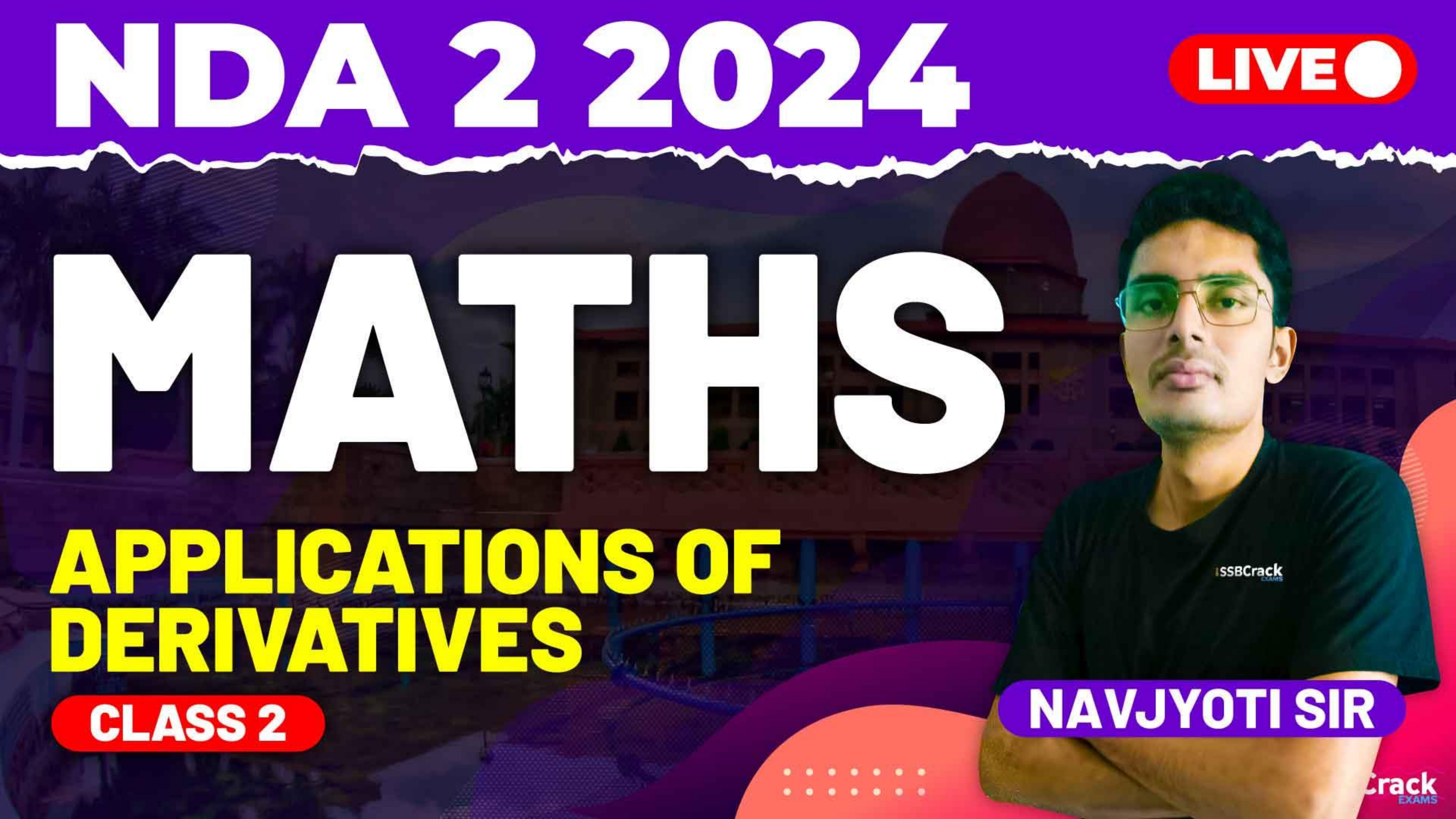

NDA 2 2024
LIVE
MATHS
APPLICATIONS OF DERIVATIVES
CLASS 2
NAVJYOTI SIR

# 26 June 2024 Live Classes Schedule

| | | |
|---|---|---|
| 8:00AM | 26 JUNE 2024 DAILY CURRENT AFFAIRS | RUBY MA'AM |
| 9:00AM | 26 JUNE 2024 DAILY DEFENCE UPDATES | DIVYANSHU SIR |

## SSB INTERVIEW LIVE CLASSES

| | | |
|---|---|---|
| 9:30AM | MOCK PERSONAL INTERVIEW | ANURADHA MA'AM |

## AFCAT 2 2024 LIVE CLASSES

| | | |
|---|---|---|
| 2:30PM | STATIC GK - INDIA & UNO | DIVYANSHU SIR |

## NDA 2 2024 LIVE CLASSES

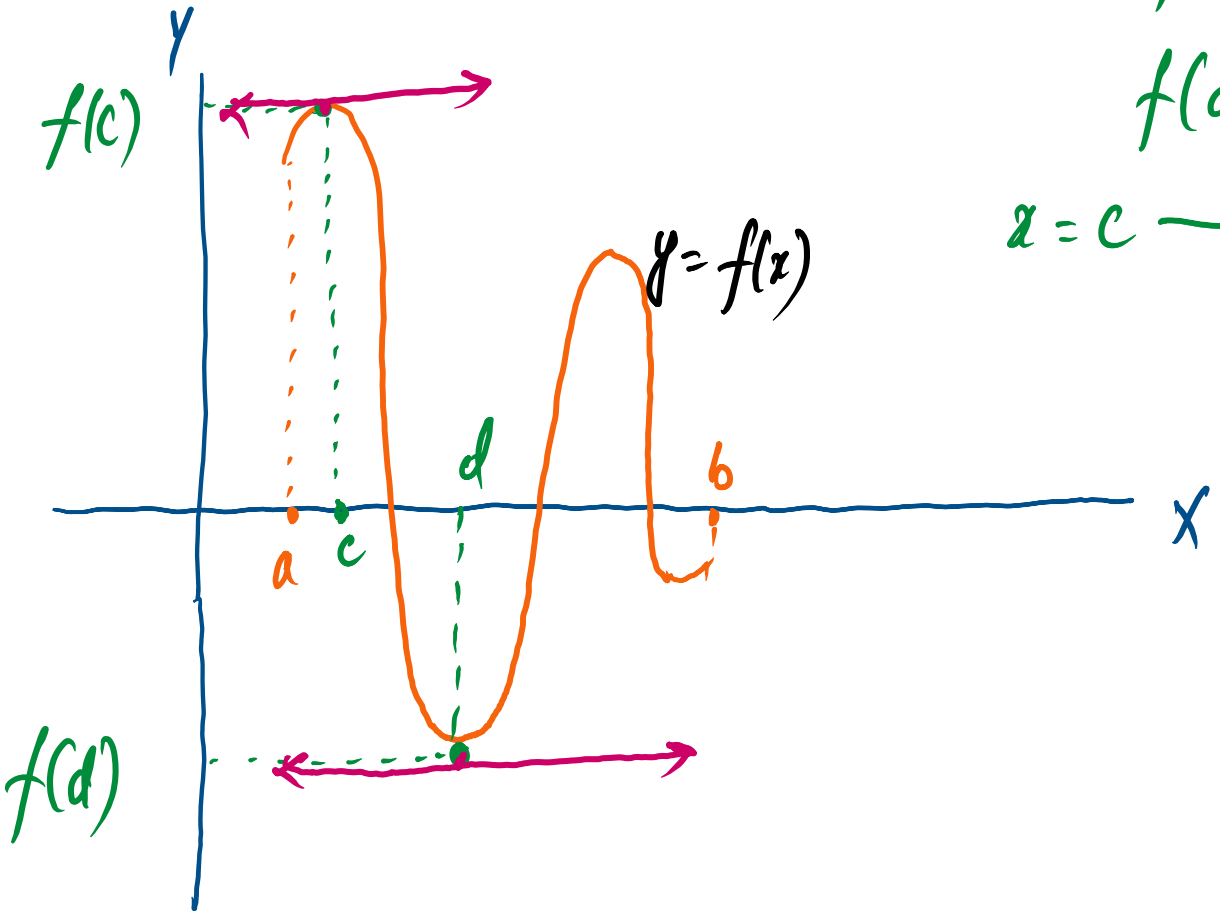
| | | |
|---|---|---|
| 11:30AM | GK - MEDIEVAL HISTORY - CLASS 2 | RUBY MA'AM |
| 2:30PM | GS - CHEMISTRY MCQS - CLASS 3 | SHIVANGI MA'AM |
| 5:30PM | ENGLISH - ORDERING OF WORDS - CLASS 1 | ANURADHA MA'AM |
| 6:30PM | MATHS - APPLICATIONS OF DERIVATIVES - CLASS 2 | NAVJYOTI SIR |

## CDS 2 2024 LIVE CLASSES

| | | |
|---|---|---|
| 11:30AM | GK - MEDIEVAL HISTORY - CLASS 2 | RUBY MA'AM |
| 2:30PM | GS - CHEMISTRY MCQS - CLASS 3 | SHIVANGI MA'AM |
| 5:30PM | ENGLISH - ORDERING OF WORDS - CLASS 1 | ANURADHA MA'AM |



# MAXIMA AND MINIMA




f(c) is maximum value of f(x).

f(d) is minimum " " ".

x = c → maxima  x = d → minima

Tangents at max. & min. value of f(x),

slope = 0 (parallel to x-axis).

$\left(\frac{dy}{dx} = 0\right)$

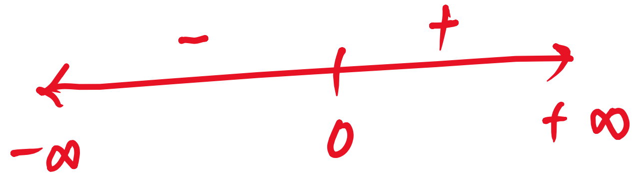
⇒ Maxima (c) & minima (d) will always be critical points.

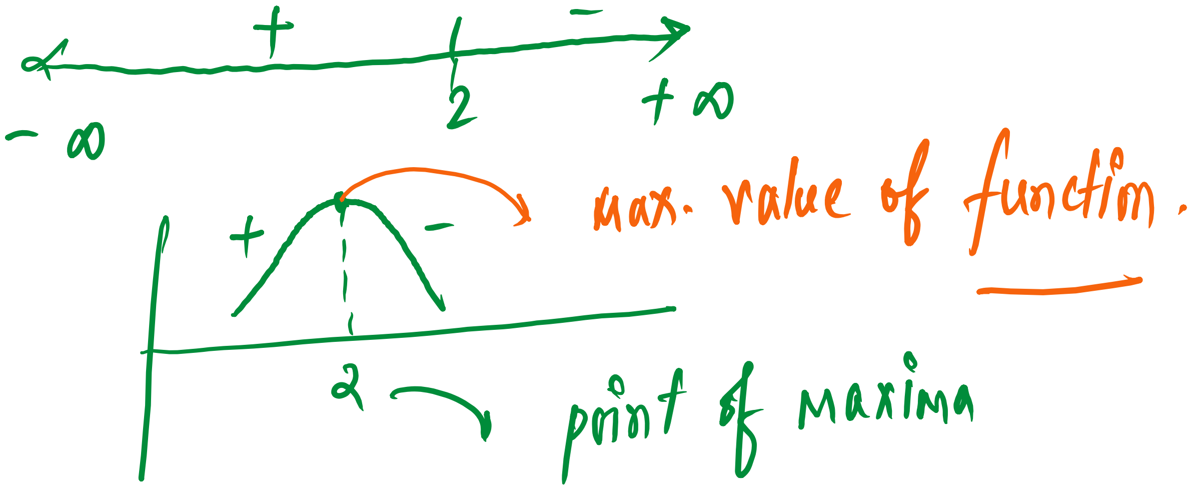
# FIRST DERIVATIVE TEST

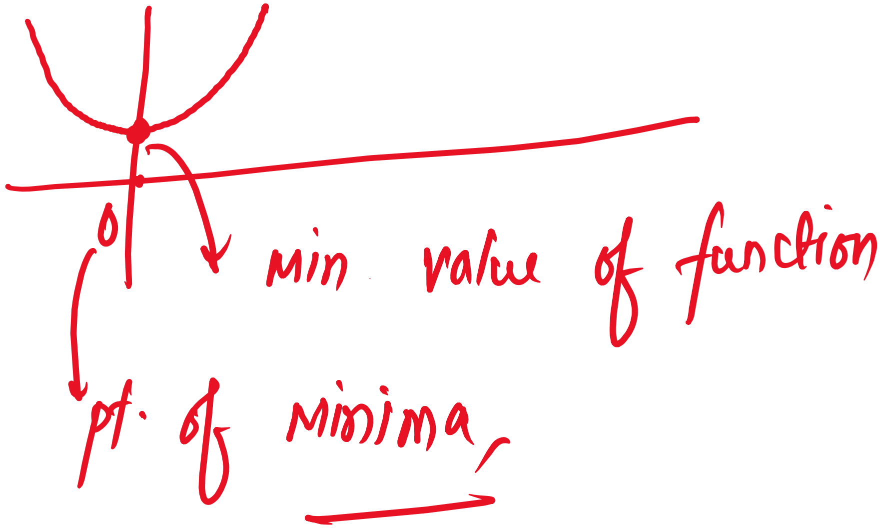
If $f'(x)$ changes sign from positive to negative as $x$ increases through $c$, then $c$ is a point of local maxima, and $f(c)$ is local maximum value.

If $f'(x)$ changes sign from negative to positive as $x$ increases through $c$, then $c$ is a point of local minima, and $f(c)$ is local minimum value.

If $f'(x)$ does not change sign as $x$ increases through $c$, then $c$ is neither a point of local minima nor a point of local maxima. Such a point is called a point of inflection.



SSBCrack EXAMS

# SECOND DERIVATIVE TEST

$x = c$ is a point of local maxima if $f'(c) = 0$ and $f''(c) < 0$. In this case $f(c)$ is then the local maximum value.

$x = c$ is a point of local minima if $f'(c) = 0$ and $f''(c) > 0$. In this case $f(c)$ is the local minimum value.

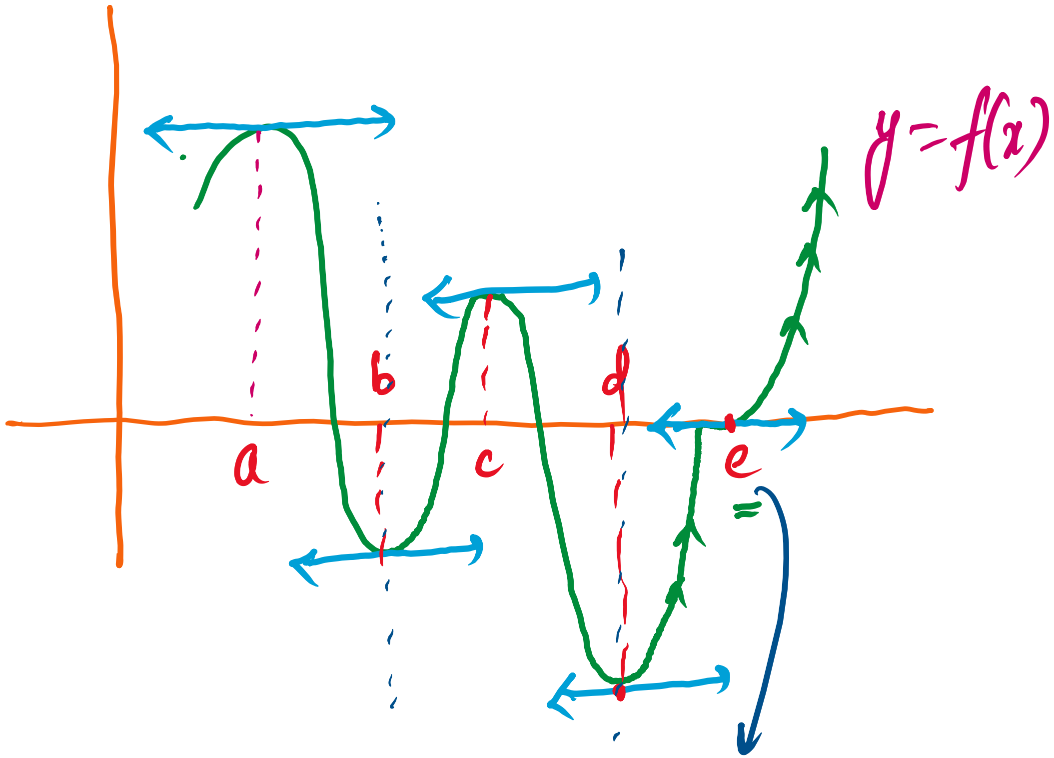
The test fails if $f'(c) = 0$ and $f''(c) = 0$. In this case, we go back to first derivative test.

$\frac{d^2y}{dx^2}$ at $x = c$ $< 0$ $\Rightarrow$ c is point of maxima.

$\frac{d^2y}{dx^2}$ at $x = d$ $> 0$ $\Rightarrow$ d is point of minima.

SSBCrack EXAMS

# ABSOLUTE AND LOCAL




point of inflexion

$$\left(\frac{d^2y}{dx^2}\Big|_{at\ x=e} = 0\right)$$

a c — maxima

a → absolute maxima / maxima

c → local maxima (neighbourhood)

b d

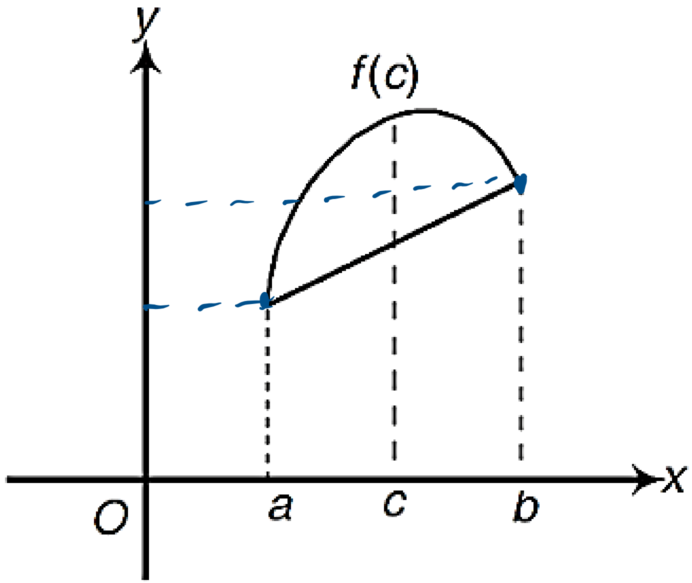
b → local minima

d → absolute minima / minima.

# LAGRANGE'S MEAN VALUE THEOREM

**Statement** If a function $f(x)$ is

1. continuous in the closed interval $[a, b]$.



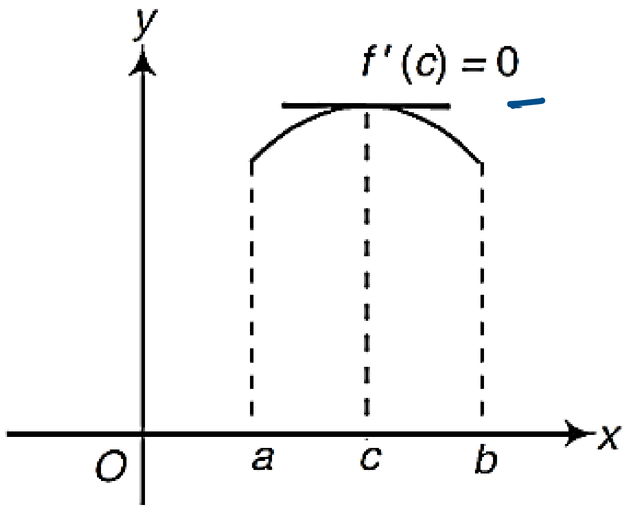

2. differentiable in an open interval $(a, b)$. Then, there will be atleast one point $c$, where $a < c < b$ such that

$$f'(c) = \frac{f(b) - f(a)}{b - a}$$

# ROLLE's THEOREM

**Statement** If a function $f(x)$ is

1. continuous in the closed interval $[a, b]$.
2. differentiable in an open interval $(a, b)$ *i.e.*, differentiable at each point in the open interval $(a, b)$.
3. $f(a) = f(b)$




Then, there will be atleast one point $c$ in the interval $(a, b)$ such that $f'(c) = 0$.

# PRACTISE QUESTIONS

**Q)** If the tangent to the curve, $y = x^3 + ax - b$ at the point $(1, -5)$ is perpendicular to the line, $-x + y + 4 = 0$, then which one of the following points lies on the curve ?

(a) $(-2, 2)$
(b) $(2, -2)$ ✓
(c) $(-2, 1)$
(d) $(2, -1)$

$-5 = (1)^3 + (-4)(1) - b$

$b = 2$

slope of tangent

$\left.\frac{dy}{dx}\right|_{\text{at } x=1,\ y=-5} = 3(1)^2 + a$

$m_1 = 3 + a$

slope of $-x + y + 4 = 0$

$y = x - 4$

$m_2 = 1$

product of slopes $= -1$

$(3 + a)1 = -1$

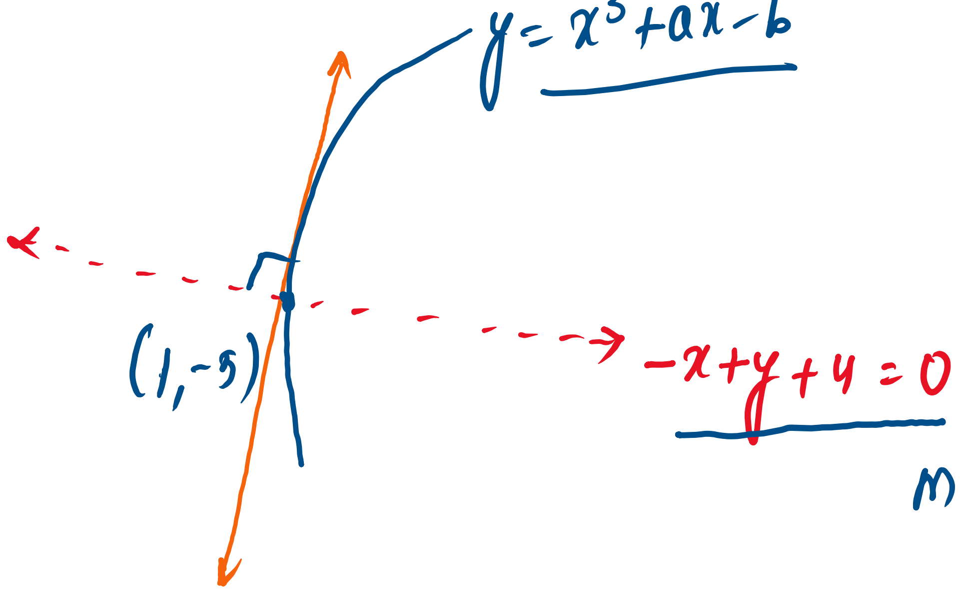
$a = -4$

curve

$y = x^3 - 4x - 2$

$(2, -2)$

satisfies



**Q)** If the tangent to the curve, $y = x^3 + ax - b$ at the point $(1, -5)$ is perpendicular to the line, $-x + y + 4 = 0$, then which one of the following points lies on the curve ?

(a) $(-2, 2)$ (b) $(2, -2)$

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

**Ans: (b)**

**Q)** What is the slope of the normal at the point $(at^2, 2at)$ of the parabola $y^2 = 4ax$ ?

(a) $\frac{1}{t}$ (b) $t$

(c) $-t$ ✓ (d) $-\frac{1}{t}$

$y^2 = 4ax$

$2y\frac{dy}{dx} = 4a$

$\frac{dy}{dx} = \frac{2a}{y}$

Slope of tangent at $(at^2, 2at)$

$\left.\frac{dy}{dx}\right|_{(at^2, 2at)} = \frac{2a}{2at} = \frac{1}{t}$

slope of normal $=$ (-ve) reciprocal $= -\left(\frac{1}{1/t}\right) = -t$

**Q)** What is the slope of the normal at the point $(at^2, 2at)$ of the parabola $y^2 = 4ax$ ?

(a) $\frac{1}{t}$

(b) $t$

(c) $-t$

(d) $-\frac{1}{t}$

**Ans: (c)**

**Q)** If $f(x) = 3x^2 + 6x - 9$, then

(a) $f(x)$ is increasing in $(-1, 3)$ ✗

(b) $f(x)$ is decreasing in $(3, \infty)$ ✗

(c) $f(x)$ is increasing in $(-\infty, -1)$ ✓

✓ (d) $f(x)$ is decreasing in $(-\infty, -1)$ ✓

$f'(x) = 6x + 6$

For critical points,

$f'(x) = 0$

$6x + 6 = 0$

$x = -1$


$f'(-2) = 6(-2) + 6$

$= -6$

$f'(-2) < 0 \Rightarrow$

**Q)** If $f(x) = 3x^2 + 6x - 9$, then

(a) $f(x)$ is increasing in $(-1, 3)$

(b) $f(x)$ is decreasing in $(3, \infty)$

(c) $f(x)$ is increasing in $(-\infty, -1)$

(d) $f(x)$ is decreasing in $(-\infty, -1)$

**Ans: (d)**

**Q)** What is the maximum slope of the curve $y = -x^3 + 3x^2 + 2x - 27$?

(a) 1 (b) 2

(c) 5 (d) $-23$

Slope

$\frac{dy}{dx} = -3x^2 + 6x + 2 = S$ (slope)

For slope to be maximum,

$\frac{dS}{dx} = -6x + 6$

$-6x + 6 = 0$

$x = 1$ ✓

$\frac{d^2S}{dx^2} = -6 < 0$

$\left.\frac{d^2S}{dx^2}\right|_{at\ x=1} = -6 < 0$

(1 is a point of maxima)

put $x = 1$ in S,

maximum slope,

$= -3 + 6 + 2$

$= 8 - 3 = 5$

**Q)** What is the maximum slope of the curve $y = -x^3 + 3x^2 + 2x - 27$?

(a) 1

(b) 2

(c) 5

(d) $-23$

**Ans: (c)**

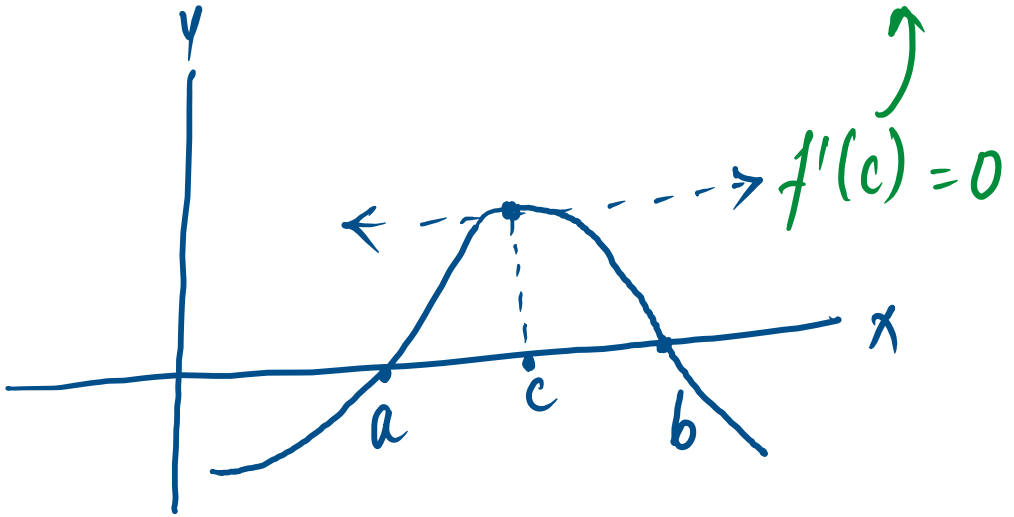
**Q)** Let $a$ and $b$ be two distinct roots of a polynomial equation $f(x) = 0$. Then there exists at least one root lying between $a$ and $b$ of the polynomial equation.

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

(c) $f''(x) = 0$ (d) None of these

$\{f(x) = 0\}$

$f(x) = 0$



SSBCrack EXAMS

**Q)** Let $a$ and $b$ be two distinct roots of a polynomial equation $f(x)=0$. Then there exists at least one root lying between $a$ and $b$ of the polynomial equation.

(a) $f(x)=0$

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

(c) $f''(x)=0$

(d) None of these

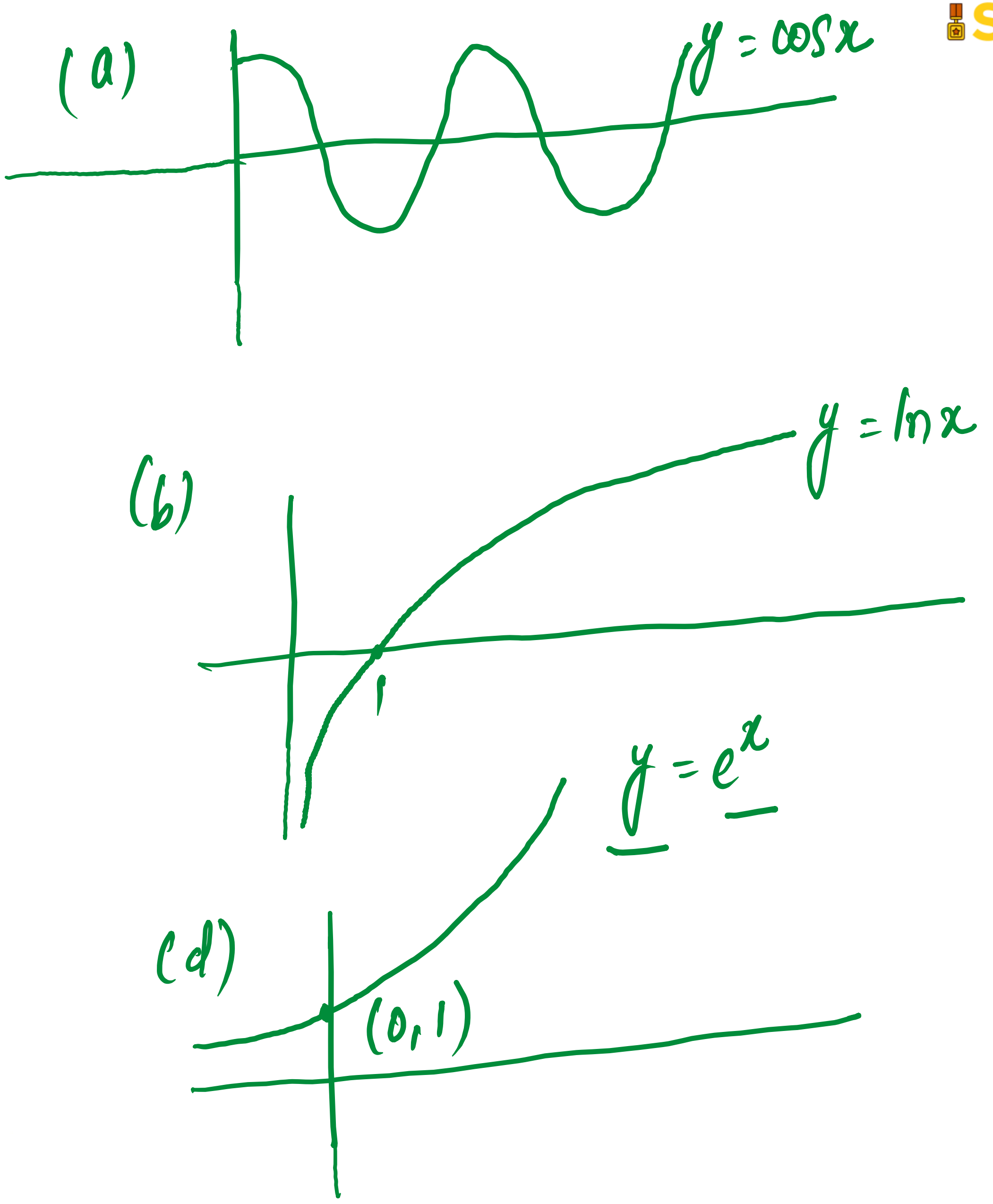
**Ans: (b)**

**Q)** Match List I with List II and select the correct answer using the code given below the lists:

| List I | | List II | |
|---|---|---|---|
| (a) | $f(x) = \cos x$ | 1. | The graph cuts y-axis in infinite number of points |
| (b) | $f(x) = \ln x$ | 2. | The graph cuts x -axis in two point |
| (c) | $f(x) = x^2 - 5x + 4$ | 3. | The graph cuts y-axis in only one point |
| (d) | $f(x) = e^x$ | 4. | The graph cuts x-axis in only one point |
| | | 5. | The graph cuts x-axis in infinite number of points |

**Codes:**

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



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| (b) | $f(x) = \ln x$ | 2. | The graph cuts x -axis in two point |
| (c) | $f(x) = x^2 - 5x + 4$ | 3. | The graph cuts y-axis in only one point |
| (d) | $f(x) = e^x$ | 4. | The graph cuts x-axis in only one point |
| | | 5. | The graph cuts x-axis in infinite number of points |

**Codes:**

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

**Ans: (c)**

**Q)** What is the area of the largest rectangular field which can be enclosed with 200 m of fencing ?

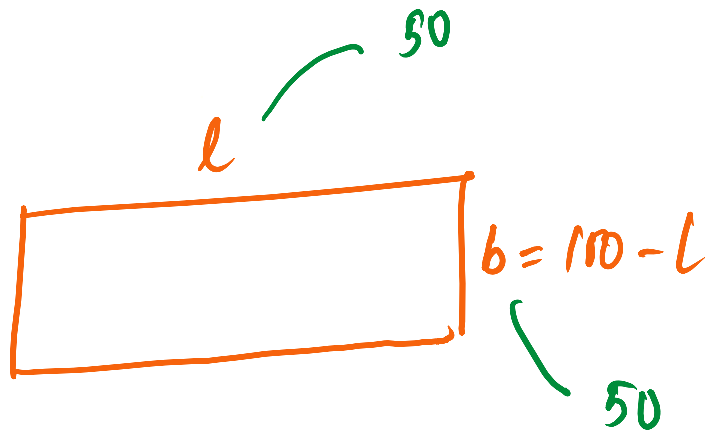
(a) 1600 m$^2$ (b) 2100 m$^2$

(c) 2400 m$^2$ (d) 2500 m$^2$ ✓

$(50 \times 50)$

$2(l+b) = 200$

$l + b = 100$




$\text{Area} = l(100 - l) = 100l - l^2$

$A = 100l - l^2$

$\frac{dA}{dl} = 100 - 2l$

$100 - 2l = 0$

$2l = 100$

$l = 50$ ; $b = 100 - l$

$= 100 - 50 = 50$

Q) What is the area of the largest rectangular field which can be enclosed with 200 m of fencing ?

(a) 1600 $m^2$ (b) 2100 $m^2$

(c) 2400 $m^2$ (d) 2500 $m^2$

**Ans: (d)**

**Q)** The maximum value of $\frac{\ln x}{x}$ is

(a) $e$ (b) $\frac{1}{e}$ (c) $\frac{2}{e}$ (d) 1

First der. Test

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

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

② $f'(x) = 0 \Rightarrow 1 - \ln x = 0$

$\ln x = 1 \Rightarrow x = e$

second derivative

$f''(x) = \frac{x^2\left(-\frac{1}{x}\right) - (1-\ln x)(2x)}{x^4}$

$f''(e) = \frac{-e - (1-1)(2x)}{e^4} = \frac{-e}{e^4} = < 0$

As $f''(e)$ is $-ve$,

$x = e$ is a point of maxima,

max. value of $\frac{\ln x}{x} = \frac{\ln e}{e} = \frac{1}{e}$

**Q)** The maximum value of $\frac{\ln x}{x}$ is

(a) $e$ (b) $\frac{1}{e}$ (c) $\frac{2}{e}$ (d) 1

**Ans: (b)**

**Q)** The velocity of telegraphic communication is given by $v = x^2 \log(1/x)$, where $x$ is the displacement. For maximum velocity, $x$ equals to?

(a) $e^{1/2}$ ✓(b) $e^{-1/2}$

(c) $(2e)^{-1}$ (d) $2e^{-1/2}$

$$v = x^2 \log\left(\frac{1}{x}\right)$$

$$\frac{dv}{dx} = 2x \log\left(\frac{1}{x}\right) + x^2 \cdot x \cdot \left(\frac{-1}{x^2}\right)$$

$$= 2x \log\left(\frac{1}{x}\right) - x$$

$$\frac{dv}{dx} = 0$$

$$2x \log\left(\frac{1}{x}\right) - x = 0$$

$$\log\left(\frac{1}{x}\right) = \frac{x}{2x}$$

$$\log x^{-1} = \frac{1}{2}$$

$$\left(\log x^m = m \log x\right)$$

$$\log x = -\frac{1}{2}$$

$$x = e^{-1/2}$$

**Q)** The velocity of telegraphic communication is given by $v = x^2 \log(1/x)$, where $x$ is the displacement. For maximum velocity, $x$ equals to?

(a) $e^{1/2}$ (b) $e^{-1/2}$

(c) $(2e)^{-1}$ (d) $2e^{-1/2}$

**Ans: (b)**

**Q)** What is the minimum value of $a^2x + b^2y$ where $xy = c^2$ ?

(a) $abc$ (b) $2abc$ ✓

(c) $3abc$ (d) $4abc$

$A = a^2x + b^2y$

$A = a^2x + b^2\left(\frac{c^2}{x}\right)$

$\frac{dA}{dx} = a^2 + b^2c^2\left(\frac{-1}{x^2}\right) = 0$

$x^2a^2 - b^2c^2 = 0$

$x^2 = \frac{b^2c^2}{a^2}$

$x = \frac{bc}{a}$ ; $x = -\frac{bc}{a}$

pt. of minima,

$\frac{d^2A}{dx^2} = -b^2c^2\left(-\frac{2}{x^3}\right)$

min. value $= a^2\left(\frac{bc}{a}\right) + b^2\left(\frac{c^2a}{bc}\right) = abc + abc$

$= 2abc$

**Q)** What is the minimum value of $a^2x + b^2y$ where $xy = c^2$ ?

(a) $abc$ (b) $2abc$

(c) $3abc$ (d) $4abc$

**Ans: (b)**

Q) Which one of the following is correct in respect of the function

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

(a) It is increasing in the interval $\left(0, \frac{\pi}{2}\right)$

(b) It remains constant in the interval $\left(0, \frac{\pi}{2}\right)$

(c) It is decreasing in the interval $\left(0, \frac{\pi}{2}\right)$

(d) It is decreasing in the interval $\left(\frac{\pi}{4}, \frac{\pi}{2}\right)$

Q) Which one of the following is correct in respect of the function

$$f(x) = x \sin x + \cos x + \frac{1}{2}\cos^2 x\,?$$

(a) It is increasing in the interval $\left(0, \frac{\pi}{2}\right)$

(b) It remains constant in the interval $\left(0, \frac{\pi}{2}\right)$

(c) It is decreasing in the interval $\left(0, \frac{\pi}{2}\right)$

(d) It is decreasing in the interval $\left(\frac{\pi}{4}, \frac{\pi}{2}\right)$

Ans: (a)

**Q)** A flower-bed in the form of a sector has been fenced by a wire of 40 m length. If the flower-bed has the greatest possible area, then what is the radius of the sector?

(a) 25 m (b) 20 m

(c) 10 m (d) 5 m

**Q)** A flower-bed in the form of a sector has been fenced by a wire of 40 m length. If the flower-bed has the greatest possible area, then what is the radius of the sector?

(a) 25 m
(b) 20 m
(c) 10 m
(d) 5 m

**Ans: (c)**

Q) What is the minimum value of $[x(x-1)+1]^{\frac{1}{3}}$, where $a \leq x \leq 1$?

(a) $\left(\frac{3}{4}\right)^{\frac{1}{3}}$ (b) 1 (c) $\frac{1}{2}$ (d) $\left(\frac{3}{8}\right)^{1/3}$

**Q)** What is the minimum value of $[x(x-1)+1]^{\frac{1}{3}}$, where $a \le x \le 1$?

(a) $\left(\frac{3}{4}\right)^{\frac{1}{3}}$ (b) 1 (c) $\frac{1}{2}$ (d) $\left(\frac{3}{8}\right)^{1/3}$

**Ans: (a)**

Q) **DIRECTIONS** : *For the next two (02) items that follow*

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

Q) **DIRECTIONS** : *For the next two (02) items that follow*

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)

**Q)** 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) $(1/2, 0)$

**Q)** 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)**

Q) **DIRECTIONS** : *For the next two (02) items that follow*

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

Q) **DIRECTIONS** : *For the next two (02) items that follow*

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

**Ans: (d)**

Q) What is the minimum value of the function ?

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

(c) 2 (d) 3

**Q)** What is the minimum value of the function ?

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

(c) 2 (d) 3

**Ans: (b)**

SSBCrack EXAMS

**Q)** 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

**Q)** 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)**

**Q)** 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) $|a^2 + b^2|$

Q) 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)

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

Q) 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)

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

**Q)** 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)**

**Q)** 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) $|2\alpha + 6\beta| = 11$

**Q)** 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)**

**Q)** 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) $\frac{8}{17}$

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

**Ans: (b)**

**Q)** 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) $\lambda > 4$

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(d) $\lambda > 4$

Ans: (d)

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

(a) 0

(b) 1

(c) 2

(d) 10

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(a) 0

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(d) 10

Ans: (b)

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

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**Ans: (d)**

**Q)** 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) $4a$

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**Ans: (c)**

**Q)** 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) $k \geq 3$

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**Ans: (c)**

Q) 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 |

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| (d) | 2 | 4 | 1 | 5 |

**Ans: (c)**

**Q)** 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

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(a) 32
(b) 40
(c) 50
(d) 80

**Ans: (b)**

**Q)** 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) $\frac{\pi}{2}$

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**Ans: (b)**

**Q)** If $y = |\sin x|^{|x|}$, then what is the value of $\frac{dy}{dx}$ at $x = \frac{\pi}{6}$?

(a) $\dfrac{2^{-\frac{\pi}{6}}\left(6\,\ell n2 - \sqrt{3}\pi\right)}{6}$

(b) $\dfrac{2^{\frac{\pi}{6}}\left(6\,\ell n2 + \sqrt{3}\pi\right)}{6}$

(c) $\dfrac{2^{-\frac{\pi}{6}}\left(6\,\ell n2 + \sqrt{3}\pi\right)}{6}$

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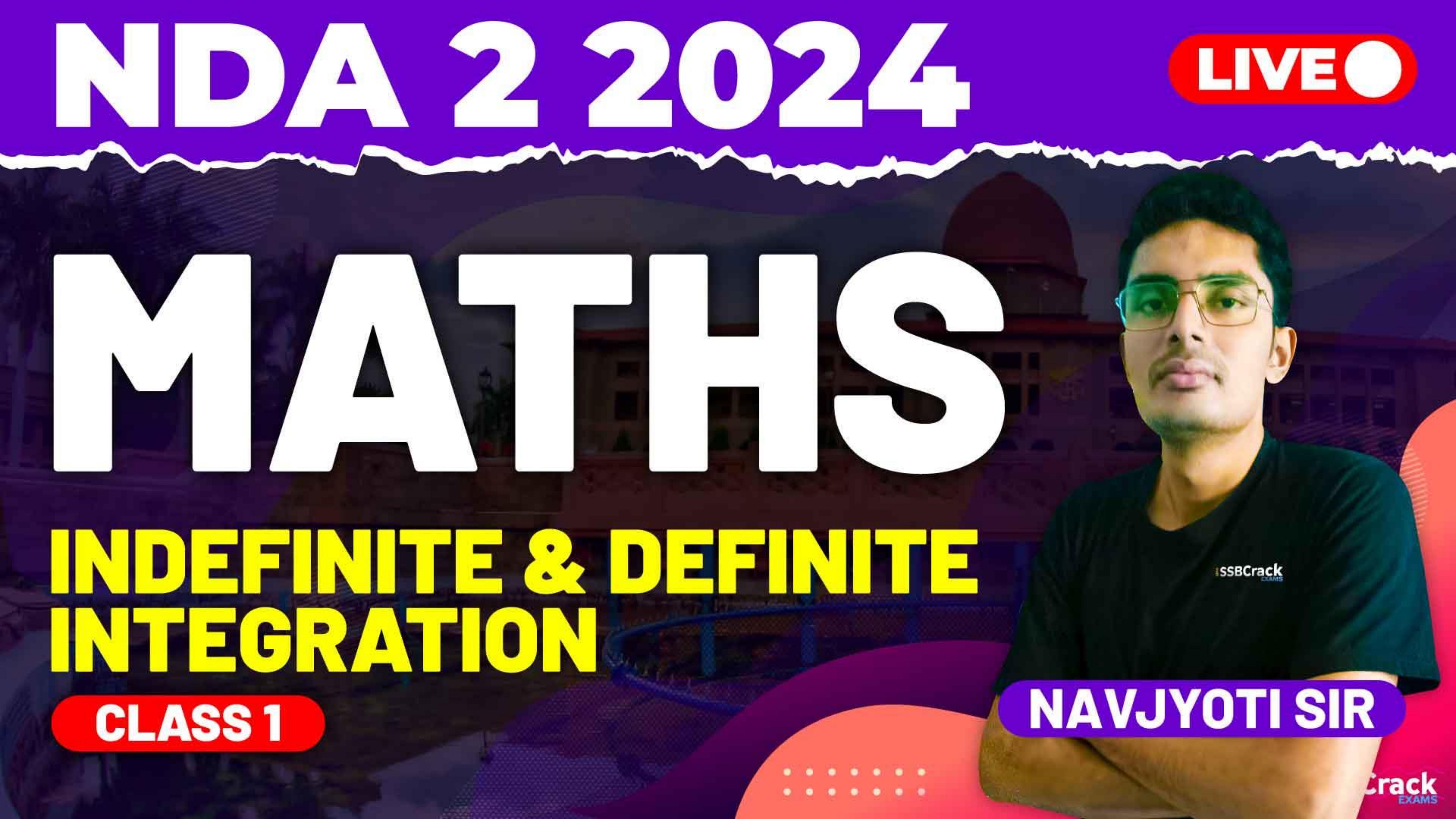
**Ans: (a)**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