

(b) $\left(\frac{7}{2}, \frac{1}{4}\right)$

(c) $\left(-\frac{1}{8}, 7\right)$

(d) $\left(\frac{1}{8}, -7\right)$

**Ans : (d)**

If the tangent to the curve $y = \frac{x}{x^2 - 3}, x \in R, (x \neq \pm\sqrt{3})$, at a point $(\alpha, \beta) \neq (0, 0)$ on it is parallel to the line $2x + 6y - 11 = 0$, then

(a) $|6\alpha + 2\beta| = 19$

(b) $|6\alpha + 2\beta| = 9$

(c) $|2\alpha + 6\beta| = 19$

(d) $|2\alpha + 6\beta| = 11$

If the tangent to the curve $y = \frac{x}{x^2 - 3}, x \in R, (x \neq \pm \sqrt{3})$, at a point $(\alpha, \beta) \neq (0, 0)$ on it is parallel to the line $2x + 6y - 11 = 0$, then

(a) $|6\alpha + 2\beta| = 19$

(b) $|6\alpha + 2\beta| = 9$

(c) $|2\alpha + 6\beta| = 19$

(d) $|2\alpha + 6\beta| = 11$

**Ans : (a)**

If $\theta$ denotes the acute angle between the curves, $y = 10 - x^2$ and $y = 2 + x^2$ at a point of their intersection, then $|\tan\theta|$ is equal to

(a) $\frac{7}{17}$ (b) $\frac{8}{15}$ (c) $\frac{4}{9}$ (d) $\frac{8}{17}$

If $\theta$ denotes the acute angle between the curves, $y = 10 - x^2$ and $y = 2 + x^2$ at a point of their intersection, then $|\tan\theta|$ is equal to

(a) $\frac{7}{17}$ (b) $\frac{8}{15}$ (c) $\frac{4}{9}$ (d) $\frac{8}{17}$

Ans : (b)

Function $f(x) = \dfrac{\lambda \sin x + 6 \cos x}{2 \sin x + 3 \cos x}$ is monotonic increasing, if

(a) $\lambda > 1$

(b) $\lambda < 1$

(c) $\lambda < 4$

(d) $\lambda > 4$

Function $f(x) = \dfrac{\lambda \sin x + 6 \cos x}{2 \sin x + 3 \cos x}$ is monotonic increasing, if

(a) $\lambda > 1$ (b) $\lambda < 1$

(c) $\lambda < 4$ (d) $\lambda > 4$

**Ans : (d)**

What is the minimum value of the function $f(x) = log_{10}(x^2 + 2x + 11)$ ?

(a) 0

(b) 1

(c) 2

(d) 10

SSBCrack EXAMS

What is the minimum value of the function $f(x) = log_{10}(x^2 + 2x + 11)$ ?

(a) 0

(b) 1

(c) 2

(d) 10

**Ans : (b)**

The angle of intersection of the curves $y = x^2$ and $x = y^2$ at (1, 1) is

(a) $\tan^{-1}\left(\frac{4}{3}\right)$

(b) $\tan^{-1}(1)$

(c) $90°$

(d) $\tan^{-1}\left(\frac{3}{4}\right)$

The angle of intersection of the curves $y = x^2$ and $x = y^2$ at (1, 1) is

(a) $\tan^{-1}\left(\frac{4}{3}\right)$

(b) $\tan^{-1}(1)$

(c) $90°$

(d) $\tan^{-1}\left(\frac{3}{4}\right)$

**Ans : (d)**

The length of subtangent to the curve $x^2y^2 = a^4$ at the point $(-a, a)$ is

(a) $3a$ (b) $2a$ (c) $a$ (d) $4a$

The length of subtangent to the curve $x^2y^2 = a^4$ at the point $(-a, a)$ is

(a) $3a$ (b) $2a$ (c) $a$ (d) $4a$

**Ans : (c)**

If $f(x) = kx^3 - 9x^2 + 9x + 3$ is monotonically increasing in every interval, which one of the following is correct?

(a) $k < 3$ (b) $k \leq 3$

(c) $k > 3$ (d) $k \geq 3$

If $f(x) = kx^3 - 9x^2 + 9x + 3$ is monotonically increasing in every interval, which one of the following is correct?

(a) $k < 3$

(b) $k \leq 3$

(c) $k > 3$

(d) $k \geq 3$

**Ans : (c)**

If the rate of change in volume of spherical soap bubble is uniform, then the rate of change of surface area varies as

(a) square of radius
(b) square root of radius
(c) inversely proportional to radius
(d) cube of the radius

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(a) square of radius
(b) square root of radius
(c) inversely proportional to radius
(d) cube of the radius

Ans : (c)

Match List I (Function) with List II (Property) and select the correct answer using the codes given below the lists.

| List I (Function) | List II (Property) |
|---|---|
| A. $f(x) = \dfrac{\tan x}{x}$ | 1. Increasing for every $x > 1$ |
| B. $f(x) = (x - 1) - \log x$ | 2. Decreasing for every $x > 0$ |
| C. $f(x) = \dfrac{\sin x}{x}$ | 3. Neither increasing nor decreasing for $x > 0$ |
| D. $f(x) = \dfrac{\log (1 + x)}{x}$ | 4. Decreasing for $x$ in $(0, \pi/2)$ |
| | 5. Increasing for $x$ in $(0, \pi/2)$ |

**Codes**

| | A | B | C | D |
|---|---|---|---|---|
| (a) | 2 | 4 | 3 | 5 |
| (b) | 5 | 3 | 1 | 2 |
| (c) | 5 | 1 | 4 | 2 |
| (d) | 2 | 4 | 1 | 5 |

Match List I (Function) with List II (Property) and select the correct answer using the codes given below the lists.

| List I (Function) | List II (Property) |
|---|---|
| A. $f(x) = \frac{\tan x}{x}$ | 1. Increasing for every $x > 1$ |
| B. $f(x) = (x - 1) - \log x$ | 2. Decreasing for every $x > 0$ |
| C. $f(x) = \frac{\sin x}{x}$ | 3. Neither increasing nor decreasing for $x > 0$ |
| D. $f(x) = \frac{\log(1 + x)}{x}$ | 4. Decreasing for $x$ in $(0, \pi/2)$ |
| | 5. Increasing for $x$ in $(0, \pi/2)$ |

**Codes**

| | A | B | C | D |
|---|---|---|---|---|
| (a) | 2 | 4 | 3 | 5 |
| (b) | 5 | 3 | 1 | 2 |
| (c) | 5 | 1 | 4 | 2 |
| (d) | 2 | 4 | 1 | 5 |

**Ans : (c)**

In which one of the following intervals is the function $f(x) = x^2 - 5x + 6$ decreasing?

(a) $(-\infty, 2]$ (b) $[3, \infty)$ (c) $(-\infty, \infty)$ (d) $(2, 3)$

In which one of the following intervals is the function $f(x) = x^2 - 5x + 6$ decreasing?

(a) $(-\infty, 2]$ (b) $[3, \infty)$ (c) $(-\infty, \infty)$ (d) $(2, 3)$

**Ans : (a)**

Let $x, y$ be real numbers such that $-4 \leq x \leq 4, -5 \leq y \leq 5$. Let $\theta \in R$ and let $A = x\cos\theta - y\sin\theta$, $B = x\cos\theta + y\sin\theta$. What is the maximum value of $A^2 - B^2$?

(a) 32 (b) 40

(c) 50 (d) 80

Let $x, y$ be real numbers such that $-4 \leq x \leq 4, -5 \leq y \leq 5$. Let $\theta \in R$ and let $A = x\cos\theta - y\sin\theta$, $B = x\cos\theta + y\sin\theta$. What is the maximum value of $A^2 - B^2$?

(a) 32 (b) 40

(c) 50 (d) 80

Ans : (b)

Let the slope of the curve $y = \cos^{-1}(\sin x)$ be $\tan\theta$. Then the value of $\theta$ in the interval $(0, \pi)$ is

(a) $\frac{\pi}{6}$ (b) $\frac{3\pi}{4}$ (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{2}$

Let the slope of the curve $y = \cos^{-1}(\sin x)$ be $\tan\theta$. Then the value of $\theta$ in the interval $(0, \pi)$ is

(a) $\frac{\pi}{6}$ (b) $\frac{3\pi}{4}$ (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{2}$

**Ans : (b)**


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