

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 $f : (0, \infty) \longrightarrow (-\infty, \infty)$ 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 $f : \mathbb{R} \longrightarrow \mathbb{R}$ 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)

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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]

Space for Rough Work

PYQSide

- (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



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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



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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																		