

JEE MAIN LIMITS AND DERIVATIVES — PYQS

Max. Marks: 76
Questions: 19

Section A (MCQ) — 16 questions

Q.1 The value of $\lim_{x \rightarrow 0} \left(\frac{x^2 \sin^2 x}{x^2 - \sin^2 x} \right)$ is :

[JEE Main 2026 (Online) 6th April Morning Shift]

- (1) 2 (2) 3 (3) 4 (4) 6

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Q.2 Let $\lim_{x \rightarrow 2} \frac{(\tan(x-2))(rx^2 + (p-2)x - 2p)}{(x-2)^2} = 5$ for some $r, p \in \mathbb{R}$. If the set of all possible values of q , such that the roots of the equation $rx^2 - px + q = 0$ lie in $(0, 2)$, be the interval $(\alpha, \beta]$, then $4(\alpha + \beta)$ equals :

[JEE Main 2026 (Online) 6th April Evening Shift]

- (1) 11 (2) 13 (3) 17 (4) 21

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Q.3 The product of all possible values of α , for which $\lim_{x \rightarrow 0} \left(\frac{1 - \cos(\alpha x) \cos((\alpha+1)x) \cos((\alpha+2)x)}{\sin^2((\alpha+1)x)} \right) = 2$, is :

[JEE Main 2026 (Online) 5th April Morning Shift]

- (1) -2 (2) 1 (3) -1 (4) $\frac{5}{4}$

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Q.4 Let $f(x) = \lim_{y \rightarrow 0} \frac{(1 - \cos(xy)) \tan(xy)}{y^3}$. Then the number of solutions of the equation $f(x) = \sin x$, $x \in \mathbb{R}$ is :

[JEE Main 2026 (Online) 5th April Evening Shift]

- (1) 0 (2) 2 (3) 3 (4) 1

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Q.5 If $\lim_{x \rightarrow 2} \frac{\sin(x^3 - 5x^2 + ax + b)}{(\sqrt{x-1} - 1) \log_e(x-1)} = m$, then $a + b + m$ is equal to :

[JEE Main 2026 (Online) 2nd April Morning Shift]

- (1) 5 (2) 6 (3) 8 (4) 10

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Q.6 The value of $\lim_{x \rightarrow 0} \frac{\log_e(\sec(ex) \cdot \sec(e^2x) \cdot \dots \cdot \sec(e^{10}x))}{e^2 - e^{2\cos x}}$ is equal to

[JEE Main 2026 (Online) 28th January Morning Shift]

- (1) $\frac{(e^{10} - 1)}{2e^2(e^2 - 1)}$ (2) $\frac{(e^{20} - 1)}{2e^2(e^2 - 1)}$
 (3) $\frac{(e^{10} - 1)}{2(e^2 - 1)}$ (4) $\frac{(e^{20} - 1)}{2(e^2 - 1)}$

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Q.7 If the function $f(x) = \frac{e^x(e^{\tan x} - x - 1) + \log_e(\sec x + \tan x) - x}{\tan x - x}$ is continuous at $x = 0$, then the value of $f(0)$ is equal to

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

- (1) $\frac{2}{3}$ (2) $\frac{1}{2}$ (3) 2 (4) $\frac{3}{2}$

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Q.8 If $\lim_{x \rightarrow 0} \frac{e^{(a-1)x} + 2\cos bx + (c-2)e^{-x}}{xcos x - \log_e(1+x)} = 2$, then $a^2 + b^2 + c^2$ is equal to :

[JEE Main 2026 (Online) 22nd January Evening Shift]

- (1) 3 (2) 5 (3) 9 (4) 7

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Q.9 Let $f: \mathbb{R} \rightarrow (0, \infty)$ be a twice differentiable function such that $f(3) = 18$, $f'(3) = 0$ and $f''(3) = 4$.

Then $\lim_{x \rightarrow 1} \log_e \left(\frac{f(2+x)}{f(3)} \right)^{\frac{18}{(x-1)^2}}$ is equal to :

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

- (1) 9 (2) 18 (3) 1 (4) 2

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Q.10 Let $f(x) = x^3 + x^2 f'(1) + 2x f''(2) + f'''(3)$, $x \in \mathbb{R}$. Then the value of $f(5)$ is :

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

- (1) $\frac{657}{5}$ (2) $\frac{117}{5}$ (3) $\frac{2}{5}$ (4) $\frac{62}{5}$

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Q.11 Given below are two statements:

Statement-I:

$$\lim_{x \rightarrow 0} \left(\frac{\tan^{-1} x + \log_e \sqrt{\frac{1+x}{1-x}} - 2x}{x^5} \right) = \frac{2}{5}$$

Statement-II: $\lim_{x \rightarrow 1} \left(\frac{2}{x^{1-x}} \right) = \frac{1}{e^2}$

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

[JEE Main 2025 (Online) 8th April Evening Shift]

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

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Q.12 $\lim_{x \rightarrow 0^+} \frac{\tan(5x^{\frac{1}{3}}) \log_e(1+3x^2)}{(\tan^{-1} 3\sqrt{x})^2 (e^{5x^{\frac{1}{3}}}-1)}$ is equal to

[JEE Main 2025 (Online) 7th April Morning Shift]

- (1) $\frac{5}{3}$ (2) 1 (3) $\frac{1}{3}$ (4) $\frac{1}{15}$

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Q.13 If $\lim_{x \rightarrow 1^+} \frac{(x-1)(6+\lambda \cos(x-1)) + \mu \sin(1-x)}{(x-1)^3} = -1$, where $\lambda, \mu \in \mathbb{R}$, then $\lambda + \mu$ is equal to

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) 20 (2) 19 (3) 18 (4) 17

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Q.14 Let f be a differentiable function on $\mathbb{R}$ such that $f(2) = 1$, $f'(2) = 4$. Let $\lim_{x \rightarrow 0} (f(2+x))^{3/x} = e^\alpha$. Then

the number of times the curve $y =$

$$4x^3 - 4x^2 - 4(\alpha - 7)x - \alpha \text{ meets } x\text{-axis is :}$$

[JEE Main 2025 (Online) 4th April Evening Shift]

- (1) 3 (2) 1 (3) 2 (4) 0

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Q.15 For $\alpha, \beta, \gamma \in \mathbb{R}$, if $\lim_{x \rightarrow 0} \frac{x^2 \sin \alpha x + (\gamma - 1)e^{x^2}}{\sin 2x - \beta x} = 3$, then $\beta + \gamma - \alpha$ is equal to :

[JEE Main 2025 (Online) 2nd April Morning Shift]

- (1) -1 (2) 4 (3) 6 (4) 7

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Q.16 If $\lim_{x \rightarrow 0} \frac{\cos(2x) + a \cos(4x) - b}{x^4}$ is finite, then $(a + b)$ is equal to:

[JEE Main 2025 (Online) 2nd April Evening Shift]

- (1) 0 (2) $\frac{3}{4}$ (3) -1 (4) $\frac{1}{2}$

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Section B (Numerical) — 3 questions

Q.17 If $\lim_{x \rightarrow 0} \left(\frac{\tan x}{x} \right)^{\frac{1}{x^2}} = p$, then $96 \log_e p$ is equal to

[JEE Main 2025 (Online) 3rd April Evening Shift]

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Q.18 Let $[t]$ be the greatest integer less than or equal to t . Then the least value of $p \in \mathbb{N}$ for which

$$\lim_{x \rightarrow 0^+} \left(x \left(\left[\frac{1}{x} \right] + \left[\frac{2}{x} \right] + \dots + \left[\frac{p}{x} \right] \right) - x^2 \left(\left[\frac{1}{x^2} \right] + \left[\frac{2^2}{x^2} \right] + \dots + \left[\frac{p^2}{x^2} \right] \right) \right) \geq 1$$

[JEE Main 2025 (Online) 29th January Morning Shift]

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Q.19 Let $f(x) = \lim_{n \rightarrow \infty} \sum_{r=0}^n \left(\frac{\tan(x/2^{r+1}) + \tan^3(x/2^{r+1})}{1 - \tan^2(x/2^{r+1})} \right)$.

Then $\lim_{x \rightarrow 0} \frac{e^x - e^{f(x)}}{(x - f(x))}$ is equal to _____.

[JEE Main 2025 (Online) 28th January Evening Shift]

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ANSWER KEY

Section A (MCQ) — 16 questions

Ques.	1	2	3	4	5	6	7	8	9	10	11
Ans.	2	3	3	3	2	4	4	4	4	2	3
Ques.	12	13	14	15	16						
Ans.	3	3	3	4	4						

Section B (Numerical) — 3 questions

Ques.	17	18	19								
Ans.	32	24	1								