

MATHEMATICS · JEE MAIN

Applications of Derivatives

Chapter-wise previous year questions, with answer key

88

PYQS

2020–2025

PAPERS

6

TOPICS

Rolle's and Mean Value Theorems

Maxima and Minima

Optimization Problems

Increasing and Decreasing Functions

Tangents and Normals

Rate of Change

- 1 Attempt each question on paper first — they're grouped by topic, newest papers first.
- 2 Check yourself against the answer key at the end.
- 3 Got one wrong? Tap “Step-by-step solution” under it for the full working.

Stuck on a question?

Every question has a free step-by-step solution on PrepWiser — tap “Step-by-step solution” under it.

Practise this chapter online with instant answer checking: prepwisser.in/learn · No signup needed to browse

Rolle's and Mean Value Theorems · 13 PYQs

Q1 JEE Main 2024 · 4 Apr · Shift 2

Let $f : \mathbb{R} \rightarrow \mathbb{R}$ be a thrice differentiable function such that $f(0) = 0, f(1) = 1, f(2) = -1, f(3) = 2$ and $f(4) = -2$. Then, the minimum number of zeros of $(3f'f'' + ff''')(x)$ is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/idyYVUYXmT](https://www.prepwiser.in/questions/idyYVUYXmT)

Q2 JEE Main 2023 · 11 Apr · Shift 1

Let $f : [2, 4] \rightarrow \mathbb{R}$ be a differentiable function such that

$$(x \log_e x) f'(x) + (\log_e x) f(x) + f(x) \geq 1, x \in [2, 4]$$

with $f(2) = \frac{1}{2}$ and $f(4) = \frac{1}{4}$.

Consider the following two statements :

(A) : $f(x) \leq 1$, for all $x \in [2, 4]$

(B) : $f(x) \geq \frac{1}{8}$, for all $x \in [2, 4]$

Then,

(A) Neither statement (A) nor statement (B) is true

(B) Only statement (A) is true

(C) Only statement (B) is true

(D) Both the statements (A) and (B) are true

[Step-by-step solution ► prepwiser.in/questions/te8e9e3Z5Z](https://www.prepwiser.in/questions/te8e9e3Z5Z)

Q3 JEE Main 2022 · 29 Jun · Shift 2

Let f and g be twice differentiable even functions on $(-2, 2)$ such that $f(\frac{1}{4}) = 0, f(\frac{1}{2}) = 0, f(1) = 1$ and $g(\frac{3}{4}) = 0, g(1) = 2$. Then, the minimum number of solutions of $f(x)g''(x) + f'(x)g'(x) = 0$ in $(-2, 2)$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/JlqLVncg4j](https://www.prepwiser.in/questions/JlqLVncg4j)

Q4 JEE Main 2021 · 31 Aug · Shift 2

Let f be any continuous function on $[0, 2]$ and twice differentiable on $(0, 2)$. If $f(0) = 0, f(1) = 1$ and $f(2) = 2$, then

(A) $f''(x) = 0$ for all $x \in (0, 2)$

(B) $f''(x) = 0$ for some $x \in (0, 2)$

(C) $f'(x) = 0$ for some $x \in [0, 2]$

(D) $f''(x) > 0$ for all $x \in (0, 2)$

[Step-by-step solution ► prepwiser.in/questions/1D0aiA_D4-](https://www.prepwiser.in/questions/1D0aiA_D4-)

Q5 JEE Main 2021 · 27 Jul · Shift 2

Let $f : (a, b) \rightarrow \mathbb{R}$ be twice differentiable function such that $f(x) = \int_a^x g(t)dt$ for a differentiable function $g(x)$. If $f(x) = 0$ has exactly five distinct roots in (a, b) , then $g(x)g'(x) = 0$ has at least :

(A) twelve roots in (a, b)

(B) five roots in (a, b)

(C) seven roots in (a, b)

(D) three roots in (a, b)

[Step-by-step solution ► prepwiser.in/questions/wMw9V8dABU](https://www.prepwiser.in/questions/wMw9V8dABU)

Q6 JEE Main 2021 · 25 Feb · Shift 1

If Rolle's theorem holds for the function $f(x) = x^3 - ax^2 + bx - 4$, $x \in [1, 2]$ with $f'\left(\frac{4}{3}\right) = 0$, then ordered pair (a, b) is equal to :

- (A) $(-5, -8)$ (B) $(5, -8)$
(C) $(-5, 8)$ (D) $(5, 8)$

Step-by-step solution ► [prepwisser.in/questions/-tzFK0YvDY](https://www.prepwisser.in/questions/-tzFK0YvDY)

Q7 JEE Main 2020 · 6 Sep · Shift 2

For all twice differentiable functions $f: \mathbb{R} \rightarrow \mathbb{R}$,
with $f(0) = f(1) = f'(0) = 0$

- (A) $f''(x) \neq 0$, at every point $x \in (0, 1)$
(B) $f''(x) = 0$, for some $x \in (0, 1)$
(C) $f''(0) = 0$
(D) $f''(x) = 0$, at every point $x \in (0, 1)$

Step-by-step solution ► [prepwisser.in/questions/EcaHlFBOL3](https://www.prepwisser.in/questions/EcaHlFBOL3)

Q8 JEE Main 2020 · 6 Sep · Shift 1

The position of a moving car at time t is

given by $f(t) = at^2 + bt + c$, $t > 0$, where a , b and c are real numbers greater than 1. Then the average speed of the car over the time interval $[t_1, t_2]$ is attained at the point :

- (A) $\frac{(t_1+t_2)}{2}$
(B) $\frac{(t_2-t_1)}{2}$
(C) $2a(t_1 + t_2) + b$
(D) $a(t_2 - t_1) + b$

Step-by-step solution ► [prepwisser.in/questions/6lAzdonzBK](https://www.prepwisser.in/questions/6lAzdonzBK)

Q9 JEE Main 2020 · 4 Sep · Shift 1

Let f be a twice differentiable function on $(1, 6)$. If $f(2) = 8$, $f'(2) = 5$, $f'(x) \geq 1$ and $f''(x) \geq 4$, for all $x \in (1, 6)$, then :

- (A) $f(5) \leq 10$ (B) $f(5) + f'(5) \geq 28$
(C) $f(5) + f'(5) \leq 26$ (D) $f'(5) + f''(5) \leq 20$

Step-by-step solution ► [prepwisser.in/questions/SS-L2bChnh](https://www.prepwisser.in/questions/SS-L2bChnh)

Q10 JEE Main 2020 · 8 Jan · Shift 1

If c is a point at which Rolle's theorem holds for the function,

$f(x) = \log_e \left(\frac{x^2 + \alpha}{7x} \right)$ in the interval $[3, 4]$, where $\alpha \in \mathbb{R}$, then $f''(c)$ is equal to

- (A) $\frac{1}{12}$ (B) $\frac{\sqrt{3}}{7}$
(C) $-\frac{1}{12}$ (D) $-\frac{1}{24}$

Step-by-step solution ► [prepwisser.in/questions/OA_DuJNl4b](https://www.prepwisser.in/questions/OA_DuJNl4b)

Q11 JEE Main 2020 · 8 Jan · Shift 2

Let S be the set of all functions $f : [0,1] \rightarrow \mathbb{R}$, which are continuous on $[0,1]$ and differentiable on $(0,1)$. Then for every f in S , there exists a $c \in (0,1)$, depending on f , such that

- (A) $|f(c) - f(1)| < |f'(c)|$
- (B) $|f(c) + f(1)| < (1+c)|f'(c)|$
- (C) $|f(c) - f(1)| < (1-c)|f'(c)|$
- (D) None

[Step-by-step solution ► prepwiser.in/questions/w-tTlrYadT](https://www.prepwiser.in/questions/w-tTlrYadT)

Q12 JEE Main 2020 · 7 Jan · Shift 2

The value of c in the Lagrange's mean value theorem for the function

$f(x) = x^3 - 4x^2 + 8x + 11$, when $x \in [0, 1]$ is:

- (A) $\frac{2}{3}$
- (B) $\frac{\sqrt{7}-2}{3}$
- (C) $\frac{4-\sqrt{5}}{3}$
- (D) $\frac{4-\sqrt{7}}{3}$

[Step-by-step solution ► prepwiser.in/questions/IpLkdi1Kfq](https://www.prepwiser.in/questions/IpLkdi1Kfq)

Q13 JEE Main 2020 · 7 Jan · Shift 1

Let the function, $f: [-7, 0] \rightarrow \mathbb{R}$ be continuous on $[-7,0]$ and differentiable on $(-7, 0)$. If $f(-7) = -3$ and $f'(x) \leq 2$, for all $x \in (-7,0)$, then for all such functions f , $f(-1) + f(0)$ lies in the interval:

- (A) $[-6, 20]$
- (B) $(-\infty, 20]$
- (C) $[-3, 11]$
- (D) $(-\infty, 11]$

[Step-by-step solution ► prepwiser.in/questions/NOnL5XMBwP](https://www.prepwiser.in/questions/NOnL5XMBwP)

Maxima and Minima · 36 PYQs

Q14 JEE Main 2025 · 7 Apr · Shift 2

Let $f : \mathbb{R} \rightarrow \mathbb{R}$ be a polynomial function of degree four having extreme values at $x = 4$ and $x = 5$. If

$\lim_{x \rightarrow 0} \frac{f(x)}{x^2} = 5$, then $f(2)$ is equal to :

- (A) 8
- (B) 10
- (C) 12
- (D) 14

[Step-by-step solution ► prepwiser.in/questions/N7bF-LrHIK](https://www.prepwiser.in/questions/N7bF-LrHIK)

Q15 JEE Main 2025 · 2 Apr · Shift 1

If the function $f(x) = 2x^3 - 9ax^2 + 12a^2x + 1$, where $a > 0$, attains its local maximum and local minimum values at p and q , respectively, such that $p^2 = q$, then $f(3)$ is equal to :

- (A) 55
- (B) 37
- (C) 10
- (D) 23

[Step-by-step solution ► prepwiser.in/questions/YN1bTaHbta](https://www.prepwiser.in/questions/YN1bTaHbta)

Q16 JEE Main 2025 · 22 Jan · Shift 2

Let $f(x) = \int_0^{x^2} \frac{t^2 - 8t + 15}{e^t} dt$, $x \in \mathbf{R}$. Then the numbers of local maximum and local minimum points of f , respectively, are :

- (A) 3 and 2 (B) 2 and 2
(C) 2 and 3 (D) 1 and 3

[Step-by-step solution ► prepwisser.in/questions/2p1iqny4MX](https://www.prepwisser.in/questions/2p1iqny4MX)

Q17 JEE Main 2024 · 9 Apr · Shift 2

Let the set of all values of p , for which $f(x) = (p^2 - 6p + 8)(\sin^2 2x - \cos^2 2x) + 2(2 - p)x + 7$ does not have any critical point, be the interval (a, b) . Then $16ab$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/zF7kE5o6o5](https://www.prepwisser.in/questions/zF7kE5o6o5)

Q18 JEE Main 2024 · 8 Apr · Shift 1

The number of critical points of the function $f(x) = (x - 2)^{2/3}(2x + 1)$ is

- (A) 2 (B) 1
(C) 0 (D) 3

[Step-by-step solution ► prepwisser.in/questions/LIuJ-ix1Yg](https://www.prepwisser.in/questions/LIuJ-ix1Yg)

Q19 JEE Main 2024 · 8 Apr · Shift 2

If the function $f(x) = 2x^3 - 9ax^2 + 12a^2x + 1$, $a > 0$ has a local maximum at $x = \alpha$ and a local minimum at $x = \alpha^2$, then α and α^2 are the roots of the equation :

- (A) $x^2 - 6x + 8 = 0$ (B) $8x^2 - 6x + 1 = 0$
(C) $8x^2 + 6x - 1 = 0$ (D) $x^2 + 6x + 8 = 0$

[Step-by-step solution ► prepwisser.in/questions/Vb3Tb30iNG](https://www.prepwisser.in/questions/Vb3Tb30iNG)

Q20 JEE Main 2024 · 6 Apr · Shift 2

If the function $f(x) = \left(\frac{1}{x}\right)^{2x}$; $x > 0$ attains the maximum value at $x = \frac{1}{e}$ then :

- (A) $e^\pi < \pi^e$
(B) $e^{2\pi} < (2\pi)^e$
(C) $(2e)^\pi > \pi^{(2e)}$
(D) $e^\pi > \pi^e$

[Step-by-step solution ► prepwisser.in/questions/9EoYKDHf7D](https://www.prepwisser.in/questions/9EoYKDHf7D)

Q21 JEE Main 2024 · 4 Apr · Shift 2

Let $f(x) = 3\sqrt{x-2} + \sqrt{4-x}$ be a real valued function. If α and β are respectively the minimum and the maximum values of f , then $\alpha^2 + 2\beta^2$ is equal to

- (A) 42 (B) 38
(C) 24 (D) 44

[Step-by-step solution ► prepwisser.in/questions/zLpH6d037o](https://www.prepwisser.in/questions/zLpH6d037o)

Q22 JEE Main 2024 · 4 Apr · Shift 1

Let the sum of the maximum and the minimum values of the function $f(x) = \frac{2x^2-3x+8}{2x^2+3x+8}$ be $\frac{m}{n}$, where $\gcd(m, n) = 1$. Then $m + n$ is equal to :

- (A) 217 (B) 182
(C) 201 (D) 195

Step-by-step solution ► [prepwiser.in/questions/VZjGBBU_Ox](https://www.prepwiser.in/questions/VZjGBBU_Ox)

Q23 JEE Main 2024 · 30 Jan · Shift 1

Let $g : \mathbf{R} \rightarrow \mathbf{R}$ be a non constant twice differentiable function such that

$$g' \left(\frac{1}{2} \right) = g' \left(\frac{3}{2} \right)$$

. If a real valued function f is defined as $f(x) = \frac{1}{2}[g(x) + g(2-x)]$, then

- (A) $f''(x) = 0$ for atleast two x in $(0, 2)$
(B) $f' \left(\frac{3}{2} \right) + f' \left(\frac{1}{2} \right) = 1$
(C) $f''(x) = 0$ for no x in $(0, 1)$
(D) $f''(x) = 0$ for exactly one x in $(0, 1)$

Step-by-step solution ► [prepwiser.in/questions/SzoOyA9Ovy](https://www.prepwiser.in/questions/SzoOyA9Ovy)

Q24 JEE Main 2023 · 12 Apr · Shift 1

If the local maximum value of the function

$$f(x) = \left(\frac{\sqrt{3e}}{2 \sin x} \right)^{\sin^2 x}, x \in \left(0, \frac{\pi}{2} \right)$$

, is $\frac{k}{e}$, then $\left(\frac{k}{e} \right)^8 + \frac{k^8}{e^5} + k^8$ is equal to

- (A) $e^3 + e^6 + e^{10}$ (B) $e^3 + e^5 + e^{11}$
(C) $e^3 + e^6 + e^{11}$ (D) $e^5 + e^6 + e^{11}$

Step-by-step solution ► [prepwiser.in/questions/XcFVKwtFUu](https://www.prepwiser.in/questions/XcFVKwtFUu)

Q25 JEE Main 2023 · 1 Feb · Shift 2

The sum of the absolute maximum and minimum values of the function $f(x) = |x^2 - 5x + 6| - 3x + 2$ in the interval $[-1, 3]$ is equal to :

- (A) 13 (B) 24
(C) 10 (D) 12

Step-by-step solution ► [prepwiser.in/questions/GsI3Rchz0c](https://www.prepwiser.in/questions/GsI3Rchz0c)

Q26 JEE Main 2023 · 30 Jan · Shift 2

If the functions $f(x) = \frac{x^3}{3} + 2bx + \frac{ax^2}{2}$

and $g(x) = \frac{x^3}{3} + ax + bx^2, a \neq 2b$

have a common extreme point, then $a + 2b + 7$ is equal to :

- (A) 6 (B) $\frac{3}{2}$
(C) 3 (D) 4

[Step-by-step solution ► prepwisser.in/questions/Cvou3Ct4pQ](https://www.prepwisser.in/questions/Cvou3Ct4pQ)

Q27 JEE Main 2023 · 25 Jan · Shift 1

Let $x = 2$ be a local minima of the function $f(x) = 2x^4 - 18x^2 + 8x + 12, x \in (-4, 4)$. If M is local maximum value of the function f in $(-4, 4)$, then M =

- (A) $18\sqrt{6} - \frac{33}{2}$ (B) $18\sqrt{6} - \frac{31}{2}$
(C) $12\sqrt{6} - \frac{33}{2}$ (D) $12\sqrt{6} - \frac{31}{2}$

[Step-by-step solution ► prepwisser.in/questions/MNLABdCqF-](https://www.prepwisser.in/questions/MNLABdCqF-)

Q28 JEE Main 2023 · 25 Jan · Shift 2

Let the function $f(x) = 2x^3 + (2p - 7)x^2 + 3(2p - 9)x - 6$ have a maxima for some value of $x < 0$ and a minima for some value of $x > 0$. Then, the set of all values of p is

- (A) $(-\frac{9}{2}, \frac{9}{2})$
(B) $(\frac{9}{2}, \infty)$
(C) $(0, \frac{9}{2})$
(D) $(-\infty, \frac{9}{2})$

[Step-by-step solution ► prepwisser.in/questions/fMAxODmvoA](https://www.prepwisser.in/questions/fMAxODmvoA)

Q29 JEE Main 2022 · 28 Jul · Shift 1

The minimum value of the twice differentiable function

$$f(x) = \int_0^x e^{x-t} f'(t) dt - (x^2 - x + 1) e^x$$

, $x \in \mathbf{R}$, is :

- (A) $-\frac{2}{\sqrt{e}}$ (B) $-2\sqrt{e}$
(C) $-\sqrt{e}$ (D) $\frac{2}{\sqrt{e}}$

[Step-by-step solution ► prepwisser.in/questions/MDbyzEXWXn](https://www.prepwisser.in/questions/MDbyzEXWXn)

Q30 JEE Main 2022 · 28 Jul · Shift 2

The sum of the absolute maximum and absolute minimum values of the function $f(x) = \tan^{-1}(\sin x - \cos x)$ in the interval $[0, \pi]$ is :

- (A) 0
- (B) $\tan^{-1}\left(\frac{1}{\sqrt{2}}\right) - \frac{\pi}{4}$
- (C) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right) - \frac{\pi}{4}$
- (D) $\frac{-\pi}{12}$

[Step-by-step solution ► prepwiser.in/questions/UkiF4ulnL-](https://www.prepwiser.in/questions/UkiF4ulnL-)

Q31 JEE Main 2022 · 26 Jul · Shift 1

Let

$$f(x) = \begin{cases} x^3 - x^2 + 10x - 7, & x \leq 1 \\ -2x + \log_2(b^2 - 4), & x > 1 \end{cases}$$

Then the set of all values of b , for which $f(x)$ has maximum value at $x = 1$, is :

- (A) $(-6, -2)$
- (B) $(2, 6)$
- (C) $[-6, -2) \cup (2, 6]$
- (D) $[-\sqrt{6}, -2) \cup (2, \sqrt{6}]$

[Step-by-step solution ► prepwiser.in/questions/mZIEg3xnWw](https://www.prepwiser.in/questions/mZIEg3xnWw)

Q32 JEE Main 2022 · 25 Jul · Shift 1

If the absolute maximum value of the function

$$f(x) = (x^2 - 2x + 7) e^{(4x^3 - 12x^2 - 180x + 31)}$$

in the interval $[-3, 0]$ is $f(\alpha)$, then :

- | | |
|--------------------------|---------------------------|
| (A) $\alpha = 0$ | (B) $\alpha = -3$ |
| (C) $\alpha \in (-1, 0)$ | (D) $\alpha \in (-3, -1]$ |

[Step-by-step solution ► prepwiser.in/questions/meWgzHxPzq](https://www.prepwiser.in/questions/meWgzHxPzq)

Q33 JEE Main 2022 · 25 Jul · Shift 1

The curve $y(x) = ax^3 + bx^2 + cx + 5$ touches the x -axis at the point $P(-2, 0)$ and cuts the y -axis at the point Q , where y' is equal to 3. Then the local maximum value of $y(x)$ is:

- | | |
|--------------------|--------------------|
| (A) $\frac{27}{4}$ | (B) $\frac{29}{4}$ |
| (C) $\frac{37}{4}$ | (D) $\frac{9}{2}$ |

[Step-by-step solution ► prepwiser.in/questions/ZCYsHQ5Zd9](https://www.prepwiser.in/questions/ZCYsHQ5Zd9)

Q34 JEE Main 2022 · 27 Jun · Shift 2

If m and n respectively are the number of local maximum and local minimum points of the function

$$f(x) = \int_0^{x^2} \frac{t^2 - 5t + 4}{2 + e^t} dt, \text{ then the ordered pair } (m, n) \text{ is equal to}$$

- (A) (3, 2) (B) (2, 3)
(C) (2, 2) (D) (3, 4)

[Step-by-step solution ► prepwisser.in/questions/f5tpqdhRLM](https://www.prepwisser.in/questions/f5tpqdhRLM)

Q35 JEE Main 2022 · 25 Jun · Shift 2

Let $f(x) = |(x - 1)(x^2 - 2x - 3)| + x - 3$, $x \in \mathbb{R}$. If m and M are respectively the number of points of local minimum and local maximum of f in the interval $(0, 4)$, then $m + M$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/mwU14PcBvr](https://www.prepwisser.in/questions/mwU14PcBvr)

Q36 JEE Main 2022 · 24 Jun · Shift 1

The sum of absolute maximum and absolute minimum values of the function $f(x) = |2x^2 + 3x - 2| + \sin x \cos x$ in the interval $[0, 1]$ is :

- (A) $3 + \frac{\sin(1)\cos^2(\frac{1}{2})}{2}$
(B) $3 + \frac{1}{2}(1 + 2\cos(1))\sin(1)$
(C) $5 + \frac{1}{2}(\sin(1) + \sin(2))$
(D) $2 + \sin(\frac{1}{2})\cos(\frac{1}{2})$

[Step-by-step solution ► prepwisser.in/questions/IK6CvIMDAk](https://www.prepwisser.in/questions/IK6CvIMDAk)

Q37 JEE Main 2021 · 31 Aug · Shift 2

Let $f(x)$ be a cubic polynomial with $f(1) = -10$, $f(-1) = 6$, and has a local minima at $x = 1$, and $f'(x)$ has a local minima at $x = -1$. Then $f(3)$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/Ncls9izpMJ](https://www.prepwisser.in/questions/Ncls9izpMJ)

Q38 JEE Main 2021 · 20 Jul · Shift 1

Let ' a ' be a real number such that the function $f(x) = ax^2 + 6x - 15$, $x \in \mathbb{R}$ is increasing in $(-\infty, \frac{3}{4})$ and decreasing in $(\frac{3}{4}, \infty)$. Then the function $g(x) = ax^2 - 6x + 15$, $x \in \mathbb{R}$ has a :

- (A) local maximum at $x = -\frac{3}{4}$
(B) local minimum at $x = -\frac{3}{4}$
(C) local maximum at $x = \frac{3}{4}$
(D) local minimum at $x = \frac{3}{4}$

[Step-by-step solution ► prepwisser.in/questions/9A3L8vsCPX](https://www.prepwisser.in/questions/9A3L8vsCPX)

Q39 JEE Main 2021 · 20 Jul · Shift 2

The sum of all the local minimum values of the twice differentiable function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = x^3 - 3x^2 - \frac{3f''(2)}{2}x + f''(1)$ is :

- (A) -22 (B) 5
(C) -27 (D) 0

[Step-by-step solution ► prepwiser.in/questions/7J-s9Pa-j2](https://www.prepwiser.in/questions/7J-s9Pa-j2)

Q40 JEE Main 2021 · 18 Mar · Shift 2

Let $P(x)$ be a real polynomial of degree 3 which vanishes at $x = -3$. Let $P(x)$ have local minima at $x = 1$, local maxima at $x = -1$ and $\int_{-1}^1 P(x)dx = 18$, then the sum of all the coefficients of the polynomial $P(x)$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/_XCeb7-7W4](https://www.prepwiser.in/questions/_XCeb7-7W4)

Q41 JEE Main 2021 · 17 Mar · Shift 2

Let $f: [-1, 1] \rightarrow \mathbb{R}$ be defined as $f(x) = ax^2 + bx + c$ for all $x \in [-1, 1]$, where $a, b, c \in \mathbb{R}$ such that $f(-1) = 2$, $f'(-1) = 1$ for $x \in (-1, 1)$ the maximum value of $f''(x)$ is $\frac{1}{2}$. If $f(x) \leq \alpha$, $x \in [-1, 1]$, then the least value of α is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/vyYKcVj72A](https://www.prepwiser.in/questions/vyYKcVj72A)

Q42 JEE Main 2021 · 16 Mar · Shift 1

The range of $a \in \mathbb{R}$ for which the

function $f(x) = (4a - 3)(x + \log_e 5) + 2(a - 7) \cot\left(\frac{x}{2}\right) \sin^2\left(\frac{x}{2}\right)$, $x \neq 2n\pi$, $n \in \mathbb{N}$ has critical points, is :

- (A) $[1, \infty)$
(B) $(-3, 1)$
(C) $\left[-\frac{4}{3}, 2\right]$
(D) $(-\infty, -1]$

[Step-by-step solution ► prepwiser.in/questions/UBkmDT3NSI](https://www.prepwiser.in/questions/UBkmDT3NSI)

Q43 JEE Main 2021 · 26 Feb · Shift 1

The maximum slope of the curve $y = \frac{1}{2}x^4 - 5x^3 + 18x^2 - 19x$ occurs at the point :

- (A) $(3, \frac{21}{2})$ (B) $(0, 0)$
(C) $(2, 9)$ (D) $(2, 2)$

[Step-by-step solution ► prepwiser.in/questions/GnOIFCSxmO](https://www.prepwiser.in/questions/GnOIFCSxmO)

Q44 JEE Main 2021 · 25 Feb · Shift 1

Let $f(x)$ be a polynomial of degree 6 in x , in which the coefficient of x^6 is unity and it has extrema at $x = -1$ and $x = 1$. If $\lim_{x \rightarrow 0} \frac{f(x)}{x^3} = 1$, then $5 \cdot f(2)$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/I2vPnhYTrQ](https://www.prepwiser.in/questions/I2vPnhYTrQ)

Q45 JEE Main 2020 · 6 Sep · Shift 2

The set of all real values of λ for which the function

$$f(x) = (1 - \cos^2 x)(\lambda + \sin x), x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$$

has exactly one maxima and exactly one minima, is :

- (A) $\left(-\frac{3}{2}, \frac{3}{2}\right) - \{0\}$
- (B) $\left(-\frac{3}{2}, \frac{3}{2}\right)$
- (C) $\left(-\frac{1}{2}, \frac{1}{2}\right) - \{0\}$
- (D) $\left(-\frac{1}{2}, \frac{1}{2}\right)$

[Step-by-step solution ► prepwiser.in/questions/EIJUDweIDa](https://www.prepwiser.in/questions/EIJUDweIDa)

Q46 JEE Main 2020 · 5 Sep · Shift 1

If the point P on the curve, $4x^2 + 5y^2 = 20$ is

farthest from the point Q(0, -4), then PQ^2 is equal to:

- (A) 36
- (B) 48
- (C) 21
- (D) 29

[Step-by-step solution ► prepwiser.in/questions/iFh-HwDDRb](https://www.prepwiser.in/questions/iFh-HwDDRb)

Q47 JEE Main 2020 · 2 Sep · Shift 1

If $p(x)$ be a polynomial of degree three that has a local maximum value 8 at $x = 1$ and a local minimum value 4 at $x = 2$; then $p(0)$ is equal to :

- (A) 6
- (B) 12
- (C) -12
- (D) -24

[Step-by-step solution ► prepwiser.in/questions/YTMmDcEaOX](https://www.prepwiser.in/questions/YTMmDcEaOX)

Q48 JEE Main 2020 · 9 Jan · Shift 2

Let a function $f : [0, 5] \rightarrow \mathbb{R}$ be continuous, $f(1) = 3$ and F be defined as :

$$F(x) = \int_1^x t^2 g(t) dt, \text{ where } g(t) = \int_1^t f(u) du$$

Then for the function F , the point $x = 1$ is :

- (A) a point of inflection.
- (B) a point of local maxima.
- (C) a point of local minima.
- (D) not a critical point.

[Step-by-step solution ► prepwiser.in/questions/OETZjIZOlY](https://www.prepwiser.in/questions/OETZjIZOlY)

Q49 JEE Main 2020 · 8 Jan · Shift 2

Let $f(x)$ be a polynomial of degree 3 such that $f(-1) = 10$, $f(1) = -6$, $f(x)$ has a critical point at $x = -1$ and $f'(x)$ has a critical point at $x = 1$. Then $f(x)$ has a local minima at $x = \underline{\hspace{2cm}}$.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/LpmFXo-HN5](https://www.prepwiser.in/questions/LpmFXo-HN5)

Optimization Problems · 7 PYQs

Q50 JEE Main 2023 · 31 Jan · Shift 1

A wire of length 20m is to be cut into two pieces. A piece of length l_1 is bent to make a square of area A_1 and the other piece of length l_2 is made into a circle of area A_2 . If $2A_1 + 3A_2$ is minimum then $(\pi l_1) : l_2$ is equal to :

- (A) 6 : 1 (B) 1 : 6
(C) 4 : 1 (D) 3 : 1

[Step-by-step solution ► prepwisar.in/questions/54Kvn9BQ9s](https://www.prepwisar.in/questions/54Kvn9BQ9s)

Q51 JEE Main 2022 · 26 Jul · Shift 2

Let P and Q be any points on the curves $(x - 1)^2 + (y + 1)^2 = 1$ and $y = x^2$, respectively. The distance between P and Q is minimum for some value of the abscissa of P in the interval :

- (A) $(0, \frac{1}{4})$ (B) $(\frac{1}{2}, \frac{3}{4})$
(C) $(\frac{1}{4}, \frac{1}{2})$ (D) $(\frac{3}{4}, 1)$

[Step-by-step solution ► prepwisar.in/questions/Fpju-ccBDd](https://www.prepwisar.in/questions/Fpju-ccBDd)

Q52 JEE Main 2022 · 30 Jun · Shift 1

If xy^4 attains maximum value at the point (x, y) on the line passing through the points $(50 + \alpha, 0)$ and $(0, 50 + \alpha)$, $\alpha > 0$, then (x, y) also lies on the line :

- (A) $y = 4x$ (B) $x = 4y$
(C) $y = 4x + \alpha$ (D) $x = 4y - \alpha$

[Step-by-step solution ► prepwisar.in/questions/LojhVXaTrM](https://www.prepwisar.in/questions/LojhVXaTrM)

Q53 JEE Main 2022 · 26 Jun · Shift 2

Consider a cuboid of sides $2x$, $4x$ and $5x$ and a closed hemisphere of radius r . If the sum of their surface areas is a constant k , then the ratio $x : r$, for which the sum of their volumes is maximum, is :

- (A) 2 : 5 (B) 19 : 45
(C) 3 : 8 (D) 19 : 15

[Step-by-step solution ► prepwisar.in/questions/pEatF5VMxE](https://www.prepwisar.in/questions/pEatF5VMxE)

Q54 JEE Main 2021 · 26 Aug · Shift 1

A wire of length 36 m is cut into two pieces, one of the pieces is bent to form a square and the other is bent to form a circle. If the sum of the areas of the two figures is minimum, and the circumference of the circle is k (meter), then $(\frac{4}{\pi} + 1)k$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/8jgg3dbZS_](https://www.prepwisar.in/questions/8jgg3dbZS_)

Q55 JEE Main 2021 · 20 Jul · Shift 2

If the point on the curve $y^2 = 6x$, nearest to the point $(3, \frac{3}{2})$ is (α, β) , then $2(\alpha + \beta)$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/FSMl1viMa-](https://www.prepwisar.in/questions/FSMl1viMa-)

Q56 JEE Main 2021 · 24 Feb · Shift 1

The minimum value of α for which the

equation $\frac{4}{\sin x} + \frac{1}{1-\sin x} = \alpha$ has at least one solution in $(0, \frac{\pi}{2})$ is

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/EUxedy7HTv](https://www.prepwiser.in/questions/EUxedy7HTv)

Increasing and Decreasing Functions · 13 PYQs

Q57 JEE Main 2025 · 8 Apr · Shift 2

Let the function $f(x) = \frac{x}{3} + \frac{3}{x} + 3, x \neq 0$ be strictly increasing in $(-\infty, \alpha_1) \cup (\alpha_2, \infty)$ and strictly decreasing in $(\alpha_3, \alpha_4) \cup (\alpha_5, \alpha_6)$. Then $\sum_{i=1}^6 \alpha_i^2$ is equal to

(A) 48

(B) 40

(C) 36

(D) 28

[Step-by-step solution ► prepwiser.in/questions/6_FAS8tQI7](https://www.prepwiser.in/questions/6_FAS8tQI7)

Q58 JEE Main 2025 · 24 Jan · Shift 2

Let $(2, 3)$ be the largest open interval in which the function $f(x) = 2 \log_e(x-2) - x^2 + ax + 1$ is strictly increasing and (b, c) be the largest open interval, in which the function $g(x) = (x-1)^3(x+2-a)^2$ is strictly decreasing. Then $100(a+b-c)$ is equal to :

(A) 360

(B) 420

(C) 160

(D) 280

[Step-by-step solution ► prepwiser.in/questions/XLUILy5pvs](https://www.prepwiser.in/questions/XLUILy5pvs)

Q59 JEE Main 2024 · 8 Apr · Shift 1

For the function $f(x) = (\cos x) - x + 1, x \in \mathbb{R}$, between the following two statements

(S1) $f(x) = 0$ for only one value of x in $[0, \pi]$.

(S2) $f(x)$ is decreasing in $[0, \frac{\pi}{2}]$ and increasing in $[\frac{\pi}{2}, \pi]$.

(A) Both (S1) and (S2) are incorrect.

(B) Only (S1) is correct.

(C) Only (S2) is correct.

(D) Both (S1) and (S2) are correct.

[Step-by-step solution ► prepwiser.in/questions/jznK1BVO8i](https://www.prepwiser.in/questions/jznK1BVO8i)

Q60 JEE Main 2024 · 6 Apr · Shift 1

The interval in which the function $f(x) = x^x, x > 0$, is strictly increasing is

(A) $(0, \infty)$

(B) $(0, \frac{1}{e}]$

(C) $[\frac{1}{e^2}, 1)$

(D) $[\frac{1}{e}, \infty)$

[Step-by-step solution ► prepwiser.in/questions/gaqajE0cJV](https://www.prepwiser.in/questions/gaqajE0cJV)

For the function

$$f(x) = \sin x + 3x - \frac{2}{\pi} (x^2 + x), \text{ where } x \in \left[0, \frac{\pi}{2}\right],$$

consider the following two statements :

(I) f is increasing in $(0, \frac{\pi}{2})$.

(II) f' is decreasing in $(0, \frac{\pi}{2})$.

Between the above two statements,

(A) only (I) is true.

(B) both (I) and (II) are true.

(C) only (II) is true.

(D) neither (I) nor (II) is true.

[Step-by-step solution ► prepwiser.in/questions/3YVtpv9Lwi](https://www.prepwiser.in/questions/3YVtpv9Lwi)

Let $g(x) = 3f\left(\frac{x}{3}\right) + f(3-x)$ and $f''(x) > 0$ for all $x \in (0, 3)$. If g is decreasing in $(0, \alpha)$ and increasing in $(\alpha, 3)$, then 8α is :

(A) 0

(B) 24

(C) 18

(D) 20

[Step-by-step solution ► prepwiser.in/questions/u0LR1SoGoD](https://www.prepwiser.in/questions/u0LR1SoGoD)

The function $f(x) = xe^{x(1-x)}$, $x \in \mathbb{R}$, is :

(A) increasing in $(-\frac{1}{2}, 1)$

(B) decreasing in $(\frac{1}{2}, 2)$

(C) increasing in $(-1, -\frac{1}{2})$

(D) decreasing in $(-\frac{1}{2}, \frac{1}{2})$

[Step-by-step solution ► prepwiser.in/questions/IYWkvoMppJ](https://www.prepwiser.in/questions/IYWkvoMppJ)

If the maximum value of a , for which the function $f_a(x) = \tan^{-1} 2x - 3ax + 7$ is non-decreasing in $(-\frac{\pi}{6}, \frac{\pi}{6})$, is $\bar{a}$, then $f_{\bar{a}}\left(\frac{\pi}{8}\right)$ is equal to :

(A) $8 - \frac{9\pi}{4(9+\pi^2)}$

(B) $8 - \frac{4\pi}{9(4+\pi^2)}$

(C) $8\left(\frac{1+\pi^2}{9+\pi^2}\right)$

(D) $8 - \frac{\pi}{4}$

[Step-by-step solution ► prepwiser.in/questions/2-p07ztMBa](https://www.prepwiser.in/questions/2-p07ztMBa)

Q65 JEE Main 2022 · 25 Jun · Shift 1

Let $f : R \rightarrow R$ and $g : R \rightarrow R$ be two functions defined by $f(x) = \log_e(x^2 + 1) - e^{-x} + 1$ and $g(x) = \frac{1-2e^{2x}}{e^x}$. Then, for which of the following range of α , the inequality

$$f\left(g\left(\frac{(\alpha-1)^2}{3}\right)\right) > f\left(g\left(\alpha - \frac{5}{3}\right)\right)$$

holds ?

(A) (2, 3)

(B) (-2, -1)

(C) (1, 2)

(D) (-1, 1)

[Step-by-step solution](#) ► [prepwisar.in/questions/T11axNKeO_](https://www.prepwisar.in/questions/T11axNKeO_)

Q66 JEE Main 2022 · 24 Jun · Shift 2

Let λ^* be the largest value of λ for which the function $f_\lambda(x) = 4\lambda x^3 - 36\lambda x^2 + 36x + 48$ is increasing for all $x \in R$. Then $f_{\lambda^*}(1) + f_{\lambda^*}(-1)$ is equal to :

(A) 36

(B) 48

(C) 64

(D) 72

[Step-by-step solution](#) ► [prepwisar.in/questions/isC1ApTwVK](https://www.prepwisar.in/questions/isC1ApTwVK)

Q67 JEE Main 2021 · 31 Aug · Shift 1

If 'R' is the least value of 'a' such that the function $f(x) = x^2 + ax + 1$ is increasing on $[1, 2]$ and 'S' is the greatest value of 'a' such that the function $f(x) = x^2 + ax + 1$ is decreasing on $[1, 2]$, then the value of $|R - S|$ is _____.

Numerical answer — enter the value.

[Step-by-step solution](#) ► [prepwisar.in/questions/KQYGS7jp3U](https://www.prepwisar.in/questions/KQYGS7jp3U)

Q68 JEE Main 2021 · 24 Feb · Shift 2

Let $f : R \rightarrow R$ be defined as

$$f(x) = \begin{cases} -55x, & \text{if } x < -5 \\ 2x^3 - 3x^2 - 120x, & \text{if } -5 \leq x \leq 4 \\ 2x^3 - 3x^2 - 36x - 336, & \text{if } x > 4, \end{cases}$$

Let $A = \{x \in R : f \text{ is increasing}\}$. Then A is equal to :

(A) $(-5, \infty)$

(B) $(-\infty, -5) \cup (4, \infty)$

(C) $(-5, -4) \cup (4, \infty)$

(D) $(-\infty, -5) \cup (-4, \infty)$

[Step-by-step solution](#) ► [prepwisar.in/questions/MhmUj1TZmZ](https://www.prepwisar.in/questions/MhmUj1TZmZ)

Q69 JEE Main 2021 · 24 Feb · Shift 1

The function

$$f(x) = \frac{4x^3 - 3x^2}{6} - 2 \sin x + (2x - 1) \cos x :$$

(A) increases in $(-\infty, \frac{1}{2}]$

(B) decreases in $(-\infty, \frac{1}{2}]$

(C) increases in $[\frac{1}{2}, \infty)$

(D) decreases in $[\frac{1}{2}, \infty)$

[Step-by-step solution](https://www.prepwiser.in/questions/JYUfhmTQcb) ► [prepwiser.in/questions/JYUfhmTQcb](https://www.prepwiser.in/questions/JYUfhmTQcb)

Tangents and Normals · 16 PYQs

Q70 JEE Main 2023 · 10 Apr · Shift 2

Let the quadratic curve passing through the point $(-1, 0)$ and touching the line $y = x$ at $(1, 1)$ be $y = f(x)$. Then the x -intercept of the normal to the curve at the point $(\alpha, \alpha + 1)$ in the first quadrant is _____.

Numerical answer — enter the value.

[Step-by-step solution](https://www.prepwiser.in/questions/djMjvQE9f5) ► [prepwiser.in/questions/djMjvQE9f5](https://www.prepwiser.in/questions/djMjvQE9f5)

Q71 JEE Main 2023 · 6 Apr · Shift 2

Let a curve $y = f(x)$, $x \in (0, \infty)$ pass through the points $P(1, \frac{3}{2})$ and $Q(a, \frac{1}{2})$. If the tangent at any point $R(b, f(b))$ to the given curve cuts the y -axis at the point $S(0, c)$ such that $bc = 3$, then $(PQ)^2$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution](https://www.prepwiser.in/questions/HvK8D96pUy) ► [prepwiser.in/questions/HvK8D96pUy](https://www.prepwiser.in/questions/HvK8D96pUy)

Q72 JEE Main 2023 · 30 Jan · Shift 1

The number of points on the curve $y = 54x^5 - 135x^4 - 70x^3 + 180x^2 + 210x$ at which the normal lines are parallel to $x + 90y + 2 = 0$ is :

(A) 2

(B) 3

(C) 4

(D) 0

[Step-by-step solution](https://www.prepwiser.in/questions/8E_Tm-2PSv) ► [prepwiser.in/questions/8E_Tm-2PSv](https://www.prepwiser.in/questions/8E_Tm-2PSv)

Q73 JEE Main 2023 · 29 Jan · Shift 2

If the equation of the normal to the curve $y = \frac{x-a}{(x+b)(x-2)}$ at the point $(1, -3)$ is $x - 4y = 13$, then the value of $a + b$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution](https://www.prepwiser.in/questions/ZzCAildJ9o) ► [prepwiser.in/questions/ZzCAildJ9o](https://www.prepwiser.in/questions/ZzCAildJ9o)

Q74 JEE Main 2022 · 29 Jul · Shift 2

If the tangent to the curve $y = x^3 - x^2 + x$ at the point (a, b) is also tangent to the curve $y = 5x^2 + 2x - 25$ at the point $(2, -1)$, then $|2a + 9b|$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution](https://www.prepwiser.in/questions/AcrbmFauor) ► [prepwiser.in/questions/AcrbmFauor](https://www.prepwiser.in/questions/AcrbmFauor)

Q75 JEE Main 2022 · 27 Jul · Shift 1

Let M and N be the number of points on the curve $y^5 - 9xy + 2x = 0$, where the tangents to the curve are parallel to x -axis and y -axis, respectively. Then the value of $M + N$ equals _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/vj_T81ouId](https://www.prepwiser.in/questions/vj_T81ouId)

Q76 JEE Main 2022 · 26 Jun · Shift 1

Let S be the set of all the natural numbers, for which the line $\frac{x}{a} + \frac{y}{b} = 2$ is a tangent to the curve $\left(\frac{x}{a}\right)^n + \left(\frac{y}{b}\right)^n = 2$ at the point (a, b) , $ab \neq 0$. Then :

(A) $S = \phi$

(B) $n(S) = 1$

(C) $S = \{2k : k \in \mathbb{N}\}$

(D) $S = \mathbb{N}$

[Step-by-step solution ► prepwiser.in/questions/bFH-HbXT5k](https://www.prepwiser.in/questions/bFH-HbXT5k)

Q77 JEE Main 2021 · 16 Mar · Shift 1

If the normal to the curve $y(x) = \int_0^x (2t^2 - 15t + 10)dt$ at a point (a, b) is parallel to the line $x + 3y = -5$, $a > 1$, then the value of $|a + 6b|$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/dSjthOve1J](https://www.prepwiser.in/questions/dSjthOve1J)

Q78 JEE Main 2021 · 25 Feb · Shift 2

If the curves $x = y^4$ and $xy = k$ cut at right angles, then $(4k)^6$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/2_xX3i5nEj](https://www.prepwiser.in/questions/2_xX3i5nEj)

Q79 JEE Main 2021 · 24 Feb · Shift 2

If the curve $y = ax^2 + bx + c$, $x \in \mathbb{R}$, passes through the point $(1, 2)$ and the tangent line to this curve at origin is $y = x$, then the possible values of a, b, c are :

(A) $a = -1, b = 1, c = 1$

(B) $a = 1, b = 1, c = 0$

(C) $a = \frac{1}{2}, b = \frac{1}{2}, c = 1$

(D) $a = 1, b = 0, c = 1$

[Step-by-step solution ► prepwiser.in/questions/HBR6R7rEW2](https://www.prepwiser.in/questions/HBR6R7rEW2)

Q80 JEE Main 2020 · 6 Sep · Shift 2

If the tangent to the curve, $y = f(x) = x \log_e x$, ($x > 0$) at a point $(c, f(c))$ is parallel to the line-segment joining the points $(1, 0)$ and (e, e) , then c is equal to :

(A) $\frac{e-1}{e}$

(B) $e^{\left(\frac{1}{1-e}\right)}$

(C) $e^{\left(\frac{1}{e-1}\right)}$

(D) $\frac{1}{e-1}$

[Step-by-step solution ► prepwiser.in/questions/KPZrNM6i8u](https://www.prepwiser.in/questions/KPZrNM6i8u)

Q81 JEE Main 2020 · 5 Sep · Shift 2

Which of the following points lies on the tangent to the curve

$$x^4 e^y + 2\sqrt{y+1} = 3 \text{ at the point } (1, 0)?$$

(A) (2, 2)

(B) (-2, 4)

(C) (2, 6)

(D) (-2, 6)

[Step-by-step solution ► prepwiser.in/questions/PcgowFACgA](https://www.prepwiser.in/questions/PcgowFACgA)

Q82 JEE Main 2020 · 3 Sep · Shift 2

If the tangent to the curve, $y = e^x$ at a point (c, e^c) and the normal to the parabola, $y^2 = 4x$ at the point $(1, 2)$ intersect at the same point on the x-axis, then the value of c is _____ .

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/DyzErIu9D6](https://www.prepwiser.in/questions/DyzErIu9D6)

Q83 JEE Main 2020 · 2 Sep · Shift 2

The equation of the normal to the curve

$$y = (1+x)^{2y} + \cos^2(\sin^{-1}x) \text{ at } x = 0 \text{ is :}$$

(A) $y = 4x + 2$

(B) $x + 4y = 8$

(C) $y + 4x = 2$

(D) $2y + x = 4$

[Step-by-step solution ► prepwiser.in/questions/2uXAti7119](https://www.prepwiser.in/questions/2uXAti7119)

Q84 JEE Main 2020 · 2 Sep · Shift 1

If the tangent to the curve $y = x + \sin y$ at a point

(a, b) is parallel to the line joining $(0, \frac{3}{2})$ and $(\frac{1}{2}, 2)$, then :

(A) $b = a$

(B) $|b - a| = 1$

(C) $b = \frac{\pi}{2} + a$

(D) $|a + b| = 1$

[Step-by-step solution ► prepwiser.in/questions/sChoqf42Ty](https://www.prepwiser.in/questions/sChoqf42Ty)

Q85 JEE Main 2020 · 8 Jan · Shift 1

Let the normal at a point P on the curve

$$y^2 - 3x^2 + y + 10 = 0 \text{ intersect the y-axis at } (0, \frac{3}{2}).$$

If m is the slope of the tangent at P to the curve, then $|m|$ is equal to

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/-Oe2o1Pjw6](https://www.prepwiser.in/questions/-Oe2o1Pjw6)

Rate of Change · 3 PYQs

Q86 JEE Main 2022 · 24 Jun · Shift 1

The surface area of a balloon of spherical shape being inflated, increases at a constant rate. If initially, the radius of balloon is 3 units and after 5 seconds, it becomes 7 units, then its radius after 9 seconds is :

(A) 9

(B) 10

(C) 11

(D) 12

[Step-by-step solution ► prepwiser.in/questions/qlvArqrvGH](https://www.prepwiser.in/questions/qlvArqrvGH)

Q87 JEE Main 2020 · 3 Sep · Shift 2

If the surface area of a cube is increasing at a rate of $3.6 \text{ cm}^2/\text{sec}$, retaining its shape; then the rate of change of its volume (in cm^3/sec), when the length of a side of the cube is 10 cm, is :

- (A) 9 (B) 10
(C) 18 (D) 20

[Step-by-step solution ► prepwiser.in/questions/pQNr2M8Kd5](https://prepwiser.in/questions/pQNr2M8Kd5)

Q88 JEE Main 2020 · 9 Jan · Shift 1

A spherical iron ball of 10 cm radius is coated with a layer of ice of uniform thickness the melts at a rate of $50 \text{ cm}^3/\text{min}$. When the thickness of ice is 5 cm, then the rate (in cm/min.) at which of the thickness of ice decreases, is :

- (A) $\frac{1}{18\pi}$ (B) $\frac{1}{36\pi}$
(C) $\frac{1}{54\pi}$ (D) $\frac{5}{6\pi}$

[Step-by-step solution ► prepwiser.in/questions/feZr46OUTb](https://prepwiser.in/questions/feZr46OUTb)

Answer key — Applications of Derivatives

Numbers match the question numbers above. For full working, open the solution link under each question.

1	5	2	D	3	4	4	B	5	C	6	D	7	B	8	A
9	B	10	A	11	D	12	D	13	B	14	B	15	B	16	C
17	252	18	A	19	A	20	D	21	A	22	C	23	A	24	C
25	C	26	A	27	C	28	D	29	A	30	C	31	C	32	B
33	A	34	B	35	3	36	B	37	22	38	A	39	C	40	8
41	5	42	C	43	D	44	144	45	A	46	A	47	C	48	C
49	3	50	A	51	C	52	A	53	B	54	36	55	9	56	9
57	C	58	A	59	B	60	D	61	B	62	C	63	A	64	A
65	A	66	D	67	2	68	C	69	C	70	11	71	5	72	C
73	4	74	195	75	2	76	D	77	406	78	4	79	B	80	C
81	D	82	4	83	B	84	B	85	4	86	A	87	A	88	A

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