

JEE MAIN APPLICATION OF DERIVATIVES — PYQS

Max. Marks: 76
Questions: 19

Section A (MCQ) — 16 questions

Q.1 For the function $f(x) = e^{\sin|x|} - |x|$, $x \in \mathbb{R}$, consider the following statements :

Statement-I: f is differentiable for all $x \in \mathbb{R}$.

Statement-II: f is increasing in $(-\pi, -\frac{\pi}{2})$.

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

[JEE Main 2026 (Online) 8th April Evening Shift]

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

Scan or tap for the full solution



Q.2 Let $A = \begin{bmatrix} 1 & 3 & -1 \\ 2 & 1 & \alpha \\ 0 & 1 & -1 \end{bmatrix}$ be a singular matrix. Let

$f(x) = \int_0^x (t^2 + 2t + 3)dt$, $x \in [1, \alpha]$. If M and m are

respectively the maximum and the minimum values of f in $[1, \alpha]$, then $3(M - m)$ is equal to :

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

- (1) 64 (2) 68 (3) 72 (4) 76

Scan or tap for the full solution



Q.3 Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a differentiable function such that $f\left(\frac{x+y}{3}\right) = \frac{f(x)+f(y)}{3}$ for all $x, y \in \mathbb{R}$, and $f(0) = 3$.

Then the minimum value of the function $g(x) = 3 + e^x f(x)$, is:

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

- (1) $3\left(\frac{e+1}{e}\right)$ (2) $3\left(\frac{e-1}{e}\right)$
 (3) $\frac{3-e}{e}$ (4) $3e$

Scan or tap for the full solution



Q.4 $\max_{0 \leq x \leq \pi} \left(16 \sin\left(\frac{x}{2}\right) \cos^3\left(\frac{x}{2}\right) \right)$ is equal to :

[JEE Main 2026 (Online) 4th April Evening Shift]

- (1) $\frac{3\sqrt{3}}{2}$ (2) $3\sqrt{3}$ (3) $4\sqrt{3}$ (4) $6\sqrt{3}$

Scan or tap for the full solution



Q.5 The number of critical points of the function

$$f(x) = \begin{cases} \left| \frac{\sin x}{x} \right|, & x \neq 0 \\ 1, & x = 0 \end{cases} \text{ in the interval } (-2\pi, 2\pi) \text{ is}$$

equal to :

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

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

Scan or tap for the full solution



Q.6 Let $f(x)$ be a polynomial of degree 5, and have extrema at $x = 1$ and $x = -1$. If $\lim_{x \rightarrow 0} \left(\frac{f(x)}{x^3} \right) = -5$, then $f(2) - f(-2)$ is equal to:

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

- (1) 0 (2) 50 (3) 92 (4) 112

Scan or tap for the full solution



Q.7 Consider the following three statements for the function $f: (0, \infty) \rightarrow \mathbb{R}$ defined by

$$f(x) = |\log_e x| - |x - 1| :$$

(I) f is differentiable at all $x > 0$.

(II) f is increasing in $(0, 1)$.

(III) f is decreasing in $(1, \infty)$.

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

- (1) Only (I) is TRUE.
 (2) Only (I) and (III) are TRUE.
 (3) Only (II) and (III) are TRUE.
 (4) All (I), (II) and (III) are TRUE.

Scan or tap for the full solution



- Q.8** Let $f(x) = x^{2025} - x^{2000}$, $x \in [0, 1]$ and the minimum value of the function $f(x)$ in the interval $[0, 1]$ be $(80)^{80}(n)^{-81}$. Then n is equal to

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

- (1) -40 (2) -41 (3) -80 (4) -81



- Q.9** Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a twice differentiable function such that $f''(x) > 0$ for all $x \in \mathbb{R}$ and $f(a - 1) = 0$, where a is a real number.

Let $g(x) = f(\tan^2 x - 2\tan x + a)$, $0 < x < \frac{\pi}{2}$.

Consider the following two statements:

(I) g is increasing in $(0, \frac{\pi}{4})$

(II) g is decreasing in $(\frac{\pi}{4}, \frac{\pi}{2})$

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

- (1) Both (I) and (II) are True
 (2) Neither (I) nor (II) is True
 (3) Only (I) is True
 (4) Only (II) is True



- Q.10** Let the function $f(x) = \frac{x}{3} + \frac{3}{x} + 3$, $x \neq 0$ be strictly increasing in $(-\infty, \alpha_1) \cup (\alpha_2, \infty)$ and strictly

decreasing in $(\alpha_3, \alpha_4) \cup (\alpha_4, \alpha_5)$. Then $\sum_{i=1}^5 \alpha_i^2$ is

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

- (1) 48 (2) 40 (3) 36 (4) 28



- Q.11** Let $x = -1$ and $x = 2$ be the critical points of the function $f(x) = x^3 + ax^2 + b \log_e |x| + 1$, $x \neq 0$. Let m and M respectively be the absolute minimum and the absolute maximum values of f in the interval $[-2, -\frac{1}{2}]$. Then $|M + m|$ is equal to (Take $\log_e 2 = 0.7$):

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

- (1) 21.1 (2) 19.8 (3) 22.1 (4) 20.9



- Q.12** Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a polynomial function of degree four having extreme values at $x = 4$ and $x = 5$. If

$\lim_{x \rightarrow 0} \frac{f(x)}{x^2} = 5$, then $f(2)$ is equal to :

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

- (1) 8 (2) 10 (3) 12 (4) 14



- Q.13** Let $a > 0$. If the function $f(x) = 6x^3 - 45ax^2 + 108a^2x + 1$ attains its local maximum and minimum values at the points x_1 and x_2 respectively such that $x_1x_2 = 54$, then $a + x_1 + x_2$ is equal to :

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

- (1) 15 (2) 13 (3) 24 (4) 18



- Q.14** Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a function defined by $f(x) = ||x + 2| - 2|x||$. If m is the number of points of local minima and n is the number of points of local maxima of f , then $m + n$ is

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

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



- Q.15** If the function $f(x) = 2x^3 - 9ax^2 + 12a^2x + 1$, where $a > 0$, attains its local maximum and local minimum values at p and q , respectively, such that $p^2 = q$, then $f(3)$ is equal to :

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

- (1) 55 (2) 37 (3) 10 (4) 23



- Q.16** The sum of all local minimum values of the function $f(x) = \begin{cases} 1 - 2x, & x < -1 \\ \frac{13}{7} + 2|\sin x|, & -1 \leq x \leq 2 \\ \frac{11}{8}(\sin x - 4)(\sin x - 5), & \sin x > 2 \end{cases}$ is

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

- (1) $\frac{167}{72}$ (2) $\frac{157}{72}$ (3) $\frac{171}{72}$ (4) $\frac{131}{72}$



Section B (Numerical) — 3 questions

- Q.17** Let f be a differentiable function satisfying $f(x) = 1 - 2x + \int_0^x e^{(x-t)} f(t) dt$, $x \in \mathbb{R}$ and let $g(x) = \int_0^x (f(t) + 2)^{15} (t - 4)^6 (t + 12)^{17} dt$, $x \in \mathbb{R}$.

If p and q are respectively the points of local minima and local maxima of g , then the value of $|p + q|$ is equal to _____.

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



- Q.18** Let $(2\alpha, \alpha)$ be the largest interval in which the function $f(t) = \frac{|t+1|}{t^2}$, $t < 0$, is strictly decreasing. Then the local maximum value of the function $g(x) = 2\log_e(x-2) + \alpha x^2 + 4x - \alpha$, $x > 2$, is _____

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

Scan or tap for the full solution



- Q.19** Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a twice differentiable function such that the quadratic equation $f(x)m^2 - 2f'(x)m + f''(x) = 0$ in m , has two equal roots for every $x \in \mathbb{R}$. If $f(0) = 1$, $f'(0) = 2$, and (α, β) is the largest interval in which the function $f(\log_e x - x)$ is increasing, then $\alpha + \beta$ is equal to _____.

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

Scan or tap for the full solution



ANSWER KEY

Section A (MCQ) — 16 questions

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

Section B (Numerical) — 3 questions

Ques.	17	18	19								
Ans.	9	4	1								