

PART 1 - MATHEMATICS

Topic : Limits and derivatives

SECTION-1 : (Maximum Marks : 6)

- This section contains **TWO** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.
- For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated according to the following marking scheme :
 Full Marks : +3 If **ONLY** the correct option is chosen;
 Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);
 Negative Marks : -1 In all other cases.

1. Let x_0 be the real number such that $e^{x_0} + x_0 = 0$. For a given real number α , define

$$g(x) = \frac{3xe^x + 3x - \alpha e^x - \alpha x}{3(e^x + 1)}$$

for all real numbers x .

Then which one of the following statements is TRUE?

[JEE Advanced 2025 Paper 2]

(A) For $\alpha = 2$, $\lim_{x \rightarrow x_0} \left| \frac{g(x) + e^{x_0}}{x - x_0} \right| = 0$

(B) For $\alpha = 2$, $\lim_{x \rightarrow x_0} \left| \frac{g(x) + e^{x_0}}{x - x_0} \right| = 1$

(C) For $\alpha = 3$, $\lim_{x \rightarrow x_0} \left| \frac{g(x) + e^{x_0}}{x - x_0} \right| = 0$

(D) For $\alpha = 3$, $\lim_{x \rightarrow x_0} \left| \frac{g(x) + e^{x_0}}{x - x_0} \right| = \frac{2}{3}$

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2. Let $k \in \mathbb{R}$. If $\lim_{x \rightarrow 0^+} (\sin(\sin kx) + \cos x + x)^{\frac{2}{x}} = e^6$, then the value of k is

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(A) 1

(B) 2

(C) 3

(D) 4

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Space for Rough Work

SECTION-2 : (Maximum Marks : 4)

- This section contains **ONE** question.
- 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	: -2	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 -2 marks.

3. Let S be the set of all $(\alpha, \beta) \in \mathbb{R} \times \mathbb{R}$ such that

$$\lim_{x \rightarrow \infty} \frac{\sin(x^2)(\log_e x)^\alpha \sin\left(\frac{1}{x^2}\right)}{x^{\alpha\beta}(\log_e(1+x))^\beta} = 0.$$

Then which of the following is (are) correct?

(A) $(-1, 3) \in S$

(B) $(-1, 1) \in S$

(C) $(1, -1) \in S$

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(D) $(1, -2) \in S$

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full solution



Space for Rough Work

SECTION-3 : (Maximum Marks : 4)

- This section contains **ONE** question.
- 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, -.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.

4. Let α and β be the real numbers such that

$$\lim_{x \rightarrow 0} \frac{1}{x^3} \left(\frac{\alpha}{2} \int_0^x \frac{1}{1-t^2} dt + \beta x \cos x \right) = 2.$$

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

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Space for Rough Work

JEE ADVANCED LIMITS AND DERIVATIVES — PYQS

Test Pattern : JEE (Advanced)

ANSWER KEY

SECTION-1																											
Ques.	1	2																									
Ans.	C	B																									

SECTION-2																											
Ques.	3																										
Ans.	B, C																										

SECTION-3													
Ques.	4												
Ans.	2.35 to 2.45												