

JEE MAIN CONTINUITY AND DIFFERENTIABILITY — PYQs

Max. Marks: 192

Questions: 48

Section A (MCQ) — 34 questions

Q.1 Let $f(x) = \begin{cases} \frac{1}{3}, & x \leq \frac{\pi}{2} \\ \frac{b(1 - \sin x)}{(\pi - 2x)^2}, & x > \frac{\pi}{2} \end{cases}$. If f is continuous

at $x = \frac{\pi}{2}$, then the value of $\int_0^{3b-6} |x^2 + 2x - 3| dx$ is :

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

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

Scan or tap for the
full solution



Q.2 If $y = \tan^{-1} \left(\frac{3\cos x - 4\sin x}{4\cos x + 3\sin x} \right) + 2\tan^{-1} \left(\frac{x}{1 + \sqrt{1-x^2}} \right)$,
then $\frac{dy}{dx}$ at $x = \frac{\sqrt{3}}{2}$ is equal to :

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

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

Scan or tap for the
full solution



Q.3 Let f be a real polynomial of degree n such that $f(x) = f'(x)f''(x)$, for all $x \in \mathbb{R}$. If $f(0) = 0$, then $36(f'(2) + f''(2) + \int_0^2 f(x) dx)$ is equal to:

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

- (1) 42 (2) 46 (3) 56 (4) 66

Scan or tap for the
full solution



Q.4 Let $f(x) = \lim_{\theta \rightarrow 0} \left(\frac{\cos \pi x - x^{\left(\frac{2}{\theta}\right)} \sin(x-1)}{1 + x^{\left(\frac{2}{\theta}\right)} (x-1)} \right)$, $x \in \mathbb{R}$.

Consider the following two statements :

- (I) $f(x)$ is discontinuous at $x = 1$.
(II) $f(x)$ is continuous at $x = -1$.

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

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



Solution

Q.5 Let $\alpha, \beta \in \mathbb{R}$ be such that the function $f(x) = \begin{cases} 2\alpha(x^2 - 2) + 2\beta x, & x < 1 \\ (\alpha + 3)x + (\alpha - \beta), & x \geq 1 \end{cases}$ be differentiable at all $x \in \mathbb{R}$. Then $34(\alpha + \beta)$ is equal to

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

- (1) 48 (2) 84 (3) 36 (4) 24

Scan or tap for the
full solution



Q.6 Let $[t]$ denote the greatest integer less than or equal to t . If the function

$$f(x) = \begin{cases} b^2 \sin \left(\frac{\pi}{2} \left[\frac{\pi}{2} (\cos x + \sin x) \cos x \right] \right), & x < 0 \\ \sin x - \frac{1}{2} \sin 2x, & x > 0 \\ a, & x = 0 \end{cases}$$

is continuous at $x = 0$, then $a^2 + b^2$ is equal to :

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

- (1) $\frac{1}{2}$ (2) $\frac{5}{8}$ (3) $\frac{3}{4}$ (4) $\frac{9}{16}$

Scan or tap for the
full solution



Q.7 Let $f(x) = \begin{cases} \frac{ax^2 + 2ax + 3}{4x^2 + 4x - 3}, & x \neq -\frac{3}{2}, \frac{1}{2} \\ b, & x = -\frac{3}{2}, \frac{1}{2} \end{cases}$ be continuous at $x = -\frac{3}{2}$. If $f \circ f(x) = \frac{7}{5}$, then x is equal to:

[JEE Main 2026 (Online) 23rd January Morning Shift]

- (1) 1.4 (2) 2 (3) 1 (4) 0

Scan or tap for the
full solution



Q.8 If $f(x) = \begin{cases} \frac{a|x| + x^2 - 2(\sin|x|)(\cos|x|)}{x}, & x \neq 0 \\ b, & x = 0 \end{cases}$

is continuous at $x = 0$, then $a + b$ is equal to :

[JEE Main 2026 (Online) 23rd January Evening Shift]

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

Scan or tap for the
full solution



- Q.9** Let $[\cdot]$ denote the greatest integer function, and let $f(x) = \min \{ \sqrt{2x}, x^2 \}$.
Let $S = \{x \in (-2, 2) : \text{the function } g(x) = |x| [x^2] \text{ is discontinuous at } x\}$.
Then $\sum_{x \in S} f(x)$ equals

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

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

Scan or tap for the full solution



- Q.10** Let $f(x) = \begin{cases} (1+ax)^{1/x}, & x < 0 \\ 1+b, & x = 0 \\ \frac{(x+4)^{1/2}-2}{(x+c)^{1/3}-2}, & x > 0 \end{cases}$ be continuous at $x = 0$. Then e^{abc} is equal to:

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

- (1) 64 (2) 48 (3) 36 (4) 72

Scan or tap for the full solution



- Q.11** Let the function $f(x) = (x^2 - 1)|x^2 - ax + 2| + \cos|x|$ be not differentiable at the two points $x = \alpha = 2$ and $x = \beta$. Then the distance of the point (α, β) from the line $12x + 5y + 10 = 0$ is equal to :

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

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

Scan or tap for the full solution



- Q.12** Let $[x]$ denote the greatest integer function, and let m and n respectively be the numbers of the points, where the function $f(x) = [x] + |x - 2|$, $-2 < x < 3$, is not continuous and not differentiable. Then $m + n$ is equal to :

[JEE Main 2025 (Online) 24th January Evening Shift]

- (1) 6 (2) 9 (3) 8 (4) 7

Scan or tap for the full solution



- Q.13** If the function

$$f(x) = \begin{cases} \frac{2}{x} \{ \sin(k_1 + 1)x + \sin(k_2 - 1)x \}, & x < 0 \\ 4, & x = 0 \\ \frac{2}{x} \log_e \left(\frac{2 + k_1 x}{2 + k_2 x} \right), & x > 0 \end{cases}$$

is continuous at $x = 0$, then $k_1^2 + k_2^2$ is equal to :

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) 5 (2) 10 (3) 20 (4) 8

Scan or tap for the full solution



- Q.14** Let $f(x) = ax^3 + bx^2 + cx + 41$ be such that $f(1) = 40$, $f'(1) = 2$ and $f''(1) = 4$. Then $a^2 + b^2 + c^2$ is equal to:

[JEE Main 2024 (Online) 9th April Morning Shift]

- (1) 54 (2) 51 (3) 73 (4) 62

Scan or tap for the full solution



- Q.15** If $\log_e y = 3\sin^{-1} x$, then $(1 - x^2)y'' - xy'$ at $x = \frac{1}{2}$ is equal to

[JEE Main 2024 (Online) 9th April Evening Shift]

- (1) $9e^{\pi/2}$ (2) $9e^{\pi/6}$ (3) $3e^{\pi/2}$ (4) $3e^{\pi/6}$

Scan or tap for the full solution



- Q.16** For $a, b > 0$, let

$$f(x) = \begin{cases} \frac{\tan((a+1)x) + b \tan x}{x}, & x < 0 \\ 3, & x = 0 \\ \frac{\sqrt{ax + b^2 x^2} - \sqrt{ax}}{b\sqrt{a}x\sqrt{x}}, & x > 0 \end{cases} \text{ be a}$$

continuous function at $x = 0$. Then $\frac{b}{a}$ is equal to :

[JEE Main 2024 (Online) 8th April Evening Shift]

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

Scan or tap for the full solution



- Q.17** If $f(x) = \begin{cases} x^3 \sin\left(\frac{1}{x}\right), & x \neq 0 \\ 0, & x = 0 \end{cases}$, then

[JEE Main 2024 (Online) 6th April Morning Shift]

- (1) $f''(0) = 0$ (2) $f''(0) = 1$
(3) $f''\left(\frac{2}{\pi}\right) = \frac{24 - \pi^2}{2\pi}$ (4) $f''\left(\frac{2}{\pi}\right) = \frac{12 - \pi^2}{2\pi}$

Scan or tap for the full solution



- Q.18** Let $f: (-\infty, \infty) - \{0\} \rightarrow \mathbb{R}$ be a differentiable function such that $f(1) = \lim_{a \rightarrow \infty} a^2 f\left(\frac{1}{a}\right)$. Then

 $\lim_{a \rightarrow \infty} \frac{a(a+1)}{2} \tan^{-1}\left(\frac{1}{a}\right) + a^2 - 2\log_e a$ is equal to

[JEE Main 2024 (Online) 6th April Morning Shift]

- (1) $\frac{5}{2} + \frac{\pi}{8}$ (2) $\frac{3}{8} + \frac{\pi}{4}$ (3) $\frac{3}{4} + \frac{\pi}{8}$ (4) $\frac{3}{2} + \frac{\pi}{4}$

Scan or tap for the full solution



- Q.19** Suppose for a differentiable function h , $h(0) = 0$, $h(1) = 1$ and $h'(0) = h'(1) = 2$. If $g(x) = h(e^x)e^{h(x)}$, then $g'(0)$ is equal to:

[JEE Main 2024 (Online) 6th April Evening Shift]

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

Scan or tap for the full solution



- Q.20** Let $f(x) = x^5 + 2x^3 + 3x + 1$, $x \in \mathbb{R}$, and $g(x)$ be a function such that $g(f(x)) = x$ for all $x \in \mathbb{R}$. Then $\frac{g(7)}{g'(7)}$ is equal to :

[JEE Main 2024 (Online) 5th April Morning Shift]

- (1) 42 (2) 7 (3) 1 (4) 14

Scan or tap for the full solution 

- Q.21** If the function $f(x) = \frac{\sin 3x + \alpha \sin x - \beta \cos 3x}{x^3}$, $x \in \mathbb{R}$, is continuous at $x = 0$, then $f(0)$ is equal to :

[JEE Main 2024 (Online) 5th April Morning Shift]

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

Scan or tap for the full solution 

- Q.22** If $y(\theta) = \frac{2\cos \theta + \cos 2\theta}{\cos 3\theta + 4\cos 2\theta + 5\cos \theta + 2}$, then at $\theta = \frac{\pi}{2}$, $y'' + y' + y$ is equal to :

[JEE Main 2024 (Online) 5th April Evening Shift]

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

Scan or tap for the full solution 

- Q.23** Let $f: [-1, 2] \rightarrow \mathbb{R}$ be given by $f(x) = 2x^2 + x + [x^2] - [x]$, where $[t]$ denotes the greatest integer less than or equal to t . The number of points, where f is not continuous, is :

[JEE Main 2024 (Online) 5th April Evening Shift]

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

Scan or tap for the full solution 

- Q.24** Let $f(x) = x^5 + 2e^{x/4}$ for all $x \in \mathbb{R}$. Consider a function $g(x)$ such that $(g \circ f)(x) = x$ for all $x \in \mathbb{R}$. Then the value of $8g'(2)$ is :

[JEE Main 2024 (Online) 4th April Morning Shift]

- (1) 4 (2) 2 (3) 16 (4) 8

Scan or tap for the full solution 

- Q.25** Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a function given by

$$f(x) = \begin{cases} \frac{1 - \cos 2x}{x^2}, & x < 0 \\ \alpha, & x = 0, \\ \frac{\beta \sqrt{1 - \cos x}}{x}, & x > 0 \end{cases}$$

where $\alpha, \beta \in \mathbb{R}$. If f is continuous at $x = 0$, then $\alpha^2 + \beta^2$ is equal to :

[JEE Main 2024 (Online) 4th April Morning Shift]

- (1) 48 (2) 6 (3) 3 (4) 12

Scan or tap for the full solution 

- Q.26** If the function

$$f(x) = \begin{cases} \frac{72^x - 9^x - 8^x + 1}{\sqrt{2} - \sqrt{1 + \cos x}}, & x \neq 0 \\ a \log_e 2 \log_e 3, & x = 0 \end{cases}$$

is continuous at $x = 0$, then the value of a^2 is equal to

[JEE Main 2024 (Online) 4th April Evening Shift]

- (1) 968 (2) 1250 (3) 1152 (4) 746

Scan or tap for the full solution 

- Q.27** Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be defined as :

$$f(x) = \begin{cases} \frac{a - b \cos 2x}{x^2}, & x < 0 \\ x^2 + cx + 2; & 0 \leq x \leq 1 \\ 2x + 1; & x > 1 \end{cases}$$

If f is continuous everywhere in $\mathbb{R}$ and m is the number of points where f is NOT differentiable then $m + a + b + c$ equals :

[JEE Main 2024 (Online) 1st February Morning Shift]

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

Scan or tap for the full solution 

- Q.28** Let $f(x) = |2x^2 + 5|x| - 3|$, $x \in \mathbb{R}$. If m and n denote the number of points where f is not continuous and not differentiable respectively, then $m + n$ is equal to :

[JEE Main 2024 (Online) 1st February Evening Shift]

- (1) 5 (2) 3 (3) 2 (4) 0

Scan or tap for the full solution 

- Q.29** Let $g(x)$ be a linear function and

$$f(x) = \begin{cases} g(x), & x \leq 0 \\ \left(\frac{1+x}{2+x}\right)^{\frac{1}{x}}, & x > 0 \end{cases}, \text{ is continuous at } x = 0.$$

If $f(1) = f(-1)$, then the value $g(3)$ is

[JEE Main 2024 (Online) 31st January Morning Shift]

- (1) $\log_e \left(\frac{4}{9}\right) - 1$ (2) $\frac{1}{3} \log_e \left(\frac{4}{9e^{1/3}}\right)$
(3) $\log_e \left(\frac{4}{9e^{1/3}}\right)$ (4) $\frac{1}{3} \log_e \left(\frac{4}{9}\right) + 1$

Scan or tap for the full solution 

- Q.30** Consider the function $f: (0, \infty) \rightarrow \mathbb{R}$ defined by $f(x) = e^{-|\log_e x|}$. If m and n be respectively the number of points at which f is not continuous and f is not differentiable, then $m + n$ is

[JEE Main 2024 (Online) 31st January Evening Shift]

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

Scan or tap for the full solution 

- Q.31** Let a and b be real constants such that the function f defined by $f(x) = \begin{cases} x^2 + 3x + a, & x \leq 1 \\ bx + 2, & x > 1 \end{cases}$ be differentiable on $\mathbb{R}$. Then, the value of $\int_{-2}^2 f(x) dx$ equals

[JEE Main 2024 (Online) 30th January Evening Shift]

- (1) 21 (2) 19/6 (3) 17 (4) 15/6

Scan or tap for the full solution



- Q.32** Let $y = \log_e \left(\frac{1-x^2}{1+x^2} \right)$, $-1 < x < 1$. Then at $x = \frac{1}{2}$, the value of $225(y' - y'')$ is equal to

[JEE Main 2024 (Online) 29th January Evening Shift]

- (1) 732 (2) 736 (3) 742 (4) 746

Scan or tap for the full solution



- Q.33** Consider the function.

$$f(x) = \begin{cases} \frac{a(7x - 12 - x^2)}{b|x^2 - 7x + 12|}, & x < 3 \\ \frac{\sin(x-3)}{2^{x-[x]}}, & x > 3 \\ b, & x = 3, \end{cases}$$

where $[x]$ denotes the greatest integer less than or equal to x . If S denotes the set of all ordered pairs (a, b) such that $f(x)$ is continuous at $x = 3$, then the number of elements in S is :

[JEE Main 2024 (Online) 27th January Morning Shift]

- (1) Infinitely many (2) 4
-
- (3) 2 (4) 1

Solution



- Q.34** Consider the function $f: (0, 2) \rightarrow \mathbb{R}$ defined by

$$f(x) = \frac{x}{2} + \frac{2}{x} \text{ and the function } g(x) \text{ defined by } g(x) = \begin{cases} \min\{f(t)\}, & 0 < t \leq x \text{ and } 0 < x \leq 1 \\ \frac{3}{2} + x, & 1 < x < 2 \end{cases}. \text{ Then,}$$

[JEE Main 2024 (Online) 27th January Evening Shift]

- (1) g is continuous but not differentiable at $x = 1$
 (2) g is continuous and differentiable for all $x \in (0, 2)$
 (3) g is not continuous for all $x \in (0, 2)$
 (4) g is neither continuous nor differentiable at $x = 1$

Scan or tap for the full solution



Section B (Numerical) — 14 questions

- Q.35** Let $f(x) = \begin{cases} x^3 + 8; & x < 0, \\ x^2 - 4; & x \geq 0, \end{cases}$ and $g(x) = \begin{cases} (x-8)^{1/3}; & x < 0, \\ (x+4)^{1/2}; & x \geq 0. \end{cases}$ Then the number of points, where the function $g \circ f$ is discontinuous, is _____.

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

Scan or tap for the full solution



- Q.36** The number of points, at which the function $f(x) = \max\{6x, 2 + 3x^2\} + |x - 1| \cos \left| x^2 - \frac{1}{4} \right|$, $x \in (-\pi, \pi)$, is not differentiable, is _____.

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

Scan or tap for the full solution



- Q.37** Let $f(x) = \begin{cases} e^{x-1}, & x < 0 \\ x^2 - 5x + 6, & x \geq 0 \end{cases}$ and $g(x) = f(|x|) + |f(x)|$. If the number of points where g is not continuous and is not differentiable are α and β respectively, then $\alpha + \beta$ is equal to _____.

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

Scan or tap for the full solution



- Q.38** The number of points in the interval $[2, 4]$, at which the function $f(x) = \left[x^2 - x - \frac{1}{2} \right]$, where $[\cdot]$ denotes the greatest integer function, is discontinuous, is _____.

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

Scan or tap for the full solution



- Q.39** The number of points of discontinuity of the function $f(x) = \left[\frac{x^2}{2} \right] - [\sqrt{x}]$, $x \in [0, 4]$, where $[\cdot]$ denotes the greatest integer function, is _____.

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

Scan or tap for the full solution



- Q.40** If the function $f(x) = \frac{\tan(\tan x) - \sin(\sin x)}{\tan x - \sin x}$ is continuous at $x = 0$, then $f(0)$ is equal to _____.

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

Scan or tap for the full solution



- Q.41** Let $f(x) = x^3 + x^2 f'(1) + x f''(2) + f'''(3)$, $x \in \mathbb{R}$. Then $f(10)$ is equal to _____.

[JEE Main 2024 (Online) 27th January Morning Shift]

Scan or tap for the full solution



- Q.42** Let m and n be the number of points at which the function $f(x) = \max \{x, x^3, x^5, \dots, x^{21}\}$, $x \in \mathbb{R}$, is not differentiable and not continuous, respectively. Then $m + n$ is equal to _____.

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

Scan or tap for the full solution



- Q.43** Let $f(x) = \begin{cases} 3x, & x < 0 \\ \min \{1 + x + [x], x + 2[x]\}, & 0 \leq x \leq 2 \\ 5, & x > 2 \end{cases}$

where $[.]$ denotes greatest integer function. If α and β are the number of points, where f is not continuous and is not differentiable, respectively, then $\alpha + \beta$ equals _____.

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

Scan or tap for the full solution



- Q.44** Let $f: (0, \pi) \rightarrow \mathbb{R}$ be a function given by

$$f(x) = \begin{cases} \left(\frac{8}{7}\right)^{\frac{\tan 8x}{\tan 7x}}, & 0 < x < \frac{\pi}{2} \\ a - 8, & x = \frac{\pi}{2} \\ (1 + |\cot x|)^{\frac{b}{a} |\tan x|}, & \frac{\pi}{2} < x < \pi \end{cases}$$

where $a, b \in \mathbb{Z}$. If f is continuous at $x = \frac{\pi}{2}$, then $a^2 + b^2$ is equal to _____.

[JEE Main 2024 (Online) 9th April Morning Shift]

Scan or tap for the full solution



- Q.45** Let $[t]$ denote the greatest integer less than or equal to t . Let $f: [0, \infty) \rightarrow \mathbb{R}$ be a function defined by $f(x) = \left[\frac{x}{2} + 3\right] - [\sqrt{x}]$. Let S be the set of all points in the interval $[0, 8]$ at which f is not continuous. Then $\sum_{a \in S} a$ is equal to _____.

[JEE Main 2024 (Online) 6th April Evening Shift]

Scan or tap for the full solution



- Q.46** If $y = \frac{(\sqrt{x} + 1)(x^2 - \sqrt{x})}{x\sqrt{x} + x + \sqrt{x}} + \frac{1}{15}(3\cos^2 x - 5)\cos^3 x$, then $96y'\left(\frac{\pi}{6}\right)$ is equal to :

[JEE Main 2024 (Online) 1st February Evening Shift]

Scan or tap for the full solution



- Q.47** If the function

$$f(x) = \begin{cases} \frac{1}{|x|}, & |x| \geq 2 \\ ax^2 + 2b, & |x| < 2 \end{cases}$$

is differentiable on $\mathbb{R}$, then $48(a + b)$ is equal to _____.

[JEE Main 2024 (Online) 30th January Morning Shift]

Scan or tap for the full solution



- Q.48** Let for a differentiable function $f: (0, \infty) \rightarrow \mathbb{R}$, $f(x) - f(y) \geq \log_e \left(\frac{x}{y}\right) + x - y$, $\forall x, y \in (0, \infty)$. Then $\sum_{n=1}^{20} f\left(\frac{1}{n^2}\right)$ is equal to _____.

[JEE Main 2024 (Online) 27th January Morning Shift]

Scan or tap for the full solution



ANSWER KEY

Section A (MCQ) — 34 questions

Ques.	1	2	3	4	5
Ans.	4	3	3	1	1
Ques.	6	7	8	9	10
Ans.	3	3	2	3	2
Ques.	11	12	13	14	15
Ans.	BONUS	3	2	2	1
Ques.	16	17	18	19	20
Ans.	4	3	BONUS	1	4
Ques.	21	22	23	24	25
Ans.	3	4	3	3	4
Ques.	26	27	28	29	30
Ans.	3	4	2	3	2
Ques.	31	32	33	34	
Ans.	3	2	4	1	

Section B (Numerical) — 14 questions

Ques.	35	36	37	38	39	40	41
Ans.	3	3	4	10	8	2	202
Ques.	42	43	44	45	46	47	48
Ans.	3	5	81	17	105	15	2890