

PART 1 - MATHEMATICS

Topic : Continuity and differentiability

SECTION-A : (Maximum Marks : 8)

- This section contains **TWO** 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. Let R denote the set of all real numbers. Let $f : R \rightarrow R$ be an arbitrary function and let $g : R \rightarrow R$ be the function defined by

$$g(x) = xf(x), \text{ for all } x \in R.$$

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

[JEE Advanced 2026 Paper 1]

- (A) The function g is always continuous at $x = 0$
- (B) If f is continuous at $x = 0$, then g is differentiable at $x = 0$
- (C) If g is differentiable at $x = 0$, then f is continuous at $x = 0$
- (D) If g is differentiable at $x = 0$, then $\lim_{x \rightarrow 0} f(x)$ exists

Scan or tap for the
full solution



Space for Rough Work

2. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ and $g: \mathbb{R} \rightarrow \mathbb{R}$ be functions defined by

$$f(x) = \begin{cases} x|x|\sin\left(\frac{1}{x}\right), & x \neq 0, \\ 0, & x = 0, \end{cases} \text{ and } g(x) = \begin{cases} 1-2x, & 0 \leq x \leq \frac{1}{2}, \\ 0, & \text{otherwise.} \end{cases}$$

Let $a, b, c, d \in \mathbb{R}$. Define the function $h: \mathbb{R} \rightarrow \mathbb{R}$ by

$$h(x) = a f(x) + b \left(g(x) + g\left(\frac{1}{2} - x\right) \right) + c(x - g(x)) + d g(x), \quad x \in \mathbb{R}.$$

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

[JEE Advanced 2024 Paper 1]

List-I		List-II	
P.	If $a = 0, b = 1, c = 0$, and $d = 0$, then	1.	h is one-one.
Q.	If $a = 1, b = 0, c = 0$, and $d = 0$, then	2.	h is onto.
R.	If $a = 0, b = 0, c = 1$, and $d = 0$, then	3.	h is differentiable on $\mathbb{R}$.
S.	If $a = 0, b = 0, c = 0$, and $d = 1$, then	4.	the range of h is $[0, 1]$.
		5.	the range of h is $\{0, 1\}$.

(A) $(P) \rightarrow (4) (Q) \rightarrow (3) (R) \rightarrow (1) (S) \rightarrow (2)$

(B) $(P) \rightarrow (5) (Q) \rightarrow (2) (R) \rightarrow (4) (S) \rightarrow (3)$

(C) $(P) \rightarrow (5) (Q) \rightarrow (3) (R) \rightarrow (2) (S) \rightarrow (4)$

(D) $(P) \rightarrow (4) (Q) \rightarrow (2) (R) \rightarrow (1) (S) \rightarrow (3)$

Scan or tap for the full solution



Space for Rough Work

SECTION-B : (Maximum Marks : 12)

- This section contains **THREE** questions.
- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value of the answer (in decimal notation, truncated / rounded-off to the **SECOND DECIMAL PLACE**; e.g. 6.25, 7.00, -0.33, -0.30, 30.27, -127.30) 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.

3. Consider the function $f: \left(-\frac{\pi}{2}, \frac{\pi}{2}\right) \rightarrow (-\infty, \infty)$ defined by

$$f(x) = (|x| + |x - 1|)\sin x + [x \sin x],$$

where $[x \sin x]$ is the greatest integer less than or equal to $x \sin x$.

Let α be the total number of points in the interval $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ at which f is NOT continuous, and let β be the total number of points in the interval $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ at which f is NOT differentiable.

Then the value of $\alpha + \beta$ is _____.

[JEE Advanced 2026 Paper 1]

Scan or tap for the full solution 

4. For a real number α , let $[\alpha]$ denote the greatest integer less than or equal to α . For a finite set S , let $|S|$ denote the number of elements in the set S .

Consider the functions $f: (-3, 3) \rightarrow (-\infty, \infty)$ and $g: (-3, 3) \rightarrow (-\infty, \infty)$ defined by

$$f(x) = [x^3] \log_e (1 + \sin^2 (\pi(x - [x])))$$

and

$$g(x) = x^3 \sin^2 (\pi \log_e (1 + x - [x])).$$

Let

$$A = \{x \in (-3, 3) : f \text{ is discontinuous at } x\}$$

and

$$B = \{x \in (-3, 3) : g \text{ is discontinuous at } x\}.$$

Then the value of $|A| + 2|B| - |A \cap B|$ is _____.

[JEE Advanced 2026 Paper 2]

Scan or tap for the full solution 

5. Let $\mathbb{R}$ denote the set of all real numbers. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ and $g: \mathbb{R} \rightarrow (0, 4)$ be functions defined by

$$f(x) = \log_e (x^2 + 2x + 4), \text{ and } g(x) = \frac{4}{1 + e^{-2x}}.$$

Define the composite function $f \circ g^{-1}$ by $(f \circ g^{-1})(x) = f(g^{-1}(x))$, where g^{-1} is the inverse of the function g .

Then the value of the derivative of the composite function $f \circ g^{-1}$ at $x = 2$ is _____.

[JEE Advanced 2025 Paper 2]

Scan or tap for the full solution 

Space for Rough Work

JEE ADVANCED CONTINUITY AND DIFFERENTIABILITY — PYQS

Test Pattern : **JEE (Advanced)**

ANSWER KEY

SECTION-A

[illegible]

SECTION-B

[illegible]