

JEE MAIN APPLICATION OF DERIVATIVES — INCREASING AND DECREASING FUNCTIONS — PYQS

Max. Marks: 20

Questions: 5

Section A (MCQ) — 4 questions

Q.1 For the function $f(x) = e^{\sin|x|} - |x|$, $x \in \mathbb{R}$, consider the following statements :

Statement-I: f is differentiable for all $x \in \mathbb{R}$.

Statement-II: f is increasing in $(-\pi, -\frac{\pi}{2})$.

In the light of the above statements, choose the correct answer from the options given below :

[JEE Main 2026 (Online) 8th April Evening Shift]

- (1) Both Statement-I and Statement-II are true
- (2) Both Statement-I and Statement-II are false
- (3) Statement-I is true but Statement-II is false
- (4) Statement-I is false but Statement-II is true

Scan or tap for the full solution



Q.2 Consider the following three statements for the function $f: (0, \infty) \rightarrow \mathbb{R}$ defined by

$$f(x) = |\log_e x| - |x - 1| :$$

- (I) f is differentiable at all $x > 0$.
- (II) f is increasing in $(0, 1)$.
- (III) f is decreasing in $(1, \infty)$.

Then [JEE Main 2026 (Online) 24th January Evening Shift]

- (1) Only (I) is TRUE.
- (2) Only (I) and (III) are TRUE.
- (3) Only (II) and (III) are TRUE.
- (4) All (I), (II) and (III) are TRUE.

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Q.3 Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a twice differentiable function such that $f''(x) > 0$ for all $x \in \mathbb{R}$ and $f(a - 1) = 0$, where a is a real number.

$$\text{Let } g(x) = f(\tan^2 x - 2\tan x + a), \quad 0 < x < \frac{\pi}{2}.$$

Consider the following two statements:

- (I) g is increasing in $(0, \frac{\pi}{4})$
- (II) g is decreasing in $(\frac{\pi}{4}, \frac{\pi}{2})$

Then, [JEE Main 2026 (Online) 21st January Evening Shift]

- (1) Both (I) and (II) are True
- (2) Neither (I) nor (II) is True
- (3) Only (I) is True
- (4) Only (II) is True

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Q.4 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 $(\alpha_3, \alpha_4) \cup (\alpha_4, \alpha_5)$. Then $\sum_{i=1}^5 \alpha_i^2$ is equal to [JEE Main 2025 (Online) 8th April Evening Shift]

- (1) 48
- (2) 40
- (3) 36
- (4) 28

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Section B (Numerical) — 1 question

Q.5 Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a twice differentiable function such that the quadratic equation $f(x)m^2 - 2f'(x)m + f''(x) = 0$ in m , has two equal roots for every $x \in \mathbb{R}$. If $f(0) = 1$, $f'(0) = 2$, and (α, β) is the largest interval in which the function $f(\log_e x - x)$ is increasing, then $\alpha + \beta$ is equal to _____.

[JEE Main 2026 (Online) 21st January Morning Shift]

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ANSWER KEY

Section A (MCQ) — 4 questions

Ques.	1	2	3	4										
Ans.	1	2	2	3										

Section B (Numerical) — 1 question

Ques.	5													
Ans.	1													