

MATHEMATICS · JEE MAIN

Continuity & Differentiability

Chapter-wise previous year questions, with answer key

62

PYQS

2020–2025

PAPERS

4

TOPICS

Continuity at a Point

Differentiability

Types of Discontinuities

Continuity and Differentiability Relation

- 1 Attempt each question on paper first — they're grouped by topic, newest papers first.
- 2 Check yourself against the answer key at the end.
- 3 Got one wrong? Tap “Step-by-step solution” under it for the full working.

Stuck on a question?

Every question has a free step-by-step solution on PrepWiser — tap “Step-by-step solution” under it.

Practise this chapter online with instant answer checking: prepwisar.in/learn · No signup needed to browse

Continuity at a Point · 31 PYQs

Q1 JEE Main 2025 · 7 Apr · Shift 2

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 _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/XLTHR-n0DJ](https://www.prepwiser.in/questions/XLTHR-n0DJ)

Q2 JEE Main 2025 · 3 Apr · Shift 1

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 $e^a b c$ is equal to:

(A) 64

(B) 48

(C) 36

(D) 72

[Step-by-step solution ► prepwiser.in/questions/TVmcMkeyA2](https://www.prepwiser.in/questions/TVmcMkeyA2)

Q3 JEE Main 2025 · 23 Jan · Shift 1

If the function

$$f(x) = \begin{cases} \frac{2}{x} \{ \sin(k_1 + 1)x + \sin(k_2 - 1)x \}, & x < 0 \\ 4, & x = 0 \\ \frac{2}{x} \log_e \left(\frac{2+k_1x}{2+k_2x} \right), & x > 0 \end{cases}$$

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

(A) 5

(B) 10

(C) 20

(D) 8

[Step-by-step solution ► prepwiser.in/questions/B2DL_MMyYH](https://www.prepwiser.in/questions/B2DL_MMyYH)

Q4 JEE Main 2024 · 9 Apr · Shift 1

Let $f : (0, \pi) \rightarrow \mathbf{R}$ 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 $a, b \in \mathbf{Z}$. If f is continuous at $x = \frac{\pi}{2}$, then $a^2 + b^2$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/UBrjAcFnBU](https://www.prepwiser.in/questions/UBrjAcFnBU)

Q5 JEE Main 2024 · 8 Apr · Shift 2

For $a, b > 0$, let

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

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

(A) 4 (B) 5

(C) 8 (D) 6

[Step-by-step solution ► prepwisser.in/questions/rTqblBa8Dd](https://www.prepwisser.in/questions/rTqblBa8Dd)

Q6 JEE Main 2024 · 6 Apr · Shift 2

Let $[t]$ denote the greatest integer less than or equal to t . Let $f : [0, \infty) \rightarrow \mathbf{R}$ 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 _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/FQ2R5XYAIi](https://www.prepwisser.in/questions/FQ2R5XYAIi)

Q7 JEE Main 2024 · 4 Apr · Shift 2

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

(A) 968 (B) 1250

(C) 1152 (D) 746

[Step-by-step solution ► prepwisser.in/questions/K7iLVTSVwD](https://www.prepwisser.in/questions/K7iLVTSVwD)

Q8 JEE Main 2024 · 4 Apr · Shift 1

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

(A) 48 (B) 6

(C) 3 (D) 12

[Step-by-step solution ► prepwisser.in/questions/0LMPUO1vtD](https://www.prepwisser.in/questions/0LMPUO1vtD)

Consider the function.

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

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 :

- (A) Infinitely many (B) 4
(C) 2 (D) 1

[Step-by-step solution ► prepwisser.in/questions/jNC6k_yrYe](https://www.prepwisser.in/questions/jNC6k_yrYe)

Let $[x]$ denote the greatest integer function and

$$f(x) = \max\{1 + x + [x], 2 + x, x + 2[x]\}, 0 \leq x \leq 2. \text{ Let } m \text{ be the number of}$$

points in $[0, 2]$, where f is not continuous and n be the number of points in

$(0, 2)$, where f is not differentiable. Then $(m + n)^2 + 2$ is equal to :

- (A) 3 (B) 6
(C) 2 (D) 11

[Step-by-step solution ► prepwisser.in/questions/iVQuddxNRM](https://www.prepwisser.in/questions/iVQuddxNRM)

If the function

$$f(x) = \begin{cases} (1 + |\cos x|)^{\frac{\lambda}{|\cos x|}} & , 0 < x < \frac{\pi}{2} \\ \mu & , x = \frac{\pi}{2} \\ e^{\frac{\cot 6x}{\cot 4x}} & , \frac{\pi}{2} < x < \pi \end{cases}$$

is continuous at $x = \frac{\pi}{2}$, then $9\lambda + 6\log_e \mu + \mu^6 - e^{6\lambda}$ is equal to

- (A) 11 (B) 10
(C) 8 (D) $2e^4 + 8$

[Step-by-step solution ► prepwisser.in/questions/bP0gJnGpw_](https://www.prepwisser.in/questions/bP0gJnGpw_)

Let the function $f(x) = \begin{cases} \frac{\log_e(1+5x) - \log_e(1+\alpha x)}{x} & ; \text{ if } x \neq 0 \\ 10 & ; \text{ if } x = 0 \end{cases}$ be continuous at $x = 0$.

Then α is equal to

- (A) 10 (B) -10
(C) 5 (D) -5

[Step-by-step solution ► prepwisser.in/questions/ff3g508Oqw](https://www.prepwisser.in/questions/ff3g508Oqw)

The function $f : \mathbb{R} \rightarrow \mathbb{R}$ defined by

$$f(x) = \lim_{n \rightarrow \infty} \frac{\cos(2\pi x) - x^{2n} \sin(x-1)}{1 + x^{2n+1} - x^{2n}}$$

is continuous for all x in :

- (A) $\mathbb{R} - \{-1\}$ (B) $\mathbb{R} - \{-1, 1\}$
(C) $\mathbb{R} - \{1\}$ (D) $\mathbb{R} - \{0\}$

[Step-by-step solution ► prepwisser.in/questions/dFbjScTKmT](https://www.prepwisser.in/questions/dFbjScTKmT)

Let a function $f : \mathbb{R} \rightarrow \mathbb{R}$ be defined as :

$$f(x) = \begin{cases} \int_0^x (5 - |t-3|) dt, & x > 4 \\ x^2 + bx & , x \leq 4 \end{cases}$$

where $b \in \mathbb{R}$. If f is continuous at $x = 4$, then which of the following statements is NOT true?

- (A) f is not differentiable at $x = 4$
(B) $f'(3) + f'(5) = \frac{35}{4}$
(C) f is increasing in $(-\infty, \frac{1}{8}) \cup (8, \infty)$
(D) f has a local minima at $x = \frac{1}{8}$

[Step-by-step solution ► prepwisser.in/questions/hAxEX9Fgju](https://www.prepwisser.in/questions/hAxEX9Fgju)

If

$$f(x) = \begin{cases} x + a & , \quad x \leq 0 \\ |x - 4| & , \quad x > 0 \end{cases}$$

and

$$g(x) = \begin{cases} x + 1 & , \quad x < 0 \\ (x - 4)^2 + b & , \quad x \geq 0 \end{cases}$$

are continuous on $\mathbb{R}$, then $(g \circ f)(2) + (f \circ g)(-2)$ is equal to :**(A)** -10**(B)** 10**(C)** 8**(D)** -8[Step-by-step solution ► prepwisser.in/questions/jgwwqQmW0E](https://www.prepwisser.in/questions/jgwwqQmW0E)

If the function

$$f(x) = \begin{cases} \frac{\log_e(1-x+x^2) + \log_e(1+x+x^2)}{\sec x - \cos x} & , \quad x \in \left(\frac{-\pi}{2}, \frac{\pi}{2}\right) - \{0\} \\ k & , \quad x = 0 \end{cases}$$

is continuous at $x = 0$, then k is equal to:**(A)** 1**(B)** -1**(C)** e **(D)** 0[Step-by-step solution ► prepwisser.in/questions/H2pR_nMZIU](https://www.prepwisser.in/questions/H2pR_nMZIU)Let $[t]$ denote the greatest integer $\leq t$. The number of points where the function

$$f(x) = [x] |x^2 - 1| + \sin\left(\frac{\pi}{[x] + 3}\right) - [x + 1], x \in (-2, 2)$$

is not continuous is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/Ze7b17cCkt](https://www.prepwisser.in/questions/Ze7b17cCkt)

Q18 JEE Main 2021 · 31 Aug · Shift 1

If the function

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

is continuous

at $x = 0$, then $\frac{1}{a} + \frac{1}{b} + \frac{4}{k}$ is equal to :

(A) -5 (B) 5

(C) -4 (D) 4

[Step-by-step solution ► prepwisers.in/questions/es690Nn1mZ](https://www.prepwisers.in/questions/es690Nn1mZ)

Q19 JEE Main 2021 · 26 Aug · Shift 1

Let $a, b \in \mathbb{R}$, $b \neq 0$, Define a function

$$f(x) = \begin{cases} a \sin \frac{\pi}{2}(x-1), & \text{for } x \leq 0 \\ \frac{\tan 2x - \sin 2x}{bx^3}, & \text{for } x > 0 \end{cases}$$

.

If f is continuous at $x = 0$, then $10 - ab$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisers.in/questions/SYEbIfi_pj](https://www.prepwisers.in/questions/SYEbIfi_pj)

Q20 JEE Main 2021 · 27 Jul · Shift 1

Let $f : \left(-\frac{\pi}{4}, \frac{\pi}{4}\right) \rightarrow \mathbb{R}$ be defined as

$$f(x) = \begin{cases} (1 + |\sin x|)^{\frac{3a}{|\sin x|}} & , \quad -\frac{\pi}{4} < x < 0 \\ b & , \quad x = 0 \\ e^{\cot 4x / \cot 2x} & , \quad 0 < x < \frac{\pi}{4} \end{cases}$$

If f is continuous at $x = 0$, then the value of $6a + b^2$ is equal to :

(A) $1 - e$ (B) $e - 1$

(C) $1 + e$ (D) e

[Step-by-step solution ► prepwisers.in/questions/A5YsWhqhfa](https://www.prepwisers.in/questions/A5YsWhqhfa)

Q21 JEE Main 2021 · 25 Jul · Shift 1

Let $f : \mathbb{R} \rightarrow \mathbb{R}$ be defined as

$$f(x) = \begin{cases} \frac{\lambda |x^2 - 5x + 6|}{\mu(5x - x^2 - 6)}, & x < 2 \\ e^{\frac{\tan(x-2)}{x-[x]}}, & x > 2 \\ \mu, & x = 2 \end{cases}$$

where $[x]$ is the greatest integer less than or equal to x . If f is continuous at $x = 2$, then $\lambda + \mu$ is equal to :

(A) $e(-e + 1)$

(B) $e(e - 2)$

(C) 1

(D) $2e - 1$

[Step-by-step solution ► prepwiser.in/questions/tABo1ojHA-](https://www.prepwiser.in/questions/tABo1ojHA-)

Q22 JEE Main 2021 · 20 Jul · Shift 1

Let a function $f : \mathbb{R} \rightarrow \mathbb{R}$ be defined as

$$f(x) = \begin{cases} \sin x - e^x & \text{if } x \leq 0 \\ a + [-x] & \text{if } 0 < x < 1 \\ 2x - b & \text{if } x \geq 1 \end{cases}$$

where $[x]$ is the greatest integer less than or equal to x . If f is continuous on $\mathbb{R}$, then $(a + b)$ is equal to:

(A) 4

(B) 3

(C) 2

(D) 5

[Step-by-step solution ► prepwiser.in/questions/IMCw4cFpVu](https://www.prepwiser.in/questions/IMCw4cFpVu)

Q23 JEE Main 2021 · 18 Mar · Shift 2

Let $f : \mathbb{R} \rightarrow \mathbb{R}$ be a function defined as

$$f(x) = \begin{cases} \frac{\sin(a+1)x + \sin 2x}{2x}, & \text{if } x < 0 \\ b, & \text{if } x = 0 \\ \frac{\sqrt{x+bx^3} - \sqrt{x}}{bx^{5/2}}, & \text{if } x > 0 \end{cases}$$

If f is continuous at $x = 0$, then the value of $a + b$ is equal to :

(A) -3

(B) -2

(C) $-\frac{5}{2}$

(D) $-\frac{3}{2}$

[Step-by-step solution ► prepwiser.in/questions/Vb5TbCfA_o](https://www.prepwiser.in/questions/Vb5TbCfA_o)

Q24 JEE Main 2021 · 17 Mar · Shift 1

If the function $f(x) = \frac{\cos(\sin x) - \cos x}{x^4}$ is continuous at each point in its domain and $f(0) = \frac{1}{k}$, then k is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/KD7k1ZZPSI](https://www.prepwiser.in/questions/KD7k1ZZPSI)

Q25 JEE Main 2021 · 16 Mar · Shift 2

Let $\alpha \in \mathbb{R}$ be such that the function

$$f(x) = \begin{cases} \frac{\cos^{-1}(1-\{x\}^2)\sin^{-1}(1-\{x\})}{\{x\}-\{x\}^3}, & x \neq 0 \\ \alpha, & x = 0 \end{cases}$$

is continuous at $x = 0$, where $\{x\} = x - [x]$ is the greatest integer less than or equal to x . Then :

(A) no such α exists

(B) $\alpha = 0$

(C) $\alpha = \frac{\pi}{4}$

(D) $\alpha = \frac{\pi}{\sqrt{2}}$

[Step-by-step solution ► prepwiser.in/questions/4Nphrvd0vv](https://www.prepwiser.in/questions/4Nphrvd0vv)

Q26 JEE Main 2021 · 16 Mar · Shift 2

Let $f : \mathbb{R} \rightarrow \mathbb{R}$ and $g : \mathbb{R} \rightarrow \mathbb{R}$ be defined as

$$f(x) = \begin{cases} x + a, & x < 0 \\ |x - 1|, & x \geq 0 \end{cases}$$

and

$$g(x) = \begin{cases} x + 1, & x < 0 \\ (x - 1)^2 + b, & x \geq 0 \end{cases}$$

,

where a, b are non-negative real numbers. If $(g \circ f)(x)$ is continuous for all $x \in \mathbb{R}$, then $a + b$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/MUmHV0hKYX](https://www.prepwiser.in/questions/MUmHV0hKYX)

Q27 JEE Main 2021 · 26 Feb · Shift 2

Let $f : \mathbb{R} \rightarrow \mathbb{R}$ be defined as

$$f(x) = \begin{cases} 2 \sin\left(-\frac{\pi x}{2}\right), & \text{if } x < -1 \\ |ax^2 + x + b|, & \text{if } -1 \leq x \leq 1 \\ \sin(\pi x), & \text{if } x > 1 \end{cases}$$

If $f(x)$ is continuous on $\mathbb{R}$, then $a + b$ equals :

(A) -3

(B) 3

(C) -1

(D) 1

[Step-by-step solution ► prepwiser.in/questions/PQINsjN0f3](https://www.prepwiser.in/questions/PQINsjN0f3)

Q28 JEE Main 2020 · 5 Sep · Shift 1

Let $f(x) = x \cdot \left[\frac{x}{2} \right]$, for $-10 < x < 10$, where $[t]$ denotes the greatest integer function. Then the number of points of discontinuity of f is equal to ____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/4ZiiMNztIW](https://www.prepwisar.in/questions/4ZiiMNztIW)

Q29 JEE Main 2020 · 2 Sep · Shift 2

Let $f : (-1, \infty) \rightarrow \mathbb{R}$ be defined by $f(0) = 1$ and $f(x) = \frac{1}{x} \log_e (1+x)$, $x \neq 0$. Then the function f :

- (A) decreases in $(-1, \infty)$
- (B) decreases in $(-1, 0)$ and increases in $(0, \infty)$
- (C) increases in $(-1, \infty)$
- (D) increases in $(-1, 0)$ and decreases in $(0, \infty)$

[Step-by-step solution ► prepwisar.in/questions/IPLLDHLe7X](https://www.prepwisar.in/questions/IPLLDHLe7X)

Q30 JEE Main 2020 · 9 Jan · Shift 1

If

$$f(x) = \begin{cases} \frac{\sin(a+2)x + \sin x}{x}; & x < 0 \\ b & x = 0 \\ \frac{(x+3x^2)^{\frac{1}{3}} - x^{\frac{1}{3}}}{x^{\frac{4}{3}}}; & x > 0 \end{cases}$$

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

- (A) 0
- (B) -1
- (C) -2
- (D) 1

[Step-by-step solution ► prepwisar.in/questions/iZDO-AfOXf](https://www.prepwisar.in/questions/iZDO-AfOXf)

Q31 JEE Main 2020 · 7 Jan · Shift 2

If the function f defined on $(-\frac{1}{3}, \frac{1}{3})$ by

$f(x) =$

$$\begin{cases} \frac{1}{x} \log_e \left(\frac{1+3x}{1-2x} \right), & \text{when } x \neq 0 \\ k, & \text{when } x = 0 \end{cases}$$

is continuous, then k is equal to ____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/MYVnD0O-Ee](https://www.prepwisar.in/questions/MYVnD0O-Ee)

Q32 JEE Main 2025 · 29 Jan · Shift 2

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 :

- (A) 5
- (B) 2
- (C) 4
- (D) 3

Step-by-step solution ► [prepwiser.in/questions/EqAWUfxrss](https://www.prepwiser.in/questions/EqAWUfxrss)

Q33 JEE Main 2024 · 6 Apr · Shift 1

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

- (A) $f''(0) = 0$
- (B) $f''(0) = 1$
- (C) $f''\left(\frac{2}{\pi}\right) = \frac{24-\pi^2}{2\pi}$
- (D) $f''\left(\frac{2}{\pi}\right) = \frac{12-\pi^2}{2\pi}$

Step-by-step solution ► [prepwiser.in/questions/JCljZ1WLCO](https://www.prepwiser.in/questions/JCljZ1WLCO)

Q34 JEE Main 2024 · 1 Feb · Shift 1

Let $f : \mathbf{R} \rightarrow \mathbf{R}$ 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 $\mathbf{R}$ and m is the number of points where f is NOT differential then $m + a + b + c$ equals :

- (A) 1
- (B) 4
- (C) 3
- (D) 2

Step-by-step solution ► [prepwiser.in/questions/iidW8UWn3r](https://www.prepwiser.in/questions/iidW8UWn3r)

Q35 JEE Main 2024 · 30 Jan · Shift 2

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

(A) 21

(B) 19/6

(C) 17

(D) 15/6

[Step-by-step solution ► prepwiser.in/questions/rKqCOtl7hq](https://www.prepwiser.in/questions/rKqCOtl7hq)

Q36 JEE Main 2024 · 30 Jan · Shift 1

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 _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/qT6Syl2Klw](https://www.prepwiser.in/questions/qT6Syl2Klw)

Q37 JEE Main 2023 · 8 Apr · Shift 2

Let k and m be positive real numbers such that the function

$$f(x) = \begin{cases} 3x^2 + k\sqrt{x+1}, & 0 < x < 1 \\ mx^2 + k^2, & x \geq 1 \end{cases}$$

is differentiable for all $x > 0$. Then $\frac{8f'(8)}{f'(\frac{1}{8})}$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/iVOJ9d0E09](https://www.prepwiser.in/questions/iVOJ9d0E09)

Q38 JEE Main 2023 · 6 Apr · Shift 1

Let $a \in \mathbb{Z}$ and $[t]$ be the greatest integer $\leq t$. Then the number of points, where the function $f(x) = [a + 13 \sin x]$, $x \in (0, \pi)$ is not differentiable, is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/HxmSWvvDI-](https://www.prepwiser.in/questions/HxmSWvvDI-)

Let

$$f(x) = \begin{cases} x^2 \sin\left(\frac{1}{x}\right) & , x \neq 0 \\ 0 & , x = 0 \end{cases}$$

Then at $x = 0$

- (A) f is continuous but f' is not continuous
- (B) f and f' both are continuous
- (C) f is continuous but not differentiable
- (D) f' is continuous but not differentiable

[Step-by-step solution ► prepwisser.in/questions/TyzIyXZ_jz](https://www.prepwisser.in/questions/TyzIyXZ_jz)

If $[t]$ denotes the greatest integer $\leq t$, then the number of points, at which the function $f(x) = 4|2x + 3| + 9\left[x + \frac{1}{2}\right] - 12[x + 20]$ is not differentiable in the open interval $(-20, 20)$, is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/R8rqjRbf9I](https://www.prepwisser.in/questions/R8rqjRbf9I)

The number of points, where the function $f : \mathbf{R} \rightarrow \mathbf{R}$,

$f(x) = |x - 1| \cos |x - 2| \sin |x - 1| + (x - 3) |x^2 - 5x + 4|$, is NOT differentiable, is :

- (A) 1
- (B) 2
- (C) 3
- (D) 4

[Step-by-step solution ► prepwisser.in/questions/LQ7ISXeW88](https://www.prepwisser.in/questions/LQ7ISXeW88)

Let $f, g : \mathbf{R} \rightarrow \mathbf{R}$ be two real valued functions defined as

$$f(x) = \begin{cases} -|x + 3| & , x < 0 \\ e^x & , x \geq 0 \end{cases}$$

and

$$g(x) = \begin{cases} x^2 + k_1 x & , x < 0 \\ 4x + k_2 & , x \geq 0 \end{cases}$$

, where k_1 and k_2 are real constants. If $(g \circ f)$ is differentiable at $x = 0$, then $(g \circ f)(-4) + (g \circ f)(4)$ is equal to :

- (A) $4(e^4 + 1)$
- (B) $2(2e^4 + 1)$
- (C) $4e^4$
- (D) $2(2e^4 - 1)$

[Step-by-step solution ► prepwisser.in/questions/GE_vOyJHuG](https://www.prepwisser.in/questions/GE_vOyJHuG)

Q43 JEE Main 2022 · 26 Jun · Shift 2

Let $f(x) = \min \{1, 1 + x \sin x\}$, $0 \leq x \leq 2\pi$. If m is the number of points, where f is not differentiable and n is the number of points, where f is not continuous, then the ordered pair (m, n) is equal to

- (A) (2, 0) (B) (1, 0)
(C) (1, 1) (D) (2, 1)

[Step-by-step solution ► prepwiser.in/questions/kglawHu-xB](https://www.prepwiser.in/questions/kglawHu-xB)

Q44 JEE Main 2021 · 31 Aug · Shift 1

The function

$$f(x) = |x^2 - 2x - 3| \cdot e^{|9x^2 - 12x + 4|}$$

is not differentiable at exactly :

- (A) four points (B) three points
(C) two points (D) one point

[Step-by-step solution ► prepwiser.in/questions/QayovYPfOQ](https://www.prepwiser.in/questions/QayovYPfOQ)

Q45 JEE Main 2021 · 25 Jul · Shift 2

If

$$f(x) = \begin{cases} \int_0^x (5 + |1 - t|) dt, & x > 2 \\ 5x + 1, & x \leq 2 \end{cases}$$

, then

- (A) $f(x)$ is not continuous at $x = 2$
(B) $f(x)$ is everywhere differentiable
(C) $f(x)$ is continuous but not differentiable at $x = 2$
(D) $f(x)$ is not differentiable at $x = 1$

[Step-by-step solution ► prepwiser.in/questions/jhWZGtdVXT](https://www.prepwiser.in/questions/jhWZGtdVXT)

Q46 JEE Main 2021 · 20 Jul · Shift 2

Let a function $g : [0, 4] \rightarrow \mathbb{R}$ be defined as

$$g(x) = \begin{cases} \max_{0 \leq t \leq x} \{t^3 - 6t^2 + 9t - 3\}, & 0 \leq x \leq 3 \\ 4 - x, & 3 < x \leq 4 \end{cases}$$

, then the number of points in the interval $(0, 4)$ where $g(x)$ is NOT differentiable, is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/Du9XA7ZEny](https://www.prepwiser.in/questions/Du9XA7ZEny)

If

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

is differentiable at every point of the domain, then the values of a and b are respectively :

(A) $\frac{1}{2}, \frac{1}{2}$

(B) $\frac{1}{2}, -\frac{3}{2}$

(C) $\frac{5}{2}, -\frac{3}{2}$

(D) $-\frac{1}{2}, \frac{3}{2}$

[Step-by-step solution ► prepwiser.in/questions/-vqdi0yVXh](https://www.prepwiser.in/questions/-vqdi0yVXh)

Consider the function $f : \mathbb{R} \rightarrow \mathbb{R}$ defined by

$$f(x) = \begin{cases} (2 - \sin(\frac{1}{x}))|x|, & x \neq 0 \\ 0, & x = 0 \end{cases}$$

. Then f is :

(A) not monotonic on $(-\infty, 0) \text{ and } (0, \infty)$

(B) monotonic on $(0, \infty)$ only

(C) monotonic on $(-\infty, 0)$ only

(D) monotonic on $(-\infty, 0) \cup (0, \infty)$

[Step-by-step solution ► prepwiser.in/questions/FgTc0unLqb](https://www.prepwiser.in/questions/FgTc0unLqb)

Let the functions $f : \mathbb{R} \rightarrow \mathbb{R}$ and $g : \mathbb{R} \rightarrow \mathbb{R}$ be defined as :

$$f(x) = \begin{cases} x + 2, & x < 0 \\ x^2, & x \geq 0 \end{cases}$$

and

$$g(x) = \begin{cases} x^3, & x < 1 \\ 3x - 2, & x \geq 1 \end{cases}$$

Then, the number of points in $\mathbb{R}$ where $(f \circ g)(x)$ is NOT differentiable is equal to :

(A) 0

(B) 3

(C) 1

(D) 2

[Step-by-step solution ► prepwiser.in/questions/TZlz0qX4PJ](https://www.prepwiser.in/questions/TZlz0qX4PJ)

Q50 JEE Main 2021 · 26 Feb · Shift 1

Let f be any function defined on $\mathbb{R}$ and let it satisfy the condition : $|f(x) - f(y)| \leq |(x - y)^2|, \forall (x, y) \in \mathbb{R}$

If $f(0) = 1$, then :

(A) $f(x)$ can take any value in $\mathbb{R}$

(B) $f(x) < 0, \forall x \in \mathbb{R}$

(C) $f(x) > 0, \forall x \in \mathbb{R}$

(D) $f(x) = 0, \forall x \in \mathbb{R}$

[Step-by-step solution ► prepwisser.in/questions/LT7XmGHk7X](https://www.prepwisser.in/questions/LT7XmGHk7X)

Q51 JEE Main 2021 · 25 Feb · Shift 1

The number of points, at which the function

$f(x) = |2x + 1| - 3|x + 2| + |x^2 + x - 2|, x \in \mathbb{R}$ is not differentiable, is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/EtBMD5dNc_](https://www.prepwisser.in/questions/EtBMD5dNc_)

Q52 JEE Main 2020 · 6 Sep · Shift 1

Let $f : \mathbb{R} \rightarrow \mathbb{R}$ be defined as

$$f(x) = \begin{cases} x^5 \sin\left(\frac{1}{x}\right) + 5x^2, & x < 0 \\ 0, & x = 0 \\ x^5 \cos\left(\frac{1}{x}\right) + \lambda x^2, & x > 0 \end{cases}$$

The value of λ for which $f''(0)$ exists, is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/dCpgekjvYi](https://www.prepwisser.in/questions/dCpgekjvYi)

Q53 JEE Main 2020 · 5 Sep · Shift 1

If the function

$$f(x) = \begin{cases} k_1(x - \pi)^2 - 1, & x \leq \pi \\ k_2 \cos x, & x > \pi \end{cases}$$

is

twice differentiable, then the ordered pair (k_1, k_2) is equal to :

(A) $\left(\frac{1}{2}, -1\right)$

(B) $(1, 1)$

(C) $(1, 0)$

(D) $\left(\frac{1}{2}, 1\right)$

[Step-by-step solution ► prepwisser.in/questions/LNcgTrmHr4](https://www.prepwisser.in/questions/LNcgTrmHr4)

Q54 JEE Main 2020 · 4 Sep · Shift 2

The function

$$f(x) = \begin{cases} \frac{\pi}{4} + \tan^{-1}x, & |x| \leq 1 \\ \frac{1}{2}(|x| - 1), & |x| > 1 \end{cases}$$

is :

- (A) continuous on $\mathbb{R} - \{-1\}$ and differentiable on $\mathbb{R} - \{-1, 1\}$
- (B) both continuous and differentiable on $\mathbb{R} - \{1\}$
- (C) both continuous and differentiable on $\mathbb{R} - \{-1\}$
- (D) continuous on $\mathbb{R} - \{1\}$ and differentiable on $\mathbb{R} - \{-1, 1\}$

[Step-by-step solution](https://www.prepwisser.in/questions/utqGgHUotF) ► [prepwisser.in/questions/utqGgHUotF](https://www.prepwisser.in/questions/utqGgHUotF)

Types of Discontinuities · 4 PYQs

Q55 JEE Main 2025 · 7 Apr · Shift 1

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

Numerical answer — enter the value.

[Step-by-step solution](https://www.prepwisser.in/questions/1ANIDolvyP) ► [prepwisser.in/questions/1ANIDolvyP](https://www.prepwisser.in/questions/1ANIDolvyP)

Q56 JEE Main 2024 · 5 Apr · Shift 2

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 :

- (A) 5
- (B) 6
- (C) 4
- (D) 3

[Step-by-step solution](https://www.prepwisser.in/questions/IBQduDd5PM) ► [prepwisser.in/questions/IBQduDd5PM](https://www.prepwisser.in/questions/IBQduDd5PM)

Q57 JEE Main 2022 · 24 Jun · Shift 1

The number of points where the function

$$f(x) = \begin{cases} |2x^2 - 3x - 7| & \text{if } x \leq -1 \\ [4x^2 - 1] & \text{if } -1 < x < 1 \\ |x + 1| + |x - 2| & \text{if } x \geq 1 \end{cases}$$

$[t]$ denotes the greatest integer $\leq t$, is discontinuous is _____.

Numerical answer — enter the value.

[Step-by-step solution](https://www.prepwisser.in/questions/J24aQsowYW) ► [prepwisser.in/questions/J24aQsowYW](https://www.prepwisser.in/questions/J24aQsowYW)

Q58 JEE Main 2020 · 9 Jan · Shift 2

Let $[t]$ denote the greatest integer $\leq t$ and $\lim_{x \rightarrow 0} x \left\lceil \frac{4}{x} \right\rceil = A$.

Then the function, $f(x) = [x^2]\sin(\pi x)$ is discontinuous, when x is equal to :

- (A) $\sqrt{A + 1}$
- (B) $\sqrt{A + 5}$
- (C) $\sqrt{A + 21}$
- (D) $\sqrt{A}$

[Step-by-step solution](https://www.prepwisser.in/questions/aqbefFI0vv) ► [prepwisser.in/questions/aqbefFI0vv](https://www.prepwisser.in/questions/aqbefFI0vv)

Continuity and Differentiability Relation · 4 PYQs

Q59 JEE Main 2024 · 31 Jan · Shift 1

Let $g(x)$ be a linear function and

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

, is continuous at $x = 0$. If $f'(1) = f(-1)$, then the value $g(3)$ is

- (A) $\log_e \left(\frac{4}{9}\right) - 1$
- (B) $\frac{1}{3} \log_e \left(\frac{4}{9e^{1/3}}\right)$
- (C) $\log_e \left(\frac{4}{9e^{1/3}}\right)$
- (D) $\frac{1}{3} \log_e \left(\frac{4}{9}\right) + 1$

[Step-by-step solution ► prepwisser.in/questions/no1SXbHplj](https://www.prepwisser.in/questions/no1SXbHplj)

Q60 JEE Main 2022 · 24 Jun · Shift 2

Let

$$f(x) = \begin{cases} \frac{\sin(x - [x])}{x - [x]} & , x \in (-2, -1) \\ \max\{2x, 3[|x|]\} & , |x| < 1 \\ 1 & , otherwise \end{cases}$$

where $[t]$ denotes greatest integer $\leq t$. If m is the number of points where f is not continuous and n is the number of points where f is not differentiable, then the ordered pair (m, n) is :

- (A) (3, 3)
- (B) (2, 4)
- (C) (2, 3)
- (D) (3, 4)

[Step-by-step solution ► prepwisser.in/questions/5ISueGTGr5](https://www.prepwisser.in/questions/5ISueGTGr5)

Q61 JEE Main 2021 · 22 Jul · Shift 2

Let $f : \mathbb{R} \rightarrow \mathbb{R}$ be a function defined as

$$f(x) = \begin{cases} 3\left(1 - \frac{|x|}{2}\right) & \text{if } |x| \leq 2 \\ 0 & \text{if } |x| > 2 \end{cases}$$

Let $g : \mathbb{R} \rightarrow \mathbb{R}$ be given by $g(x) = f(x + 2) - f(x - 2)$. If n and m denote the number of points in $\mathbb{R}$ where g is not continuous and not differentiable, respectively, then $n + m$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/UzvPjY94g4](https://www.prepwisser.in/questions/UzvPjY94g4)

If a function $f(x)$ defined by

$$f(x) = \begin{cases} ae^x + be^{-x}, & -1 \leq x < 1 \\ cx^2, & 1 \leq x \leq 3 \\ ax^2 + 2cx, & 3 < x \leq 4 \end{cases}$$

be continuous for some $a, b, c \in \mathbb{R}$ and $f'(0) + f'(2) = e$, then the value of a is :

(A) $\frac{e}{e^2 - 3e - 13}$

(B) $\frac{1}{e^2 - 3e + 13}$

(C) $\frac{e}{e^2 - 3e + 13}$

(D) $\frac{e}{e^2 + 3e + 13}$

Step-by-step solution ► [prepwisar.in/questions/nh9QICPqdN](https://www.prepwisar.in/questions/nh9QICPqdN)

Answer key — Continuity & Differentiability

Numbers match the question numbers above. For full working, open the solution link under each question.

1	2	2	B	3	B	4	81	5	D	6	17	7	C	8	D
9	D	10	A	11	B	12	D	13	B	14	C	15	D	16	A
17	2	18	A	19	14	20	C	21	A	22	B	23	D	24	6
25	A	26	1	27	C	28	8	29	A	30	A	31	5	32	D
33	C	34	D	35	C	36	15	37	309	38	25	39	A	40	79
41	B	42	D	43	B	44	C	45	C	46	1	47	D	48	A
49	C	50	C	51	2	52	5	53	D	54	D	55	8	56	C
57	7	58	A	59	C	60	C	61	4	62	C				

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