

PART 1 - MATHEMATICS

Topic : Application of derivatives

SECTION-A : (Maximum Marks : 16)

This section contains **FOUR** questions.

Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct answer(s).

For each question, choose the option(s) corresponding to (all) the correct answer(s).

Answer to each question will be evaluated according to the following marking scheme :

Full Marks : +4 ONLY if (all) the correct option(s) is(are) chosen;

Partial Marks : +3 If all the four options are correct but ONLY three options are chosen;

Partial Marks : +2 If three or more options are correct but ONLY two options are chosen, both of which are correct;

Partial Marks : +1 If two or more options are correct but ONLY one option is chosen and it is a correct option;

Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);

Negative Marks : -1 In all other cases.

For example, in a question, if (A), (B) and (D) are the ONLY three options corresponding to correct answers, then choosing ONLY (A), (B) and (D) will get +4 marks; choosing ONLY (A) and (B) will get +2 marks; choosing ONLY (A) and (D) will get +2 marks; choosing ONLY (B) and (D) will get +2 marks; choosing ONLY (A) will get +1 mark; choosing ONLY (B) will get +1 mark; choosing ONLY (D) will get +1 mark; choosing no option (i.e. the question is unanswered) will get 0 marks; and choosing any other combination of options will get -1 marks.

1. Consider the function $f: (0, \infty) \rightarrow (-\infty, \infty)$ given by

$$f(x) = \sqrt{x} \log_e(x) - x + 1.$$

Then which one of the following statements is TRUE ?

[JEE Advanced 2026 Paper 1]

(A) The derivative of the function f is decreasing in the interval $(0, 1)$

(B) The function f has a local maximum at some point $a \in (0, \infty)$

(C) The function f has a local minimum at some point $b \in (0, \infty)$

(D) The function f has NEITHER a point of local maximum NOR a point of local minimum in the interval $(0, \infty)$

Scan or tap for the full solution



2. Let $\mathbb{R}$ denote the set of all real numbers. Define the function $f: \mathbb{R} \rightarrow \mathbb{R}$ by

$$f(x) = \begin{cases} 2 - 2x^2 - x^2 \sin \frac{1}{x} & \text{if } x \neq 0, \\ 2 & \text{if } x = 0. \end{cases}$$

Then which one of the following statements is TRUE?

[JEE Advanced 2025 Paper 1]

Space for Rough Work

- (A) The function f is NOT differentiable at $x = 0$
 (B) There is a positive real number δ , such that f is a decreasing function on the interval $(0, \delta)$
 (C) For any positive real number δ , the function f is NOT an increasing function on the interval $(-\delta, 0)$
 (D) $x = 0$ is a point of local minima of f

Scan or tap for the full solution



3. Let $\mathbb{R}$ denote the set of all real numbers. For a real number x , let $[x]$ denote the greatest integer less than or equal to x . Let n denote a natural number.

Match each entry in **List-I** to the correct entry in **List-II** and choose the correct option.

[JEE Advanced 2025 Paper 1]

List-I		List-II	
P.	The minimum value of n for which the function $f(x) = \left\lfloor \frac{10x^3 - 45x^2 + 60x + 35}{n} \right\rfloor$ is continuous on the interval $[1, 2]$, is	1.	8
Q.	The minimum value of n for which $g(x) = (2n^2 - 13n - 15)(x^3 + 3x)$, $x \in \mathbb{R}$, is an increasing function on $\mathbb{R}$, is	2.	9
R.	The smallest natural number n which is greater than 5, such that $x = 3$ is a point of local minima of $h(x) = (x^2 - 9)^n(x^2 + 2x + 3)$, is	3.	5
S.	Number of $x_0 \in \mathbb{R}$ such that $l(x) = \sum_{k=0}^4 \left(\sin x - k + \cos \left x - k + \frac{1}{2} \right \right)$, $x \in \mathbb{R}$, is NOT differentiable at x_0 , is	4.	6
		5.	10

- (A) $(P) \rightarrow (1), (Q) \rightarrow (3), (R) \rightarrow (2), (S) \rightarrow (5)$ (B) $(P) \rightarrow (2), (Q) \rightarrow (1), (R) \rightarrow (4), (S) \rightarrow (3)$
 (C) $(P) \rightarrow (5), (Q) \rightarrow (1), (R) \rightarrow (4), (S) \rightarrow (3)$ (D) $(P) \rightarrow (2), (Q) \rightarrow (3), (R) \rightarrow (1), (S) \rightarrow (5)$

Scan or tap for the full solution



Space for Rough Work

4. Let $\mathbb{R}$ denote the set of all real numbers. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be defined by

$$f(x) = \begin{cases} \frac{6x + \sin x}{2x + \sin x} & \text{if } x \neq 0, \\ \frac{7}{3} & \text{if } x = 0. \end{cases}$$

Then which of the following statements is (are) TRUE?

[JEE Advanced 2025 Paper 2]

- (A) The point $x = 0$ is a point of local maxima of f
- (B) The point $x = 0$ is a point of local minima of f
- (C) Number of points of local maxima of f in the interval $[\pi, 6\pi]$ is 3
- (D) Number of points of local minima of f in the interval $[2\pi, 4\pi]$ is 1

Scan or tap for the
full solution



Space for Rough Work

SECTION-B : (Maximum Marks : 4)

This section contains **ONE** question.

The answer to each question is a **NON-NEGATIVE INTEGER**.

For each question, enter the correct integer corresponding to the answer in the place designated to enter the answer.

Answer to each question will be evaluated according to the following marking scheme :

Full Marks : +4 If **ONLY** the correct answer is entered;

Zero Marks : 0 In all other cases.

5. Let the function $f: \mathbb{R} \rightarrow \mathbb{R}$ be defined by

$$f(x) = \frac{\sin x (x^{2023} + 2024x + 2025)}{e^{\pi x} (x^2 - x + 3)} + \frac{2 (x^{2023} + 2024x + 2025)}{e^{\pi x} (x^2 - x + 3)}.$$

Then the number of solutions of $f(x) = 0$ in $\mathbb{R}$ is _____.

[JEE Advanced 2024 Paper 2]

Scan or tap for the
full solution



Space for Rough Work

JEE ADVANCED APPLICATION OF DERIVATIVES —
PYQS

Test Pattern : JEE (Advanced)

ANSWER KEY

SECTION-A																
Ques.	1	2	3	4												
Ans.	D	C	B	B, C, D												

SECTION-B																
Ques.	5															
Ans.	1															