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MATHEMATICS · JEE MAIN

Applications of Derivatives

Previous Year Questions with answers

241 questions · **160** papers · **2002–2026** · newest paper first

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What is in this PDF: every Applications of Derivatives question we hold from past JEE Main and AIEEE papers, with its options and answer. Where an answer comes from a source other than the official final key, it says so next to the answer.

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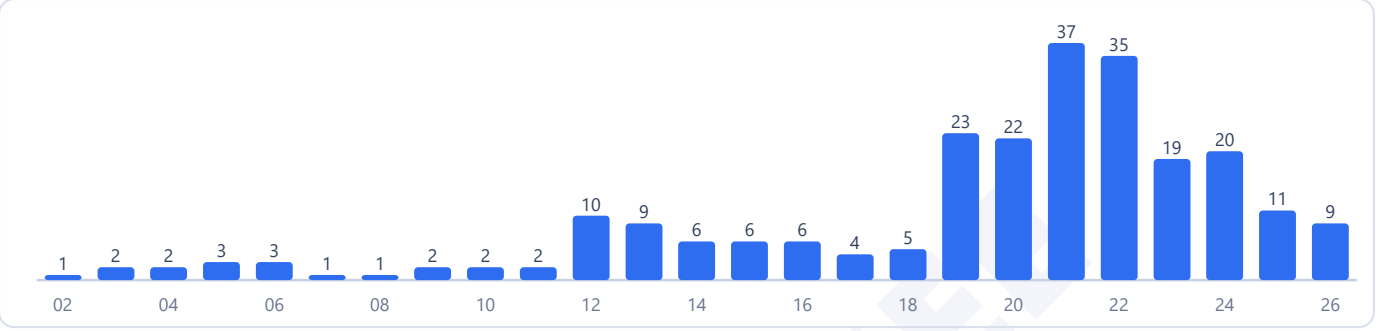
Chapter at a glance

3.9%	241	123 of 162	200 / 41
of Mathematics questions, 2019–2026	questions, 2002–2026	papers asked it, 2019–2026	MCQ / numerical, 2002–2026

Trend. Falling: 0.7 questions per paper in 2024–2026 against 1.3 in 2019–2023.

Questions per year



Counts are the questions we hold: 241 in 160 papers. 4 questions in this chapter came back in more than one paper.

Most-asked topics in this chapter (2002–2026)



How often it comes up

Applications of derivatives connects calculus rules with geometric optimization under Unit 7: Limit, Continuity and Differentiability in the Class 12 curriculum, standing at rank 13 among the 29 chapters in the subject. Across the 162 papers administered between 2019 and 2026, this chapter supplied 176 questions, capturing 3.9 percent of the total mathematics questions. It appeared in 123 of those 162 papers and has been represented every single year since 2019. Over the recent 2024 to 2026 test cycles, it accounted for 40 questions across 58 papers, averaging 0.7 questions per paper and holding a 2.6 percent subject share. Comparing the earlier 2002 to 2018 share of 5.0 percent with the 2024 to 2026 share of 2.6 percent, the trend is down, and comparing the 2019 to 2026 share with 2024 to 2026 also shows it is down. Across the complete historical record from 2002 to 2026 spanning 200 papers, 241 questions appeared in 160 papers, with 41 questions featured in the numerical answer format from 2019 to 2026.

In the 2024, 2025, and 2026 testing periods, 20, 11, and 9 questions were asked respectively.

The downward trajectory in question volume reflects recent NTA syllabus reductions, notably the explicit deletion of tangents and normals. As a consequence, current examination papers concentrate primarily on extreme values, local turning points, and monotonic intervals.

Most-asked topics

Questions in this chapter group into four distinct topics:

1. **Maxima & Minima (95 questions, 2019-2026; 125 total, last asked 2026)** The dominant topic in the chapter. Problems require determining local extrema, global extrema on closed intervals, critical points where derivatives vanish or fail to exist, and optimization of geometric structures such as cones, cylinders, and rectangles.

2. **Monotonicity (40 questions, 2019-2026; 48 total, last asked 2026)** Focuses on intervals where functions strictly increase or decrease, sign analysis of first derivatives, and establishing functional inequalities. Questions regularly involve composite functions or functions defined by integrals using Leibniz's rule.

3. **Tangents & Normals (32 questions, 2019-2026; 48 total, last asked 2023)** Dealt with equations of tangents and normals to curves, orthogonality of intersecting curves, and intercept lengths. This topic was officially removed from the syllabus starting in 2024, explaining why it was last asked in 2023.

4. **Rate of Change (9 questions, 2019-2026; 20 total, last asked 2025)** Examines related rates problems involving physical models, such as expanding fluid volumes, melting spherical shells, or geometric shapes with changing dimensional parameters.

What the questions look like

Recent problems in applications of derivatives frequently adhere to these standard paradigms:

- **Global Extremum on Closed Intervals**: You are given a high-degree polynomial or an algebraic difference on a closed interval. Finding the minimum or maximum requires comparing functional values at critical points against boundary values.
- **Monotonicity of Composite Functions**: Given a base function with specified convexity and derivative roots, you determine the intervals where a composite quadratic argument increases or decreases.
- **Integral-Defined Function Optimization**: The function is presented as an integral with variable limits containing a parameter. Applying Leibniz's differentiation rule yields the derivative, whose roots give candidate extreme points.
- **Inequalities Derived from Monotonicity**: Establishing that one function dominates another over a positive interval by constructing an auxiliary difference function and proving that its derivative remains strictly positive.

How to practise it

Solving optimization and monotonicity questions cleanly requires sound algebraic discipline:

- **Check boundary endpoints systematically**: When asked for absolute maxima or minima on a closed interval, never stop at critical points where the derivative vanishes. Always compute values at the endpoints of the interval and compare them directly.
- **Examine non-differentiable points**: Critical points include locations where the first derivative does not exist, such as vertices of absolute value expressions. Test these corner points alongside stationary points.
- **Use first-derivative sign charts**: Rather than calculating complicated second derivatives to classify extrema, observe the sign changes of the first derivative around the stationary point. A sign shift from positive to negative indicates a local maximum, while negative to positive marks a local minimum.
- **Differentiate Leibniz integrals with care**: When finding extrema of an accumulation function, apply Leibniz's rule accurately by substituting the upper limit and multiplying by its derivative before subtracting the lower limit contribution.

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Q1 JEE Main 2026 · 6 Apr · Shift 2 MCQ

Let $\mathrm{A}=\begin{bmatrix}1 & 3 & -1\\ 2 & 1 & \alpha\\ 0 & 1 & -1\end{bmatrix}$ be a singular matrix. Let $f(x)=\int_0^x\left(t^2+2t+3\right)dt$, $x\in[1,\alpha]$. If M and m are respectively the maximum and the minimum values of f in $[1,\alpha]$, then $3(\mathrm{M}-m)$ is equal to :

(A) 64
(B) 68
(C) 72
(D) 76

Answer: (B) 68 · Official NTA final key

Q2 JEE Main 2026 · 4 Apr · Shift 2 MCQ

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

(A) $\frac{3\sqrt{3}}{2}$
(B) $3\sqrt{3}$
(C) $4\sqrt{3}$
(D) $6\sqrt{3}$

Answer: (B) $3\sqrt{3}$ · Official NTA final key

Q3 JEE Main 2026 · 2 Apr · Shift 1 MCQ

The number of critical points of the function $f(x)=\begin{cases}\left|\frac{\sin x}{x}\right|, & x\neq 0\\ 1, & x=0\end{cases}$ in the interval $(-2\pi,2\pi)$ is equal to :

(A) 1
(B) 3
(C) 5
(D) 7

Answer: (C) 5 · Official NTA final key

Q4 JEE Main 2026 · 2 Apr · Shift 2 MCQ

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

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(A) 0
(B) 50
(C) 92
(D) 112

Answer: (D) 112 · Official NTA final key

Q5 JEE Main 2026 · 24 Jan · Shift 1 · Numerical

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 _____.

Numerical value type: the answer is a number.

Answer: 4. · Official NTA final key

Q6 JEE Main 2026 · 24 Jan · Shift 2 · MCQ

Consider the following three statements for the function $f : (0, \infty) \to \mathbb{R}$ 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.

(A) All (I), (II) and (III) are TRUE.
(B) Only (II) and (III) are TRUE.
(C) Only (I) and (III) are TRUE.
(D) Only (I) is TRUE.

Answer: (C) Only (I) and (III) are TRUE. · Official NTA final key

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Q7 JEE Main 2026 · 22 Jan · Shift 1 · MCQ

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

(A) -40
(B) -81
(C) -80
(D) -41

Answer: (B) -81 · Official NTA final key

Q8 JEE Main 2026 · 21 Jan · Shift 1 Numerical

Let $f : \mathbf{R} \to \mathbf{R}$ 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 $x \in \mathbf{R}$. 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 _____.

Numerical value type: the answer is a number.

Answer: 1. · Official NTA final key

Q9 JEE Main 2026 · 21 Jan · Shift 2 MCQ

Let $f : \mathbf{R} \to \mathbf{R}$ be a twice differentiable function such that $f''(x) > 0$ for all $x \in \mathbf{R}$ 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 $\left(0, \frac{\pi}{4}\right)$

(II) g is deceasing in $\left(\frac{\pi}{4}, \frac{\pi}{2}\right)$

Then,

(A) Only (II) is True
(B) Only (I) is True
(C) Both (I) and (II) are True
(D) Neither (I) nor (II) is True

Answer: (D) Neither (I) nor (II) is True · Official NTA final key

Q10 JEE Main 2025 · 8 Apr · Shift 2 MCQ

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

(A) 48
(B) 36
(C) 28
(D) 40

Answer: (B) 36 · Key from source paper

Q11 JEE Main 2025 · 7 Apr · Shift 1 MCQ

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 $\left[-2, -\frac{1}{2}\right]$. Then $|\mathbf{M} + m|$ is equal to _____ . (Take $\log_e 2 = 0.7$) :

(A) 21.1
(B) 22.1
(C) 19.8
(D) 20.9

Answer: (A) 21.1 · Key from source paper

Q12 JEE Main 2025 · 7 Apr · Shift 2 MCQ

Let $f : \mathbf{R} \to \mathbf{R}$ be a polynomial function of degree four having extreme values at $x = 4$ and $x = 5$. If $\lim_{x \to 0} \frac{f(x)}{x^2} = 5$, then $f(2)$ is equal to :

(A) 10
(B) 8
(C) 12
(D) 14

Answer: (A) 10 · Key from source paper

Q13 JEE Main 2025 · 4 Apr · Shift 2 MCQ

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 :

(A) 15
(B) 13
(C) 18
(D) 24

Answer: (C) 18 · Key from source paper

Q14 JEE Main 2025 · 3 Apr · Shift 2 MCQ

Let $f : \mathrm{R} \to \mathrm{R}$ 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

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

Answer: (B) 3 · Key from source paper

Q15 JEE Main 2025 · 2 Apr · Shift 1 MCQ

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 :

(A) 10
(B) 55
(C) 37
(D) 23

Answer: (C) 37 · Key from source paper

Q16 JEE Main 2025 · 28 Jan · Shift 1 MCQ

The sum of all local minimum values of the function $f(x) = \begin{cases} 1-2x, & x < -1 \\ \frac{1}{3}(7+2|x|), & -1 \le x \le 2 \\ \frac{11}{18}(x-4)(x-5), & x > 2 \end{cases}$ is

(A) $\frac{157}{72}$
(B) $\frac{131}{72}$
(C) $\frac{171}{72}$
(D) $\frac{167}{72}$

Answer: (A) $\frac{157}{72}$ · Key from source paper

Q17 JEE Main 2025 · 24 Jan · Shift 1 MCQ

Consider the region $R = \left\{(x, y) : x \le y \le 9 - \frac{11}{3}x^2, x \ge 0\right\}$. The area, of the largest rectangle of sides parallel to the coordinate axes and inscribed in R , is:

(A) $\frac{730}{119}$
(B) $\frac{625}{111}$
(C) $\frac{821}{123}$
(D) $\frac{567}{121}$

Answer: (D) $\frac{567}{121}$ · Key from source paper

Q18 JEE Main 2025 · 24 Jan · Shift 2 MCQ

Let $(2, 3)$ be the largest open interval in which the function $f(x) = 2\log_e(x-2) - x^2 + ax + 1$ is strictly increasing and (b, c) be the largest open interval, in which the function $g(x) = (x-1)^3(x + 2 - a)^2$ is strictly decreasing. Then $100(a + b - c)$ is equal to :

(A) 420
(B) 360
(C) 160
(D) 280

Answer: (B) 360 · Key from source paper

Q19 JEE Main 2025 · 23 Jan · Shift 2 MCQ

A spherical chocolate ball has a layer of ice-cream of uniform thickness around it. When the thickness of the ice-cream layer is 1 cm , the ice-cream melts at the rate of 81 cm^3/min and the thickness of the ice-cream layer decreases at the rate of $\frac{1}{4\pi}$ cm/min. The surface area (in cm^2) of the chocolate ball (without the ice-cream layer) is :

(A) 196π
(B) 256π
(C) 225π
(D) 128π

Answer: (B) 256π · Key from source paper

Q20 JEE Main 2025 · 22 Jan · Shift 2 MCQ

Let $f(x)=\int_0^{x^2}\frac{t^2-8t+15}{e^t}\,\mathrm{d}t$, $x\in\mathbf{R}$. Then the numbers of local maximum and local minimum points of f , respectively, are :

(A) 2 and 3
(B) 2 and 2
(C) 3 and 2
(D) 1 and 3

Answer: (A) 2 and 3 · Key from source paper

Q21 JEE Main 2024 · 9 Apr · Shift 1 Numerical

Let the set of all positive values of λ, for which the point of local minimum of the function $(1+x(\lambda^2-x^2))$ satisfies $\frac{x^2+x+2}{x^2+5x+6}<0$, be (α,β). Then $\alpha^2+\beta^2$ is equal to _____

Numerical value type: the answer is a number.

Answer: 39. · Key from source paper

Q22 JEE Main 2024 · 9 Apr · Shift 2 Numerical

Let the set of all values of p, for which $f(x)=(p^2-6p+8)(\sin^2 2x-\cos^2 2x)+2(2-p)x+7$ does not have any critical point, be the interval (a,b). Then $16ab$ is equal to _____

Numerical value type: the answer is a number.

Answer: 252. · Key from source paper

Q23 JEE Main 2024 · 8 Apr · Shift 1 MCQ

For the function $f(x)=(\cos x)-x+1, x\in\mathbb{R}$, between the following two statements (S1) $f(x)=0$ for only one value of x in $[0,\pi]$. (S2) $f(x)$ is decreasing in $\left[0,\frac{\pi}{2}\right]$ and increasing in $\left[\frac{\pi}{2},\pi\right]$.

(A) Both (S1) and (S2) are correct.
(B) Both (S1) and (S2) are incorrect.
(C) Only (S2) is correct.
(D) Only (S1) is correct.

Answer: (D) Only (S1) is correct. · Key from source paper

Q24 JEE Main 2024 · 8 Apr · Shift 1 MCQ

Let $f(x) = 4\cos^3 x + 3\sqrt{3}\cos^2 x - 10$. The number of points of local maxima of f in interval $(0, 2\pi)$ is

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

Answer: (D) 2 · Key from source paper

Q25 JEE Main 2024 · 8 Apr · Shift 1 MCQ

The number of critical points of the function $f(x) = (x-2)^{2/3}(2x+1)$ is

(A) 1
(B) 2
(C) 0
(D) 3

Answer: (B) 2 · Key from source paper

Q26 JEE Main 2024 · 8 Apr · Shift 2 MCQ

If the function $f(x) = 2x^3 - 9x^2 + 12\mathrm{a}^2x + 1$, $\mathrm{a} > 0$ has a local maximum at $x = \alpha$ and a local minimum at $x = \alpha^2$, then α and α^2 are the roots of the equation :

(A) $x^2 - 6x + 8 = 0$
(B) $x^2 + 6x + 8 = 0$
(C) $8x^2 + 6x - 1 = 0$
(D) $8x^2 - 6x + 1 = 0$

Answer: (A) $x^2 - 6x + 8 = 0$ · Key from source paper

Q27 JEE Main 2024 · 8 Apr · Shift 2 Numerical

Let A be the region enclosed by the parabola $y^2 = 2x$ and the line $x = 24$. Then the maximum area of the rectangle inscribed in the region A is _____

Numerical value type: the answer is a number.

Answer: 128. · Key from source paper

Q28 JEE Main 2024 · 6 Apr · Shift 1 MCQ

The interval in which the function $f(x) = x^x$, $x > 0$, is strictly increasing is

(A) $(0, \frac{1}{e}]$
(B) $(0, \infty)$
(C) $[\frac{1}{e}, \infty)$
(D) $[\frac{1}{e^2}, 1)$

Answer: (C) $[\frac{1}{e}, \infty)$ · Key from source paper

Q29 JEE Main 2024 · 6 Apr · Shift 2 MCQ

If the function $f(x) = \left(\frac{1}{x}\right)^{2x}$; $x > 0$ attains the maximum value at $x = \frac{1}{e}$ then :

(A) $e^\pi < \pi^e$
(B) $e^\pi > \pi^e$
(C) $(2e)^\pi > \pi^{(2e)}$
(D) $e^{2\pi} < (2\pi)^e$

Answer: (B) $e^\pi > \pi^e$ · Key from source paper

Q30 JEE Main 2024 · 5 Apr · Shift 1 MCQ

Let a rectangle $ABCD$ of sides 2 and 4 be inscribed in another rectangle $PQRS$ such that the vertices of the rectangle $ABCD$ lie on the sides of the rectangle $PQRS$. Let a and b be the sides of the rectangle $PQRS$ when its area is maximum. Then $(a+b)^2$ is equal to :

(A) 72
(B) 60
(C) 64
(D) 80

Answer: (A) 72 · Key from source paper

Q31 JEE Main 2024 · 5 Apr · Shift 1 MCQ

For the function $f(x) = \sin x + 3x - \frac{2}{\pi}(x^2 + x)$, where $x \in \left[0, \frac{\pi}{2}\right]$, consider the following two statements : (I) f is increasing in $\left(0, \frac{\pi}{2}\right)$. (II) f' is decreasing in $\left(0, \frac{\pi}{2}\right)$. Between the above two statements,

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(A) only (II) is true.
(B) only (I) is true.
(C) neither (I) nor (II) is true.
(D) both (I) and (II) are true

Answer: (D) both (I) and (II) are true · Key from source paper

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Q32 JEE Main 2024 · 1 Feb · Shift 1 MCQ

If $5f x + 4f\frac{1}{x} = x^2 - 2, \forall x \neq 0$ and $y = 9x^2 f x$, then y is strictly increasing in:

(A) $0, \frac{1}{\sqrt{5}} \cup \frac{1}{\sqrt{5}}, \infty$
(B) $-\frac{1}{\sqrt{5}}, 0 \cup \frac{1}{\sqrt{5}}, \infty$
(C) $-\frac{1}{\sqrt{5}}, 0 \cup 0, \frac{1}{\sqrt{5}}$
(D) $-\infty, \frac{1}{\sqrt{5}} \cup 0, \frac{1}{\sqrt{5}}$

Answer: (B) $-\frac{1}{\sqrt{5}}, 0 \cup \frac{1}{\sqrt{5}}, \infty$ · Key from source paper

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Q33 JEE Main 2024 · 31 Jan · Shift 1 Numerical

Let $S = -1, \infty$ and $f : S \to \mathbb{R}$ be defined as $f(x) = \int_{-1}^{x} e^t - 1^{11}\, 2t - 1^5\, t - 2^7\, t - 3^{12}\, 2t - 10^{61}\, dt$. Let $p =$ Sum of square of the values of x, where $f(x)$ attains local maxima on S. and $q =$ Sum of the values of x, where $f(x)$ attains local minima on S. Then, the value of $p^2 + 2q$ is _____.

Numerical value type: the answer is a number.

Answer: 27. · Key from source paper

Q34 JEE Main 2024 · 30 Jan · Shift 1 MCQ

The maximum area of a triangle whose one vertex is at $(0, 0)$ and the other two vertices lie on the curve $y = -2x^2 + 54$ at points (x, y) and $(-x, y)$ where $y > 0$ is :

(A) 88
(B) 122
(C) 92
(D) 108

Answer: (D) 108 · Key from source paper

Q35 JEE Main 2024 · 30 Jan · Shift 2 MCQ

Let $f(x) = x + 3^2 x - 2^3, x \in [-4, 4]$. If M and m are the maximum and minimum values of f, respectively in $[-4, 4]$, then the value of $M - m$ is :

(A) 600
(B) 392
(C) 608
(D) 108

Answer: (C) 608 · Key from source paper

Q36 JEE Main 2024 · 29 Jan · Shift 1 MCQ

In an A.P., the sixth term $a_6 = 2$. If the $a_1a_4a_5$ is the greatest, then the common difference of the A.P., is equal to

(A) $\frac{3}{2}$
(B) $\frac{8}{5}$
(C) $\frac{2}{3}$
(D) $\frac{5}{8}$

Answer: (B) $\frac{8}{5}$ · Key from source paper

Q37 JEE Main 2024 · 29 Jan · Shift 1 Numerical

Let f(x) = $2^x - x^2$, x ∈ R. If m and n are respectively the number of points at which the curves y = f(x) and y = f′(x) intersects the x−axis, then the value of m + n is

Numerical value type: the answer is a number.

Answer: 5. · Key from source paper

Q38 JEE Main 2024 · 29 Jan · Shift 2 MCQ

The function $f(x) = 2x + 3x^{\frac{2}{3}}, x \in R$, has

(A) exactly one point of local minima and no point of local maxima
(B) exactly one point of local maxima and no point of local minima
(C) exactly one point of local maxima and exactly one point of local minima
(D) exactly two points of local maxima and exactly one point of local minima

Answer: (C) exactly one point of local maxima and exactly one point of local minima · Key from source paper

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Q39 JEE Main 2024 · 29 Jan · Shift 2 MCQ

The function $f(x) = \frac{x}{x^2-6x-16}, x \in \mathbb{R} - \{-2, 8\}$

(A) decreases in $(-2, 8)$ and increases in $(-\infty, -2) \cup (8, \infty)$
(B) decreases in $(-\infty, -2) \cup (-2, 8) \cup (8, \infty)$
(C) decreases in $(-\infty, -2)$ and increases in $(8, \infty)$
(D) increases in $(-\infty, -2) \cup (-2, 8) \cup (8, \infty)$

Answer: (B) decreases in $(-\infty, -2) \cup (-2, 8) \cup (8, \infty)$ · Key from source paper

Q40 JEE Main 2024 · 27 Jan · Shift 2 MCQ

Let $g(x) = 3f_{\frac{x}{3}} + f(3-x)$ and $f''(x) > 0$ for all $x \in (0,3)$. If g is decreasing in $(0,\alpha)$ and increasing in $(\alpha,3)$, then 8α is

(A) 24
(B) 0
(C) 18
(D) 20

Answer: (C) 18 · Key from source paper

Q41 JEE Main 2023 · 15 Apr · Shift 1 Numerical

Consider the triangles with vertices $A(2,1)$, $B(0,0)$ and $C(t,4)$, $t = [0,4]$. If the maximum and the minimum perimeters of such triangles are obtained at $t = \alpha$ and $t = \beta$ respectively, then $6\alpha + 21\beta$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 48. · Key from source paper

Q42 JEE Main 2023 · 13 Apr · Shift 1 MCQ

$\max_{0\le x\le\pi}\left\{x - 2\sin x\cos x + \frac{1}{3}\sin 3x\right\} =$

(A) $\frac{\pi+2-3\sqrt{3}}{6}$
(B) π
(C) 0
(D) $\frac{5\pi+2+3\sqrt{3}}{6}$

Answer: (D) $\frac{5\pi+2+3\sqrt{3}}{6}$ · Key from source paper

Q43 JEE Main 2023 · 12 Apr · Shift 1 MCQ

If the total maximum value of the function $f(x) = \left(\frac{\sqrt{3e}}{2\sin x}\right)^{\sin^2 x}$, $x \in \left(0, \frac{\pi}{2}\right)$, is $\frac{k}{e}$, then $\left(\frac{k}{e}\right)^8 + \frac{k^8}{e^5} + k^8$ is equal to

(A) $e^3 + e^6 + e^{11}$
(B) $e^5 + e^6 + e^{11}$
(C) $e^3 + e^6 + e^{10}$
(D) $e^3 + e^5 + e^{11}$

Answer: (A) $e^3 + e^6 + e^{11}$ · Key from source paper

Q44 JEE Main 2023 · 11 Apr · Shift 1 MCQ

Let $f : 2,4 \to \mathbb{R}$ be a differentiable function such that $x\log_e xf'x + \log_e xfx + fx \ge 1$, $x \in 2,4$ with $f2 = \frac{1}{2}$ and $f4 = \frac{1}{2}$.

Consider the following two statements:
(A) $fx \leq 1$, for all $x \in 2,4$
(B) $fx \geq 1/8$, for all $x \in 2,4$
Then,

(A) Neither statement (A) nor statement (B) is true
(B) Only statement (B) is true
(C) Both the statements (A) and (B) are true
(D) Only statement (A) is true

Answer: (C) Both the statements (A) and (B) are true · Key from source paper

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Q45 JEE Main 2023 · 10 Apr · Shift 1 MCQ

A square piece of tin of side 30 cm is to be made into a box without top by cutting a square from each corner and folding up the flaps to form a box. If the volume of the box is maximum, then its surface area (in cm^2) is equal to

(A) 800
(B) 675
(C) 1025
(D) 900

Answer: (A) 800 · Key from source paper

Q46 JEE Main 2023 · 10 Apr · Shift 2 MCQ

Let $gx = fx + f1 - x$ and $f''x > 0$, $x \in 0,1$. If g is decreasing in the interval $0,\alpha$ and increasing in the interval $\alpha,1$, then $\tan^{-1} 2\alpha + \tan^{-1} \frac{1}{\alpha} + \tan^{-1} \frac{\alpha+1}{\alpha}$ is equal to

(A) π
(B) $\frac{5\pi}{4}$
(C) $\frac{3\pi}{4}$
(D) $\frac{3\pi}{2}$

Answer: (A) π · Key from source paper

Q47 JEE Main 2023 · 10 Apr · Shift 2 Numerical

Let the quadratic curve passing through the point $-1,0$ and touching the line $y = x$ at $1,1$ be $y = fx$. Then the x-intercept of the normal to the curve at the point $\alpha, \alpha+1$ in the first quadrant is

Numerical value type: the answer is a number.

Answer: 11. · Key from source paper

Q48 JEE Main 2023 · 8 Apr · Shift 1 Numerical

If a_α is the greatest term in the sequence $a_n = \frac{n^3}{n^4+147}$, $n = 1,2,3,\ldots$, then α is equal to _____

Numerical value type: the answer is a number.

Answer: 5. · Key from source paper

Q49 JEE Main 2023 · 6 Apr · Shift 1 Numerical

Let the tangent to the curve $x^2 + 2x - 4y + 9 = 0$ at the point $P(1, 3)$ on it meet the y - axis at A. Let the line passing through P and parallel to the line $x - 3y = 6$ meet the parabola $y^2 = 4x$ at B. If B lies on the line $2x - 3y = 8$, then AB^2 is equal to _____ .

Numerical value type: the answer is a number.

Answer: 292. · Key from source paper

Q50 JEE Main 2023 · 6 Apr · Shift 2 Numerical

The number of points, where the curve $y = x^5 - 20x^3 + 50x + 2$ crosses the x-axis, is _____ .

Numerical value type: the answer is a number.

Answer: 5. · Key from source paper

Q51 JEE Main 2023 · 1 Feb · Shift 1 MCQ

Let $fx = 2x + \tan^{-1} x$ and $gx = \log_e \sqrt{1 + x^2} + x$, $x \in 0, 3$. Then

(A) There exists $x \in 0, 3$ such that $f'x < g'x$

(B) $\max\ fx > \max\ gx$

(C) There exist $0 < x_1 < x_2 < 3$ such that $fx < gx$, $\forall x \in x_1, x_2$

(D) $\min\ f'x = 1 + \max\ g'x$

Answer: (B) $\max\ fx > \max\ gx$ · Key from source paper

Q52 JEE Main 2023 · 1 Feb · Shift 2 MCQ

The sum of the abosolute maximum and minimum values of the function $f(x) = |x^2 - 5x + 6| - 3x + 2$ in the interval $[-1, 3]$ is equal to :

(A) 10

(B) 12

(C) 13

(D) 24

Answer: (A) 10 · Key from source paper

Q53 JEE Main 2023 · 31 Jan · Shift 1 MCQ

A wire of length 20 m is to be cut into two pieces. A piece of length ℓ_1 is bent to make a square of area A_1 and the other piece of length ℓ_2 is made into a circle of area A_2. If $2A_1 + 3A_2$ is minimum then $\pi\ell_1 : \ell_2$ is equal to:

(A) 6: 1
(B) 3: 1
(C) 1: 6
(D) 4: 1

Answer: (A) 6: 1 · Key from source paper

Q54 JEE Main 2023 · 30 Jan · Shift 1 MCQ

The number of points on the curve $y = 54x^5 - 135x^4 - 70x^3 + 180x^2 + 210x$ at which the normal lines are parallel to $x + 90y + 2 = 0$ is:

(A) 2
(B) 3
(C) 4
(D) 0

Answer: (C) 4 · Key from source paper

Q55 JEE Main 2023 · 30 Jan · Shift 2 MCQ

If the functions $f(x) = \frac{x^3}{3} + 2bx + \frac{ax^2}{2}$ and $g(x) = \frac{x^3}{3} + ax + bx^2$, $a \neq 2b$ have a common extreme point, then $a + 2b + 7$ is equal to

(A) 4
(B) $\frac{3}{2}$
(C) 3
(D) 6

Answer: (D) 6 · Key from source paper

Q56 JEE Main 2023 · 29 Jan · Shift 2 Numerical

If the equation of the normal to the curve $y = \frac{x-a}{(x+b)(x-2)}$ at the point $(1, -3)$ is $x - 4y = 13$ then the value of $a + b$ is equal to _____

Numerical value type: the answer is a number.

Answer: 4. · Key from source paper

Q57 JEE Main 2023 · 25 Jan · Shift 1 MCQ

Let $f : (0, 1) \to \mathbb{R}$ be a function defined by $f(x) = \frac{1}{1-e^{-x}}$, and $g(x) = (f(-x) - f(x))$. Consider two statements
(I) g is an increasing function in $(0, 1)$
(II) g is one-one in $(0, 1)$
Then,

(A) Only (I) is true
(B) Only (II) is true
(C) Neither (I) nor (II) is true
(D) Both (I) and (II) are true

Answer: (D) Both (I) and (II) are true · Key from source paper

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Q58 JEE Main 2023 · 25 Jan · Shift 1 MCQ

Let $x = 2$ be a local minima of the function $f(x) = 2x^4 - 18x^2 + 8x + 12$, $x \in (-4, 4)$. If M is local maximum value of the function f in $(-4, 4)$, then $M =$

(A) $12\sqrt{6} - \frac{33}{2}$
(B) $12\sqrt{6} - \frac{31}{2}$
(C) $18\sqrt{6} - \frac{33}{2}$
(D) $18\sqrt{6} - \frac{31}{2}$

Answer: (A) $12\sqrt{6} - \frac{33}{2}$ · Key from source paper

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Q59 JEE Main 2023 · 25 Jan · Shift 2 MCQ

Let the function $f(x) = 2x^3 + (2p - 7)x^2 + 3(2p - 9)x - 6$ have a maxima for some value of $x < 0$ and a minima for some value of $x > 0$. Then, the set of all values of p is

(A) $\left(\frac{9}{2}, \infty\right)$
(B) $\left(0, \frac{9}{2}\right)$
(C) $\left(-\infty, \frac{9}{2}\right)$
(D) $\left(-\frac{9}{2}, \frac{9}{2}\right)$

Answer: (C) $\left(-\infty, \frac{9}{2}\right)$ · Key from source paper

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Q60 JEE Main 2022 · 29 Jul · Shift 1 MCQ

Let $f(x) = 3^{(x^2-2)^3+4}$, $x \in R$. Then which of the following statements are true?
P : $x = 0$ is a point of local minima of f
Q : $x = \sqrt{2}$ is a point of inflection of f
R : f' is increasing for $x > \sqrt{2}$

(A) Only P and Q
(B) Only P and R
(C) Only Q and R
(D) All P, Q and R

Answer: (D) All P, Q and R · Key from source paper

Q61 JEE Main 2022 · 29 Jul · Shift 2 · Numerical

If the tangent to the curve $y = x^3 - x^2 + x$ at the point a, b is also tangent to the curve $y = 5x^2 + 2x - 25$ at the point $2, -1$, then $2a + 9b$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 195. · Key from source paper

Q62 JEE Main 2022 · 28 Jul · Shift 1 · MCQ

If the minimum value of $f(x) = \frac{5x^2}{2} + \frac{\alpha}{x^5}, x > 0$, is 14, then the value of α is equal to

(A) 32
(B) 64
(C) 128
(D) 256

Answer: (C) 128 · Key from source paper

Q63 JEE Main 2022 · 28 Jul · Shift 2 · MCQ

The function $f(x) = xe^{x(1-x)}, x \in R$, is

(A) increasing in $\left(-\frac{1}{2}, 1\right)$
(B) decreasing in $\left(\frac{1}{2}, 2\right)$
(C) increasing in $\left(-1, -\frac{1}{2}\right)$
(D) decreasing in $\left(-\frac{1}{2}, \frac{1}{2}\right)$

Answer: (A) increasing in $\left(-\frac{1}{2}, 1\right)$ · Key from source paper

Q64 JEE Main 2022 · 28 Jul · Shift 2 · MCQ

The sum of the absolute maximum and absolute minimum values of the function $f(x) = \tan^{-1}(\sin x - \cos x)$ in the interval $[0, \pi]$ is

(A) 0
(B) $\tan^{-1}\left(\frac{1}{\sqrt{2}}\right) - \frac{\pi}{4}$
(C) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right) - \frac{\pi}{4}$
(D) $\frac{-\pi}{12}$

Answer: (C) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right) - \frac{\pi}{4}$ · Key from source paper

Q65 JEE Main 2022 · 27 Jul · Shift 1 · MCQ

Let a function $f : \mathbb{R} \to \mathbb{R}$ 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 $\left(-\infty, \frac{1}{8}\right) \cup (8, \infty)$

(D) f has a local minima at $x = \frac{1}{8}$

Answer: (C) f **is increasing in** $\left(-\infty, \frac{1}{8}\right) \cup (8, \infty)$ · Key from source paper

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Q66 JEE Main 2022 · 27 Jul · Shift 1 Numerical

Let M and N be the number of points on the curve $y^5 - 9xy + 2x = 0$, where the tangents to the curve are parallel to x-axis and y-axis, respectively. Then the value of $M + N$ equals _____ .

Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q67 JEE Main 2022 · 27 Jul · Shift 2 Numerical

A water tank has the shape of a right circular cone with axis vertical and vertex downwards. Its semivertical angle is $\tan^{-1}\frac{3}{4}$. Water is poured in it at a constant rate of 6 cubic meter per hour. The rate (in square meter per hour), at which the wet curved surface area of the tank is increasing, when the depth of water in the tank is 4 meters, is _____ .

Numerical value type: the answer is a number.

Answer: 5. · Key from source paper

Q68 JEE Main 2022 · 26 Jul · Shift 1 MCQ

Let $f(x) = \begin{cases} x^3 - x^2 + 10x - 7, & x \le 1 \\ -2x + \log_2(b^2 - 4), & x > 1 \end{cases}$ Then the set of all values of b, for which $f(x)$ has maximum value at $x = 1$, is:

(A) $(-6, -2)$

(B) $(2, 6)$

(C) $[-6, -2) \cup (2, 6]$

(D) $\left[-\sqrt{6}, -2\right) \cup \left(2, \sqrt{6}\right]$

Answer: (C) $[-6, -2) \cup (2, 6]$ · Key from source paper

Q69 JEE Main 2022 · 26 Jul · Shift 2 MCQ

Let P and Q be any points on the curves $x - 1^2 + y + 1^2 = 1$ and $y = x^2$, respectively. The distance between P and Q is minimum for some value of the abscissa of P in the interval

(A) $0, \frac{1}{4}$
(B) $\frac{1}{2}, \frac{3}{4}$
(C) $\frac{1}{4}, \frac{1}{2}$
(D) $\frac{3}{4}, 1$

Answer: (C) $\frac{1}{4}, \frac{1}{2}$ · Key from source paper

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Q70 JEE Main 2022 · 25 Jul · Shift 1 MCQ

If the absolute maximum value of the function $fx = x^2 - 2x + 7e^{4x^3-12x^2-180x+31}$ in the interval $-3, 0$ is $f\alpha$, then

(A) $\alpha = 0$
(B) $\alpha = -3$
(C) $\alpha \in -1, 0$
(D) $\alpha \in -3, -1$

Answer: (B) $\alpha = -3$ · Key from source paper

Q71 JEE Main 2022 · 25 Jul · Shift 1 MCQ

The curve $yx = ax^3 + bx^2 + cx + 5$ touches the x-axis at the point $P - 2, 0$ and cuts the y-axis at the point Q, where y' is equal to 3. Then the local maximum value of yx is

(A) $\frac{27}{4}$
(B) $\frac{29}{4}$
(C) $\frac{37}{4}$
(D) $\frac{9}{2}$

Answer: (A) $\frac{27}{4}$ · Key from source paper

Q72 JEE Main 2022 · 25 Jul · Shift 2 Numerical

The sum of the maximum and minimum values of the function $f(x) = |5x - 7| + \left[x^2 + 2x\right]$ in the interval $\left[\frac{5}{4}, 2\right]$, where $[t]$ is the greatest integer $\leq t$, is _____.

Numerical value type: the answer is a number.

Answer: 15. · Key from source paper

Q73 JEE Main 2022 · 25 Jul · Shift 2 Numerical

Let the area enclosed by the x-axis, and the tangent and normal drawn to the curve $4x^3 - 3xy^2 + 6x^2 - 5xy - 8y^2 + 9x + 14 = 0$ at the point $(-2, 3)$ be A. Then $8A$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 170. · Key from source paper

Q74 JEE Main 2022 · 29 Jun · Shift 1 MCQ

A wire of length 22m is to be cut into two pieces. One of the pieces is to be made into a square and the other into an equilateral triangle. Then, the length of the side of the equilateral triangle, so that the combined area of the square and the equilateral triangle is minimum, is

(A) $\frac{22}{9+4\sqrt{3}}$
(B) $\frac{66}{9+4\sqrt{3}}$
(C) $\frac{22}{4+9\sqrt{3}}$
(D) $\frac{66}{4+9\sqrt{3}}$

Answer: (B) $\frac{66}{9+4\sqrt{3}}$ · Key from source paper

Q75 JEE Main 2022 · 29 Jun · Shift 1 Numerical

The number of solutions of the equation $2\theta - \cos^2\theta + \sqrt{2} = 0$ in R is equal to _____.

Numerical value type: the answer is a number.

Answer: 1. · Key from source paper

Q76 JEE Main 2022 · 29 Jun · Shift 2 MCQ

Let $f : R \to R$ be a function defined by $f(x) = (x-3)^{n_1}(x-5)^{n_2}$, $n_1, n_2 \in N$. The, which of the following is NOT true?

(A) For $n_1 = 3,\ n_2 = 4$, there exists $\alpha \in (3,\ 5)$ where f attains local maxima.
(B) For $n_1 = 4,\ n_2 = 3$, there exists $\alpha \in (3,\ 5)$ where f attains local maxima.
(C) For $n_1 = 3,\ n_2 = 5$, there exists $\alpha \in (3,\ 5)$ where f attains local maxima.
(D) For $n_1 = 4,\ n_2 = 6$, there exists $\alpha \in (3,\ 5)$ where f attains local maxima.

Options (3) or (2) were accepted. More than one answer was accepted. · Key from source paper

Q77 JEE Main 2022 · 28 Jun · Shift 1 MCQ

The number of real solutions of $x^7 + 5x^3 + 3x + 1 = 0$ is equal to _____.

(A) 0
(B) 1
(C) 3
(D) 5

Answer: (B) 1 · Key from source paper

Q78 JEE Main 2022 · 28 Jun · Shift 1 · Numerical

Let l be a line which is normal to the curve $y = 2x^2 + x + 2$ at a point P on the curve. If the point $Q(6, 4)$ lies on the line l and O is origin, then the area of the triangle OPQ is equal to _____.

Numerical value type: the answer is a number.

Answer: 13. · Key from source paper

Q79 JEE Main 2022 · 27 Jun · Shift 1 · MCQ

The lengths of the sides of a triangle are $10 + x^2$, $10 + x^2$ and $20 - 2x^2$. If for $x = k$, the area of the triangle is maximum, then $3k^2$ is equal to

(A) 5
(B) 12
(C) 10
(D) 20

Answer: (C) 10 · Key from source paper

Q80 JEE Main 2022 · 27 Jun · Shift 2 · MCQ

If m and n respectively are the number of local maximum and local minimum points of the function $f(x) = \int_0^{x^2} \frac{t^2-5t+4}{2+e^t}\,dt$, then the ordered pair (m, n) is equal to

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

Answer: (A) $(2, 3)$ · Key from source paper

Q81 JEE Main 2022 · 26 Jun · Shift 1 · MCQ

The sum of the absolute minimum and the absolute maximum values of the function $f(x) = |3x - x^2 + 2| - x$ in the interval $[-1, 2]$ is

(A) $\frac{\sqrt{17}+3}{2}$
(B) $\frac{\sqrt{17}+5}{2}$
(C) 5
(D) $\frac{9-\sqrt{17}}{2}$

Answer: (A) $\frac{\sqrt{17}+3}{2}$ · Key from source paper

Q82 JEE Main 2022 · 26 Jun · Shift 1 · MCQ

Let S be the set of all the natural numbers, for which the line $\frac{x}{a} + \frac{y}{b} = 2$ is a tangent to the curve $\left(\frac{x}{a}\right)^n + \left(\frac{y}{b}\right)^n = 2$ at the point (a, b), $ab \neq 0$. Then

(A) $S = \phi$

(B) $n(S) = 1$

(C) $S = \{2k : k \in N\}$

(D) $S = N$

Answer: (D) $S = N$ · Key from source paper

Q83 JEE Main 2022 · 26 Jun · Shift 2 MCQ

Consider a cuboid of sides $2x, 4x$ and $5x$ and a closed hemisphere of radius r. If the sum of their surface areas is constant k, then the ratio $x : r$, for which the sum of their volumes is maximum, is

(A) $2 : 5$

(B) $19 : 45$

(C) $3 : 8$

(D) $19 : 15$

Answer: (B) $19 : 45$ · Key from source paper

Q84 JEE Main 2022 · 25 Jun · Shift 1 MCQ

Let $f : R \to R$ and $g : R \to R$ be two functions defined by $fx = \log_e x^2 + 1 - e^{-x} + 1$ and $gx = \frac{1-2e^{2x}}{e^x}$. Then, for which of the following range of α, the inequality $fg\frac{\alpha-1^2}{3} > fg\alpha - \frac{5}{3}$ holds?

(A) $-2, -1$

(B) $2, 3$

(C) $1, 2$

(D) $-1, 1$

Answer: (B) $2, 3$ · Key from source paper

Q85 JEE Main 2022 · 25 Jun · Shift 1 MCQ

Let $g : 0, \infty \to R$ be a differentiable function such that $\int \left(\frac{x \cos x - \sin x}{e^x + 1} + \frac{gxe^x + 1 - xe^x}{e^x + 1^2} \right) dx = \frac{xgx}{e^x + 1} + C$, for all $x > 0$, where C is an arbitrary constant. Then

(A) g is decreasing in $0, \frac{\pi}{4}$

(B) $g - g'$ is increasing in $0, \frac{\pi}{2}$

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

(D) $g + g'$ is increasing in $0, \frac{\pi}{2}$

Answer: (B) $g - g'$ **is increasing in** $0, \frac{\pi}{2}$ · Key from source paper

Q86 JEE Main 2022 · 25 Jun · Shift 2 MCQ

Water is being filled at the rate of $1\text{cm}^3\text{sec}^{-1}$ in a right circular conical vessel (vertex downwards) of height 35cm and diameter 14cm. When the height of the water level is 10cm, the rate (in $\text{cm}^2\ \text{sec}^{-1}$)

at which the wet conical surface area of the vessel increases is

(A) 5
(B) $\frac{\sqrt{21}}{5}$
(C) $\frac{\sqrt{26}}{5}$
(D) $\frac{\sqrt{26}}{10}$

Answer: (C) $\frac{\sqrt{26}}{5}$ · Key from source paper

Q87 JEE Main 2022 · 25 Jun · Shift 2 MCQ

If the angle made by the tangent at the point x_0, y_0 on the curve $x = 12t + \sin t \cos t$, $y = 121 + \sin t^2$, $0 < t < \frac{\pi}{2}$, with the positive x-axis is $\frac{\pi}{3}$, then y_0 is equal to

(A) $63 + 2\sqrt{2}$
(B) $37 + 4\sqrt{3}$
(C) 27
(D) 48

Answer: (C) 27 · Key from source paper

Q88 JEE Main 2022 · 25 Jun · Shift 2 Numerical

Let $fx = x - 1x^2 - 2x - 3 + x - 3$, $x \in \mathbb{R}$. If m and M are respectively the number of points of local minimum and local maximum of f in the interval $0, 4$, then $m + M$ is equal to _____ .

Numerical value type: the answer is a number.

Answer: 3. · Key from source paper

Q89 JEE Main 2022 · 24 Jun · Shift 1 MCQ

For the function $f(x) = 4\log_e(x-1) - 2x^2 + 4x + 5$, $x > 1$, which one of the following is NOT correct?

(A) $f(x)$ is increasing in $(1, 2)$ and decreasing in $(2, \infty)$
(B) $f(x) = -1$ has exactly two solutions
(C) $f'(\mathrm{e}) - f''(2) < 0$
(D) $f(x) = 0$ has a root in the interval $(e, e+1)$

Answer: (C) $f'(\mathrm{e}) - f''(2) < 0$ · Key from source paper

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Q90 JEE Main 2022 · 24 Jun · Shift 1 MCQ

If the tangent at the point (x_1, y_1) on the curve $y = x^3 + 3x^2 + 5$ passes through the origin, then (x_1, y_1) does NOT lie on the curve

(A) $x^2 + \frac{y^2}{81} = 2$
(B) $\frac{y^2}{9} - x^2 = 8$
(C) $y = 4x^2 + 5$
(D) $\frac{x}{3} - y^2 = 2$

Answer: (D) $\frac{x}{3} - y^2 = 2$ · Key from source paper

Q91 JEE Main 2022 · 24 Jun · Shift 1 MCQ

The sum of absolute maximum and absolute minimum values of the function $f(x) = |2x^2 + 3x - 2| + \sin x \cos x$ in the interval $[0, 1]$ is

(A) $3 + \frac{\sin(1)\cos^2\left(\frac{1}{2}\right)}{2}$
(B) $3 + \frac{1}{2}(1 + 2\cos(1))\sin(1)$
(C) $5 + \frac{1}{2}(\sin(1) + \sin(2))$
(D) $2 + \sin\left(\frac{1}{2}\right)\cos\left(\frac{1}{2}\right)$

Answer: (B) $3 + \frac{1}{2}(1 + 2\cos(1))\sin(1)$ · Key from source paper

Q92 JEE Main 2022 · 24 Jun · Shift 1 MCQ

The surface area of a balloon of spherical shape being inflated, increases at a constant rate. If initially, the radius of balloon is 3 units and after 5 seconds, it becomes 7 units, then its radius after 9 seconds is

(A) 9
(B) 7
(C) 5
(D) 3

Answer: (A) 9 · Key from source paper

Q93 JEE Main 2022 · 24 Jun · Shift 2 MCQ

The number of distinct real roots of the equation $x^7 - 7x - 2 = 0$ is

(A) 5
(B) 7
(C) 1
(D) 3

Answer: (D) 3 · Key from source paper

Q94 JEE Main 2022 · 24 Jun · Shift 2 MCQ

Let λ^* be the largest value of λ for which the function $f_\lambda(x) = 4\lambda x^3 - 36\lambda x^2 + 36x + 48$ is increasing for all $x \in \mathbb{R}$. Then $f_{\lambda^*}(1) + f_{\lambda^*}(-1)$ is equal to:

(A) 36
(B) 48
(C) 64
(D) 72

Answer: (D) 72 · Key from source paper

Q95 JEE Main 2021 · 1 Sep · Shift 2 MCQ

Let θ be the acute angle between the tangents to the ellipse $\frac{x^2}{9}+\frac{y^2}{1}=1$ and the circle $x^2+y^2=3$ at their point of intersection in the first quadrant. Then $\tan\theta$ is equal to :

(A) $\frac{5}{2\sqrt{3}}$
(B) $\frac{4}{\sqrt{3}}$
(C) $\frac{2}{\sqrt{3}}$
(D) 2

Answer: (C) $\frac{2}{\sqrt{3}}$ · Key from source paper

Q96 JEE Main 2021 · 31 Aug · Shift 1 Numerical

If R is the least value of a such that the function $f(x)=x^2+ax+1$ is increasing on $[1,2]$ and S is the greatest value of a such that the function $f(x)=x^2+ax+1$ is decreasing on $[1,2]$, then the value of $|R-S|$ is _____

Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q97 JEE Main 2021 · 31 Aug · Shift 2 MCQ

An angle of intersection of the curves, $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ and $x^2+y^2=ab$, $a>b$, is :

(A) $\tan^{-1}2\sqrt{ab}$
(B) $\tan^{-1}\frac{a+b}{\sqrt{ab}}$
(C) $\tan^{-1}\frac{a-b}{\sqrt{ab}}$
(D) $\tan^{-1}\frac{a-b}{2\sqrt{ab}}$

Answer: (C) $\tan^{-1}\frac{a-b}{\sqrt{ab}}$ · Key from source paper

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Q98 JEE Main 2021 · 31 Aug · Shift 2 Numerical

Let fx be a cubic polynomial with $f1=-10$, $f-1=6$, and has a local minima at $x=1$, and $f'x$ has a local minima at $x=-1$. Then $f3$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 22. · Key from source paper

Q99 JEE Main 2021 · 27 Aug · Shift 1 MCQ

A wire of length 20 m is to be cut into two pieces. One of the pieces is to be made into a square and the other into a regular hexagon. Then the length of the side (in meters) of the hexagon, so that the combined area of the square and the hexagon is minimum, is

(A) $\frac{10}{2+3\sqrt{3}}$
(B) $\frac{5}{3+\sqrt{3}}$
(C) $\frac{10}{3+2\sqrt{3}}$
(D) $\frac{5}{2+\sqrt{3}}$

Answer: (C) $\frac{10}{3+2\sqrt{3}}$ · Key from source paper

Q100 JEE Main 2021 · 27 Aug · Shift 1 Numerical

The number of distinct real roots of the equation $3x^4 + 4x^3 - 12x^2 + 4 = 0$ is _____.

Numerical value type: the answer is a number.

Answer: 4. · Key from source paper

Q101 JEE Main 2021 · 27 Aug · Shift 2 MCQ

A box open from top is made from a rectangular sheet of dimension $a \times b$ by cutting squares each of side x from each of the four corners and folding up the flaps. If the volume of the box is maximum, then x is equal to:

(A) $\frac{a+b+\sqrt{a^2+b^2-ab}}{6}$
(B) $\frac{a+b-\sqrt{a^2+b^2-ab}}{12}$
(C) $\frac{a+b-\sqrt{a^2+b^2-ab}}{6}$
(D) $\frac{a+b-\sqrt{a^2+b^2+ab}}{6}$

Answer: (C) $\frac{a+b-\sqrt{a^2+b^2-ab}}{6}$ · Key from source paper

Q102 JEE Main 2021 · 26 Aug · Shift 1 Numerical

A wire of length 36 m is cut into two pieces, one of the pieces is bent to form a square and the other is bent to form a circle. If the sum of the areas of the two figures is minimum, and the circumference of the circle is k (meter), then $\left(\frac{4}{\pi}+1\right)k$ is equal to

Numerical value type: the answer is a number.

Answer: 36. · Key from source paper

Q103 JEE Main 2021 · 26 Aug · Shift 2 MCQ

The local maximum value of the function, $f(x) = \left(\frac{2}{x}\right)^{x^2}$, $x > 0$, is

(A) 1

(B) $\left(\frac{4}{\sqrt{e}}\right)^{\frac{e}{4}}$

(C) $(e)^{\frac{2}{e}}$

(D) $(2\sqrt{e})^{\frac{1}{e}}$

Answer: (C) $(e)^{\frac{2}{e}}$ · Key from source paper

Q104 JEE Main 2021 · 25 Jul · Shift 1 MCQ

Let $fx = 3\sin^4 x + 10\sin^3 x + 6\sin^2 x - 3$, $x \in -\frac{\pi}{6}, \frac{\pi}{2}$. Then, f is :

(A) increasing in $-\frac{\pi}{6}, \frac{\pi}{2}$

(B) decreasing in $0, \frac{\pi}{2}$

(C) increasing in $-\frac{\pi}{6}, 0$

(D) decreasing in $-\frac{\pi}{6}, 0$

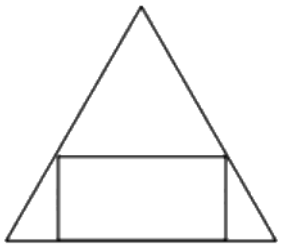
Answer: (D) decreasing in $-\frac{\pi}{6}, 0$ · Key from source paper

Q105 JEE Main 2021 · 25 Jul · Shift 2 Numerical

If a rectangle is inscribed in an equilateral triangle of side length $2\sqrt{2}$ as shown in the figure, then the square of the largest area of such a rectangle is _____.

(see the figure above)

Q86. If a rectangle is inscribed in an equilateral triangle of side length $2\sqrt{2}$ as shown in the figure, then the square of the largest area of such a rectangle is _____.



Numerical value type: the answer is a number.

Answer: 3. · Key from source paper

Q106 JEE Main 2021 · 22 Jul · Shift 1 MCQ

Let $f : R \to R$ be defined as $f(x) = \begin{cases} -\frac{4}{3}x^3 + 2x^2 + 3x & , x > 0 \\ 3xe^x & , x \leq 0 \end{cases}$. Then f is increasing function in the interval

(A) $\left(-\frac{1}{2}, 2\right)$
(B) $(0, 2)$
(C) $\left(-1, \frac{3}{2}\right)$
(D) $(-3, -1)$

Answer: (C) $\left(-1, \frac{3}{2}\right)$ · Key from source paper

Q107 JEE Main 2021 · 22 Jul · Shift 1 Numerical

The number of elements in the set $\{n \in \{1, 2, 3, \ldots, 100\} \mid (11)^n > (10)^n + (9)^n\}$ is _____.

Numerical value type: the answer is a number.

Answer: 96. · Key from source paper

Q108 JEE Main 2021 · 20 Jul · Shift 1 MCQ

Let $A = [a_{ij}]$ be a 3×3 matrix, where $a_{ij} = \begin{cases} 1 & , \text{ if } i = j \\ -x & , \text{ if } |i - j| = 1 \\ 2x + 1 & , \text{ otherwise} \end{cases}$

Let a function $f : R \to R$ be defined as $f(x) = \det(A)$. Then the sum of maximum and minimum values of f on R is equal to:

(A) $-\frac{20}{27}$
(B) $\frac{88}{27}$
(C) $\frac{20}{27}$
(D) $-\frac{88}{27}$

Answer: (D) $-\frac{88}{27}$ · Key from source paper

Q109 JEE Main 2021 · 20 Jul · Shift 1 MCQ

Let a be a real number such that the function $f(x) = ax^2 + 6x - 15$, $x \in R$ is increasing in $\left(-\infty, \frac{3}{4}\right)$ and decreasing in $\left(\frac{3}{4}, \infty\right)$. Then the function $g(x) = ax^2 - 6x + 15$, $x \in R$ has a

(A) local maximum at $x = -\frac{3}{4}$
(B) local minimum at $x = -\frac{3}{4}$
(C) local maximum at $x = \frac{3}{4}$
(D) local minimum at $x = \frac{3}{4}$

Answer: (A) local maximum at $x = -\frac{3}{4}$ · Key from source paper

Q110 JEE Main 2021 · 20 Jul · Shift 2 MCQ

The sum of all the local minimum values of the twice differentiable function $f : R \to R$ defined by $f(x) = x^3 - 3x^2 - \frac{3f''(2)}{2}x + f''(1)$ is:

(A) -22
(B) 5
(C) -27
(D) 0

Answer: (C) -27 · Key from source paper

Q111 JEE Main 2021 · 20 Jul · Shift 2 Numerical

If the point on the curve $y^2 = 6x$, nearest to the point $\left(3, \frac{3}{2}\right)$ is (α, β), then $2(\alpha + \beta)$ is equal to _____ .

Numerical value type: the answer is a number.

Answer: 9. · Key from source paper

Q112 JEE Main 2021 · 18 Mar · Shift 2 Numerical

Let $P(x)$ be a real polynomial of degree 3 which vanishes at $x = -3$. Let $P(x)$ have local minima at $x = 1$, local maxima at $x = -1$ and $\int_{-1}^{1} P(x)dx = 18$, then the sum of all the coefficients of the polynomial $P(x)$ is equal to _____ .

Numerical value type: the answer is a number.

Answer: 8. · Key from source paper

Q113 JEE Main 2021 · 17 Mar · Shift 1 Numerical

The maximum value of z in the following equation $z = 6xy + y^2$, where $3x + 4y \leq 100$ and $4x + 3y \leq 75$ for $x \geq 0$ and $y \geq 0$ is _____

Numerical value type: the answer is a number.

Answer: 904. · Key from source paper

Q114 JEE Main 2021 · 17 Mar · Shift 2 MCQ

Consider the function $f : R \to R$ defined by $f(x) = \begin{cases} \left(2 - \sin\left(\frac{1}{x}\right)\right)|x|, & x \neq 0 \\ 0, & x = 0 \end{cases}$. Then f is:

(A) monotonic on $(-\infty, 0) \cup (0, \infty)$
(B) not monotonic on $(-\infty, 0)$ and $(0, \infty)$
(C) monotonic on $(0, \infty)$ only
(D) monotonic on $(-\infty, 0)$ only

Answer: (B) not monotonic on $(-\infty, 0)$ and $(0, \infty)$ · Key from source paper

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Q115 JEE Main 2021 · 17 Mar · Shift 2 Numerical

Let $f : [-1, 1] \to R$ be defined as $f(x) = ax^2 + bx + c$ for all $x \in [-1, 1]$, where $a, b, c \in R$ such that $f(-1) = 2$, $f'(-1) = 1$ and for $x \in (-1, 1)$ the maximum value of $f''(x)$ is $\frac{1}{2}$. If $f(x) \leq \alpha, x \in [-1, 1]$,

then the least value of α is equal to

Numerical value type: the answer is a number.

Answer: 5. · Key from source paper

Q116 JEE Main 2021 · 16 Mar · Shift 1 MCQ

The range of $a \in R$ for which the function $f(x) = (4a-3)(x + \log_e 5) + 2(a-7)\cot\left(\frac{x}{2}\right)\sin^2\left(\frac{x}{2}\right), x \neq 2n\pi, n \in N$, has critical points, is :

(A) $(-3, 1)$

(B) $\left[-\frac{4}{3}, 2\right]$

(C) $[1, \infty)$

(D) $(-\infty, -1]$

Answer: (B) $\left[-\frac{4}{3}, 2\right]$ · Key from source paper

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Q117 JEE Main 2021 · 16 Mar · Shift 1 Numerical

If the normal to the curve $y(x) = \int_0^x \left(2t^2 - 15t + 10\right) dt$ at a point (a, b) is parallel to the line $x + 3y = -5, a > 1$, then the value of $|a + 6b|$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 406. · Key from source paper

Q118 JEE Main 2021 · 16 Mar · Shift 2 MCQ

Let f be a real valued function, defined on $R - \{-1, 1\}$ and given by $f(x) = 3\log_e\left|\frac{x-1}{x+1}\right| - \frac{2}{x-1}$. Then in which of the following intervals, function $f(x)$ is increasing?

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

(B) $(-\infty, \infty) - \{-1, 1\}$

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

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

Answer: (A) $(-\infty, -1) \cup \left(\left[\frac{1}{2}, \infty\right) - \{1\}\right)$ · Key from source paper

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Q119 JEE Main 2021 · 26 Feb · Shift 1 MCQ

The maximum slope of the curve $y = \frac{1}{2}x^4 - 5x^3 + 18x^2 - 19x$ occurs at the point

(A) $\left(3, \frac{21}{2}\right)$

(B) $(2, 2)$

(C) $(2, 9)$

(D) $(0, 0)$

Answer: (B) $(2, 2)$ · Key from source paper

Q120 JEE Main 2021 · 26 Feb · Shift 2 MCQ

The triangle of maximum area that can be inscribed in a given circle of radius 'r' is :

(A) An equilateral triangle having each of its side of length $\sqrt{3}r$.

(B) An isosceles triangle with base equal to $2r$.

(C) An equilateral triangle of height $\frac{2r}{3}$.

(D) A right angle triangle having two of its sides of length $2r$ and r.

Answer: (A) An equilateral triangle having each of its side of length $\sqrt{3}r$. · Key from source paper

Q121 JEE Main 2021 · 26 Feb · Shift 2 Numerical

Let a be an integer such that all the real roots of the polynomial $2x^5 + 5x^4 + 10x^3 + 10x^2 + 10x + 10$ lie in the interval $(a, a+1)$. Then, $|a|$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q122 JEE Main 2021 · 25 Feb · Shift 1 MCQ

If the curves, $\frac{x^2}{a} + \frac{y^2}{b} = 1$ and $\frac{x^2}{c} + \frac{y^2}{d} = 1$ intersect each other at an angle of 90°, then which of the following relations is TRUE?

(A) $a - c = b + d$

(B) $a - b = c - d$

(C) $a + b = c + d$

(D) $ab = \frac{c+d}{a+b}$

Answer: (B) $a - b = c - d$ · Key from source paper

Q123 JEE Main 2021 · 25 Feb · Shift 1 Numerical

Let $f(x)$ be a polynomial of degree 6 in x, in which the coefficient of x^6 is unity and it has extrema at $x = -1$ and $x = 1$. If $\lim_{x\to 0} \frac{f(x)}{x^3} = 1$, then $5 \cdot f(2)$ is equal to

Numerical value type: the answer is a number.

Answer: 144. · Key from source paper

Q124 JEE Main 2021 · 25 Feb · Shift 2 MCQ

The shortest distance between the line $x - y = 1$ and the curve $x^2 = 2y$ is:

(A) $\frac{1}{2}$
(B) $\frac{1}{\sqrt{2}}$
(C) $\frac{1}{2\sqrt{2}}$
(D) 0

Answer: (C) $\frac{1}{2\sqrt{2}}$ · Key from source paper

Q125 JEE Main 2021 · 25 Feb · Shift 2 Numerical

If the curves $x = y^4$ and $xy = k$ cut at right angles, then $(4k)^6$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 4. · Key from source paper

Q126 JEE Main 2021 · 24 Feb · Shift 1 MCQ

The function $fx = \frac{4x^3 - 3x^2}{6} - 2\sin x + 2x - 1\cos x$:

(A) increases in $\frac{1}{2}, \infty$
(B) decreases in $-\infty, \frac{1}{2}$
(C) decreases in $\frac{1}{2}, \infty$
(D) increases in $-\infty, \frac{1}{2}$

Answer: (A) increases in $\frac{1}{2}, \infty$ · Key from source paper

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Q127 JEE Main 2021 · 24 Feb · Shift 1 MCQ

If the tangent to the curve $y = x^3$ at the point Pt, t^3 meets the curve again at Q, then the ordinate of the point which divides PQ internally in the ratio $1 : 2$ is:

(A) 0
(B) $-2t^3$
(C) $-t^3$
(D) $2t^3$

Answer: (B) $-2t^3$ · Key from source paper

Q128 JEE Main 2021 · 24 Feb · Shift 1 Numerical

The minimum value of α for which the equation $\frac{4}{\sin x} + \frac{1}{1-\sin x} = \alpha$ has at least one solution in $0, \frac{\pi}{2}$ is _____.

Numerical value type: the answer is a number.

Answer: 9. · Key from source paper

EdLoop JEE

Q129 JEE Main 2021 · 24 Feb · Shift 2 MCQ

If P is a point on the parabola $y = x^2 + 4$ which is closest to the straight line $y = 4x - 1$, then the co-ordinates of P are:

(A) $(-2, 8)$
(B) $(1, 5)$
(C) $(2, 8)$
(D) $(3, 13)$

Answer: (C) $(2, 8)$ · Key from source paper

Q130 JEE Main 2021 · 24 Feb · Shift 2 MCQ

Let $f : R \to R$ be defined as

$$f(x) = \begin{cases} -55x, & \text{if } x < -5 \\ 2x^3 - 3x^2 - 120x, & \text{if } -5 \le x \le 4 \\ 2x^3 - 3x^2 - 36x - 336, & \text{if } x > 4 \end{cases}$$

Let $A = \{x \in R : f \text{ is increasing}\}$. Then A is equal to:

(A) $(-5, \infty)$
(B) $(-5, -4) \cup (4, \infty)$
(C) $(-\infty, -5) \cup (-4, \infty)$
(D) $(-\infty, -5) \cup (4, \infty)$

Answer: (B) $(-5, -4) \cup (4, \infty)$ · Key from source paper

Q131 JEE Main 2021 · 24 Feb · Shift 2 MCQ

If the curve $y = ax^2 + bx + c, x \in R$, passes through the point $(1, 2)$ and the tangent line to this curve at origin is $y = x$, then the possible values of a, b, c are:

(A) $a = -1, b = 1, c = 1$
(B) $a = 1, b = 0, c = 1$
(C) $a = 1, b = 1, c = 0$
(D) $a = \frac{1}{2}, b = \frac{1}{2}, c = 1$

Answer: (C) $a = 1, b = 1, c = 0$ · Key from source paper

Q132 JEE Main 2020 · 6 Sep · Shift 1 Numerical

Let AD and BC be two vertical poles at A and B respectively on a horizontal ground. If $AD = 8\text{m}$, $BC = 11\text{m}$, $AB = 10\text{m}$; then the distance (in meters) of a point M lying in between AB from the point A such that $\text{MD}^2 + \text{MC}^2$ is minimums, is _____

Numerical value type: the answer is a number.

Answer: 5. · Key from source paper

Q133 JEE Main 2020 · 6 Sep · Shift 2 MCQ

The set of all real values λ for which the function $f(x) = (1 - \cos^2 x).(\lambda + \sin\ x)$, $x\varepsilon\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$, has exactly one maxima and exactly one minima, is :

(A) $\left(-\frac{1}{2}, \frac{1}{2}\right) - \{0\}$
(B) $\left(-\frac{3}{2}, \frac{3}{2}\right)$
(C) $\left(-\frac{1}{2}, \frac{1}{2}\right)$
(D) $\left(-\frac{3}{2}, \frac{3}{2}\right) - \{0\}$

Answer: (D) $\left(-\frac{3}{2}, \frac{3}{2}\right) - \{0\}$ · Key from source paper

Q134 JEE Main 2020 · 5 Sep · Shift 2 MCQ

If $x = 1$ is a critical point of the function $f(x) = (3x^2 + ax - 2 - a)e^x$, then

(A) $x = 1$ and $x = -\frac{2}{3}$ are local minima of f
(B) $x = 1$ and$x = -\frac{2}{3}$ is a local maxima of f
(C) $x = 1$ is a local maxima and$x = -\frac{2}{3}$ is a local minima of f
(D) $x = 1$ is a local minima and$x = -\frac{2}{3}$ are local maxima of f

Answer: (D) $x = 1$ **is a local minima and**$x = -\frac{2}{3}$ **are local maxima of** f · Key from source paper

Q135 JEE Main 2020 · 5 Sep · Shift 2 MCQ

Which of the following points lies on the tangent to the curve $x^4e^y + 2\sqrt{y+1} = 3$ at the point $(1, 0)$?

(A) $(2,\ 2)$
(B) $(2,\ 6)$
(C) $(-2,\ 6)$
(D) $(-2,\ 4)$

Answer: (C) $(-2,\ 6)$ · Key from source paper

Q136 JEE Main 2020 · 5 Sep · Shift 2 Numerical

If the lines $x + y = a$ and $x - y = b$ touch the curve $y = x^2 - 3x + 2$ at the points where the curve intersects the x–axis, then $\frac{a}{b}$ is equal to _____

Numerical value type: the answer is a number.

Answer: 0.5. · Key from source paper

Q137 JEE Main 2020 · 4 Sep · Shift 2 MCQ

The area (in sq. units) of the largest rectangle $ABCD$ whose vertices A and B lie on the x-axis and vertices C and D lie on the parabola, $y = x^2 - 1$ below the x-axis, is :

(A) $\frac{2}{3\sqrt{3}}$
(B) $\frac{1}{3\sqrt{3}}$
(C) $\frac{4}{3}$
(D) $\frac{4}{3\sqrt{3}}$

Answer: (D) $\frac{4}{3\sqrt{3}}$ · Key from source paper

Q138 JEE Main 2020 · 3 Sep · Shift 1 MCQ

The function, $f(x) = (3x-7)x^{\frac{2}{3}}$, $x \in \mathrm{R}$, is increasing for all x lying in

(A) $(-\infty, 0) \cup \left(\frac{14}{15}, \infty\right)$
(B) $(-\infty, 0) \cup \left(\frac{3}{7}, \infty\right)$
(C) $\left(-\infty, \frac{14}{15}\right)$
(D) $\left(-\infty, -\frac{14}{15}\right) \cup (0, \infty)$

Answer: (A) $(-\infty, 0) \cup \left(\frac{14}{15}, \infty\right)$ · Key from source paper

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Q139 JEE Main 2020 · 3 Sep · Shift 2 MCQ

Suppose $f(x)$ is a polynomial of degree four having critical points at $-1,\ 0,\ 1$. If $T = \{x \in R \mid f(x) = f(0)\}$, then the sum of squares of all the elements of T is :

(A) 4
(B) 6
(C) 2
(D) 8

Answer: (A) 4 · Key from source paper

Q140 JEE Main 2020 · 3 Sep · Shift 2 MCQ

If the surface area of a cube is increasing at a rate of $3.6\mathrm{cm}^2/\mathrm{sec}$, retaining its shape; then the rate of change of its volume (in $\mathrm{cm}^3/\mathrm{sec}$), when the length of a side of the cube is $10\mathrm{cm}$, is:

(A) 20
(B) 10
(C) 18
(D) 9

Answer: (D) 9 · Key from source paper

Q141 JEE Main 2020 · 3 Sep · Shift 2 Numerical

If the tangent to the curve $y = e^x$ at a point $(c,\ e^c)$ and the normal to the parabola $y^2 = 4x$ at the point $(1,\ 2)$ intersect at the same point on the $x-$axis, then the value of c is _____

Numerical value type: the answer is a number.

Answer: 4. · Key from source paper

Q142 JEE Main 2020 · 2 Sep · Shift 1 MCQ

If the tangent to the curve $y = x + \sin y$ at a point (a, b) is parallel to the line joining $\left(0, \frac{3}{2}\right)$ and $\left(\frac{1}{2}, 2\right)$, then

(A) $b = a$

(B) $|b - a| = 1$

(C) $|a + b| = 1$

(D) $b = \frac{\pi}{2} + a$

Answer: (B) $|b - a| = 1$ · Key from source paper

Q143 JEE Main 2020 · 2 Sep · Shift 1 MCQ

If $p(x)$ be a polynomial of degree three that has a local maximum value 8 at $x = 1$ and a local minimum value 4 at $x = 2$ then $p(0)$ is equal to

(A) 6

(B) -12

(C) 24

(D) 12

Answer: (B) -12 · Key from source paper

Q144 JEE Main 2020 · 2 Sep · Shift 1 MCQ

Let $P(h, k)$ be a point on the curve $y = x^2 + 7x + 2$, nearest to the line, $y = 3x - 3$. Then the equation of the normal to the curve at P is

(A) $x + 3y + 26 = 0$

(B) $x + 3y - 62 = 0$

(C) $x - 3y - 11 = 0$

(D) $x - 3y + 22 = 0$

Answer: (A) $x + 3y + 26 = 0$ · Key from source paper

Q145 JEE Main 2020 · 2 Sep · Shift 2 MCQ

The equation of the normal to the curve $y = (1 + x)^{2y} + \cos^2\left(\sin^{-1} x\right)$, at $x = 0$ is

(A) $y + 4x = 2$
(B) $y = 4x + 2$
(C) $x + 4y = 8$
(D) $2y + x = 4$

Answer: (C) $x + 4y = 8$ · Key from source paper

Q146 JEE Main 2020 · 2 Sep · Shift 2 MCQ

Let $f : (-1, \infty) \to R$ 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$(-1, 0)$ and increases in $(0, \infty)$
(B) Increases in $(-1, \infty)$
(C) Increases in $(-1, 0)$ and decreases in $(0, \infty)$
(D) Decreases in $(-1, \infty)$

Answer: (D) Decreases in $(-1, \infty)$ · Key from source paper

Q147 JEE Main 2020 · 9 Jan · Shift 1 MCQ

A spherical iron ball of 10cm radius is coated with a layer of ice of uniform thickness that melts at a rate of $50\text{cm}^3/\text{min}$. When the thickness of ice is 5cm , then the rate (in cm/min .) at which the thickness of ice decreases, is:

(A) $\frac{5}{6\pi}$
(B) $\frac{1}{54\pi}$
(C) $\frac{1}{36\pi}$
(D) $\frac{1}{18\pi}$

Answer: (D) $\frac{1}{18\pi}$ · Key from source paper

Q148 JEE Main 2020 · 9 Jan · Shift 2 MCQ

Let a function $f : [0, 5] \to R$ be continuous, $f(1) = 3$ and F be defined as:
$F(x) = \int_1^x t^2 g(t)dt$, where $g(t) = \int_1^t f(u)du$.
Then for the function $F(x)$, the point $x = 1$ is:

(A) a point of local minima
(B) not a critical point
(C) a point of local maxima
(D) a point of inflection

Answer: (A) a point of local minima · Key from source paper

Q149 JEE Main 2020 · 8 Jan · Shift 1 MCQ

Let $f(x) = x\cos^{-1}(-\sin|x|)$, $x \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$, then which of the following is true?

(A) f' is increasing in $\left(-\frac{\pi}{2}, 0\right)$ and decreasing in $\left(0, \frac{\pi}{2}\right)$

(B) $f'(0) = -\frac{\pi}{2}$

(C) f is not differentiable at $x = 0$

(D) f' is decreasing in $\left(-\frac{\pi}{2}, 0\right)$ and increasing in $\left(0, \frac{\pi}{2}\right)$

Answer: (D) f' **is decreasing in** $\left(-\frac{\pi}{2}, 0\right)$ **and increasing in** $\left(0, \frac{\pi}{2}\right)$ · Key from source paper

Q150 JEE Main 2020 · 8 Jan · Shift 1 Numerical

Let the normal at a point P on the curve $y^2 - 3x^2 + y + 10 = 0$ intersect the y -axis at $\left(0, \frac{3}{2}\right)$. If m is the slope of the tangent at P to the curve, then $|m|$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 4. · Key from source paper

Q151 JEE Main 2020 · 8 Jan · Shift 2 MCQ

The length of the perpendicular from the origin, on normal to the curve, $x^2 + 2xy - 3y^2 = 0$, at the point $(2, 2)$, is.

(A) $\sqrt{2}$

(B) $4\sqrt{2}$

(C) 2

(D) $2\sqrt{2}$

Answer: (D) $2\sqrt{2}$ · Key from source paper

Q152 JEE Main 2020 · 8 Jan · Shift 2 Numerical

Let $f(x)$, be a polynomial of degree 3, such that $f(-1) = 10$, $f(1) = -6$, $f(x)$, has a critical point at $x = -1$ and $f'(x)$, has a critical point at $x = 1$. Then $f(x)$, has local minima at $x =$

Numerical value type: the answer is a number.

Answer: 3. · Key from source paper

Q153 JEE Main 2020 · 7 Jan · Shift 2 MCQ

Let $f(x)$ be a polynomial of degree 5 such that $x = \pm 1$ are its critical points. If $\lim_{x \to 0}\left(2 + \frac{f(x)}{x^3}\right) = 4$, then which one of the following is not true?

(A) f is an odd function

(B) $f(1) - 4f(-1) = 4$. $x = 1$ is a point of maximum and $x = -1$

(C) $x = 1$ is a point of local minimum and $x = -1$ is a point of local maximum

(D) $x = 1$ is a point of local maxima of f

Answer: (C) $x = 1$ **is a point of local minimum and** $x = -1$ **is a point of local maximum** · Checked by our team

Q154 JEE Main 2019 · 12 Apr · Shift 1 MCQ

A 2m ladder leans against a vertical wall. If the top of the ladder begins to slide down the wall at the rate 25cm / sec , then the rate (in cm/sec.) at which the bottom of the ladder slides away from the wall on the horizontal ground when the top of the ladder is 1 m above the ground is:

(A) 25
(B) $25\sqrt{3}$
(C) $\frac{25}{3}$
(D) $\frac{25}{\sqrt{3}}$

Answer: (D) $\frac{25}{\sqrt{3}}$ · Key from source paper

Q155 JEE Main 2019 · 12 Apr · Shift 1 MCQ

If m is the minimum value of k for which the function $fx = x\sqrt{kx - x^2}$ is increasing in the interval $[0,\ 3]$ and M is the maximum value of f in $[0,\ 3]$ when $k = m$, then the ordered pair $(m,\ M)$ is equal to:

(A) $4,\ 3\sqrt{3}$
(B) $5,\ 3\sqrt{6}$
(C) $3,\ 3\sqrt{3}$
(D) $4,\ 3\sqrt{2}$

Answer: (A) $4,\ 3\sqrt{3}$ · Key from source paper

Q156 JEE Main 2019 · 12 Apr · Shift 2 MCQ

The tangents to the curve $y = (x-2)^2 - 1$ at its points of intersection with the line $x - y = 3$, intersect at the point:

(A) $\left(\frac{5}{2}, 1\right)$
(B) $\left(\frac{5}{2}, -1\right)$
(C) $\left(-\frac{5}{2}, -1\right)$
(D) $\left(-\frac{5}{2}, 1\right)$

Answer: (B) $\left(\frac{5}{2}, -1\right)$ · Key from source paper

Q157 JEE Main 2019 · 10 Apr · Shift 1 MCQ

Let $f(x) = e^x - x$ and $g(x) = x^2 - x,\ \forall\, x \in R$. Then the set of all $x \in R$, where the function $h(x) = (fog)(x)$ is increasing, is:

(A) $\left[-1,-\frac{1}{2}\right] \cup \left[\frac{1}{2},\infty\right)$
(B) $[0,\infty)$
(C) $\left[0,\frac{1}{2}\right] \cup [1,\infty)$
(D) $\left[-\frac{1}{2},0\right] \cup [1,\infty)$

Answer: (C) $\left[0,\frac{1}{2}\right] \cup [1,\infty)$ · Key from source paper

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Q158 JEE Main 2019 · 10 Apr · Shift 2 MCQ

If the tangent to the curve $y = \frac{x}{x^2-3},\ x \in R,\ x \neq \pm\sqrt{3}$, at a point $\alpha,\ \beta \neq 0,\ 0$ on it is parallel to the line $2x + 6y - 11 = 0$, then:

(A) $2\alpha + 6\beta = 19$
(B) $2\alpha + 6\beta = 11$
(C) $6\alpha + 2\beta = 19$
(D) $6\alpha + 2\beta = 9$

Answer: (C) $6\alpha + 2\beta = 19$ · Key from source paper

Q159 JEE Main 2019 · 10 Apr · Shift 2 MCQ

A spherical iron ball of radius $10\ cm$ is coated with a layer of ice of uniform thickness that melts at a rate of $50\ cm^3\ /\ min$. When the thickness of the ice is $5\ cm$, then the rate at which the thickness $(\text{in } cm\ /\ min)$ of the ice decreases, is :

(A) $\frac{1}{9\pi}$
(B) $\frac{1}{36\pi}$
(C) $\frac{1}{18\pi}$
(D) $\frac{5}{6\pi}$

Answer: (C) $\frac{1}{18\pi}$ · Key from source paper

Q160 JEE Main 2019 · 9 Apr · Shift 1 MCQ

If $f(x)$ is a non-zero polynomial of degree four, having local extreme points at $x = -1, 0, 1$; then the set $S = \{x \in R : f(x) = f(0)\}$ contains exactly

(A) Two irrational and two rational numbers
(B) Four rational numbers
(C) Two irrational and one rational number
(D) Four irrational numbers

Answer: (C) Two irrational and one rational number · Key from source paper

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Q161 JEE Main 2019 · 9 Apr · Shift 1 MCQ

If the tangent to the curve, $y = x^3 + ax - b$ at the point $(1,-5)$ is perpendicular to the line, $-x + y + 4 = 0$, then which one of the following points lies on the curve?

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

Answer: (A) $(2, -2)$ · Key from source paper

Q162 JEE Main 2019 · 9 Apr · Shift 2 MCQ

A water tank has the shape of an inverted right circular cone, whose semi-vertical angle is $\tan^{-1}\left(\frac{1}{2}\right)$. Water is poured into it at a constant rate of 5 $cubic\ m/min$. Then the rate (in m/min), at which the level of water is rising at the instant when the depth of water in the tank is 10 m; is:

(A) $\frac{1}{10\pi}$
(B) $\frac{1}{15\pi}$
(C) $\frac{1}{5\pi}$
(D) $\frac{2}{\pi}$

Answer: (C) $\frac{1}{5\pi}$ · Key from source paper

Q163 JEE Main 2019 · 8 Apr · Shift 1 MCQ

The shortest distance between the line $y = x$ and the curve $y^2 = x - 2$ is

(A) $\frac{7}{4\sqrt{2}}$
(B) $\frac{7}{8}$
(C) $\frac{11}{4\sqrt{2}}$
(D) 2

Answer: (A) $\frac{7}{4\sqrt{2}}$ · Key from source paper

Q164 JEE Main 2019 · 8 Apr · Shift 1 MCQ

If S_1 and S_2 are respectively the sets of local minimum and local maximum points of the function, $fx = 9x^4 + 12x^3 - 36x^2 + 25, x \in R$, then

(A) $S_1 = -2; S_2 = \{0, 1\}$
(B) $S_1 = -1; S_2 = 0, 2$
(C) $S_1 = -2, 0; S_2 = \{1\}$
(D) $S_1 = -2, 1; S_2 = \{0\}$

Answer: (D) $S_1 = -2, 1; S_2 = \{0\}$ · Key from source paper

EdLoop JEE

Q165 JEE Main 2019 · 8 Apr · Shift 1 MCQ

Let $f : 0, 2 \to R$ be a twice differentiable function such that $f''x > 0$, for all $x \in 0, 2$. If $\phi x = fx + f2 - x$, then ϕ is

(A) decreasing on 0,2
(B) increasing on 0,2
(C) increasing on (0,1) and decreasing on 1,2
(D) decreasing on 0,1 and increasing on (1,2)

Answer: (D) decreasing on 0,1 and increasing on (1,2) · Key from source paper

Q166 JEE Main 2019 · 8 Apr · Shift 2 MCQ

The height of a right circular cylinder of maximum volume inscribed in a sphere of radius 3 is:

(A) $\sqrt{3}$
(B) $\frac{2}{3}\sqrt{3}$
(C) $\sqrt{6}$
(D) $2\sqrt{3}$

Answer: (D) $2\sqrt{3}$ · Key from source paper

Q167 JEE Main 2019 · 12 Jan · Shift 1 MCQ

The maximum area (in sq. units) of a rectangle having its base on the $x-$ axis and its other two vertices on the parabola, $y = 12 - x^2$ such that the rectangle lies inside the parabola, is :

(A) $20\sqrt{2}$
(B) 32
(C) 36
(D) $18\sqrt{3}$

Answer: (B) 32 · Key from source paper

Q168 JEE Main 2019 · 12 Jan · Shift 2 MCQ

The tangent to the curve $y = x^2 - 5x + 5$, parallel to the line $2y = 4x + 1$, also passes through the point :

(A) $\left(\frac{1}{4}, \frac{7}{2}\right)$
(B) $\left(\frac{7}{2}, \frac{1}{4}\right)$
(C) $\left(-\frac{1}{8}, 7\right)$
(D) $\left(\frac{1}{8}, -7\right)$

Answer: (D) $\left(\frac{1}{8}, -7\right)$ · Key from source paper

Q169 JEE Main 2019 · 12 Jan · Shift 2 MCQ

If the function f given by $f(x) = x^3 - 3(a-2)x^2 + 3ax + 7$, for some $a \in R$ is increasing in $(0,\ 1]$ and decreasing in $[1,\ 5)$, then a root of the equation, $\frac{f(x)-14}{(x-1)^2} = 0$, $(x \neq 1)$ is :

(A) 7
(B) -7
(C) 6
(D) 5

Answer: (A) 7 · Key from source paper

Q170 JEE Main 2019 · 11 Jan · Shift 1 MCQ

Themaximum value of the finction $f(x) = 3x^3 - 18x^2 + 27x - 40$ on the set S = $\{x \in R : x^2 + 30 \leq 11x\}$ is :

(A) -122
(B) -222
(C) 122
(D) 222

Answer: (C) 122 · Key from source paper

Q171 JEE Main 2019 · 11 Jan · Shift 2 MCQ

Let $f(x) = \frac{x}{\sqrt{a^2+x^2}} - \frac{d-x}{\sqrt{b^2+(d-x)^2}}$, $x \in \mathbb{R}$ wherea, b and d are non-zero real constants. Then :

(A) f is an increasing function of x
(B) f is a decreasing function of x
(C) f' is not a continuous function of x
(D) f is neither increasing nor decreasing function of x

Answer: (A) f is an increasing function of x · Key from source paper

Q172 JEE Main 2019 · 10 Jan · Shift 1 MCQ

The shortest distance between the point $\left(\frac{3}{2}, 0\right)$ and the curve $y = \sqrt{x},\ (x > 0)$, is

(A) $\frac{\sqrt{3}}{2}$
(B) $\frac{5}{4}$
(C) $\frac{3}{2}$
(D) $\frac{\sqrt{5}}{2}$

Answer: (D) $\frac{\sqrt{5}}{2}$ · Key from source paper

Q173 JEE Main 2019 · 10 Jan · Shift 2 MCQ

A helicopter is flying along the curve given by $y - x^{\frac{3}{2}} = 7,\ (x \geq 0)$. A soldier positioned at the point $\left(\frac{1}{2},\ 7\right)$, who wants to shoot down the helicopter when it is nearest to him. Then this nearest distance is:

(A) $\frac{1}{6}\sqrt{\frac{7}{3}}$
(B) $\frac{1}{2}$
(C) $\frac{1}{3}\sqrt{\frac{7}{3}}$
(D) $\frac{\sqrt{5}}{6}$

Answer: (A) $\frac{1}{6}\sqrt{\frac{7}{3}}$ · Key from source paper

Q174 JEE Main 2019 · 10 Jan · Shift 2 MCQ

The tangent to the curve, $y = xe^{x^2}$ passing through the point $(1, e)$ also passes through the point:

(A) $\left(\frac{4}{3},\ 2e\right)$
(B) $(2,\ 3e)$
(C) $\left(\frac{5}{3},\ 2e\right)$
(D) $(3,\ 6e)$

Answer: (A) $\left(\frac{4}{3},\ 2e\right)$ · Key from source paper

Q175 JEE Main 2019 · 9 Jan · Shift 1 MCQ

The maximum volume in $cu.m$ of the right circular cone having slant height $3\ m$ is:

(A) $2\sqrt{3}\,\pi$
(B) $3\sqrt{3}\,\pi$
(C) $6\,\pi$
(D) $\frac{4}{3}\pi$

Answer: (A) $2\sqrt{3}\,\pi$ · Key from source paper

Q176 JEE Main 2019 · 9 Jan · Shift 1 MCQ

If θ denotes the acute angle between the curves, $y = 10 - x^2$ and $y = 2 + x^2$ at a point of their intersection, then $\tan\theta$ is equal to:

(A) $\frac{4}{9}$
(B) $\frac{8}{17}$
(C) $\frac{7}{17}$
(D) $\frac{8}{15}$

Answer: (D) $\frac{8}{15}$ · Key from source paper

Q177 JEE Main 2018 · 16 Apr · Online MCQ

Let M and m be respectively the absolute maximum and the absolute minimum values of the function, $f(x) = 2x^3 - 9x^2 + 12x + 5$ in the interval $[0, 3]$. Then $M - m$ is equal to

(A) 9
(B) 4
(C) 1
(D) 5

Answer: (A) 9 · Key from source paper

Q178 JEE Main 2018 · 15 Apr · Shift 1 MCQ

If a right circularcone (sic) having maximum volume, is inscribed in a sphere of radius 3 cm, then the curved surface area (in cm^2) of this cone is

(A) $8\sqrt{3}\pi$
(B) $6\sqrt{2}\pi$
(C) $6\sqrt{3}\pi$
(D) $8\sqrt{2}\pi$

Answer: (A) $8\sqrt{3}\pi$ · Key from source paper

Q179 JEE Main 2018 · 15 Apr · Shift 2 MCQ

Let $f(x)$ be a polynomial of degree 4 having extreme values at $x = 1$ and $x = 2$. If $\lim_{x\to 0}\left(\frac{f(x)}{x^2} + 1\right) = 3$ then $f(-1)$ is equal to

(A) $\frac{1}{2}$
(B) $\frac{3}{2}$
(C) $\frac{5}{2}$
(D) $\frac{9}{2}$

Answer: (D) $\frac{9}{2}$ · Key from source paper

Q180 JEE Main 2018 · 8 Apr · Offline MCQ

If the curves $y^2 = 6x,\ 9x^2 + by^2 = 16$ intersect each other at right angles, then the value of b is:

(A) $\frac{9}{2}$
(B) 6
(C) $\frac{7}{2}$
(D) 4

Answer: (A) $\frac{9}{2}$ · Key from source paper

Q181 JEE Main 2018 · 8 Apr · Offline MCQ

Let $f(x) = x^2 + \frac{1}{x^2}$ and $g(x) = x - \frac{1}{x},\ x \in R - \{-1,\ 0,\ 1\}$. If $h(x) = \frac{f(x)}{g(x)}$, then the local minimum value of $h(x)$ is:

(A) $2\sqrt{2}$
(B) 3
(C) -3
(D) $-2\sqrt{2}$

Answer: (A) $2\sqrt{2}$ · Key from source paper

Q182 JEE Main 2017 · 9 Apr · Online MCQ

The function f defined by $f(x) = x^3 - 3x^2 + 5x + 7$ is:

(A) Decreasing in R
(B) Increasing in R
(C) Increasing in $(0, \infty)$ and decreasing in $(-\infty, 0)$
(D) Decreasing in $(0, \infty)$ and increasing in $(-\infty, 0)$

Answer: (B) Increasing in R · Key from source paper

Q183 JEE Main 2017 · 8 Apr · Online MCQ

The tangent at the point $(2, -2)$ to the curve, $x^2y^2 - 2x = 4(1 - y)$ does not pass through the point:

(A) $(-2,\ -7)$
(B) $(8,\ 5)$
(C) $(-4,\ -9)$
(D) $\left(4,\ \frac{1}{3}\right)$

Answer: (A) $(-2,\ -7)$ · Key from source paper

Q184 JEE Main 2017 · 2 Apr · Offline MCQ

Twenty meters of wire is available for fencing off a flower-bed in the form of a circular sector. Then the maximum area (in sq. m) of the flower-bed, is:

(A) 12.5
(B) 10
(C) 25
(D) 30

Answer: (C) 25 · Key from source paper

Q185 JEE Main 2017 · 2 Apr · Offline MCQ

The normal to the curve $y(x-2)(x-3)=x+6$ at the point where the curve intersects the y-axis passes through the point:

(A) $\left(-\frac{1}{2}, -\frac{1}{2}\right)$
(B) $\left(\frac{1}{2}, \frac{1}{2}\right)$
(C) $\left(\frac{1}{2}, -\frac{1}{3}\right)$
(D) $\left(\frac{1}{2}, \frac{1}{3}\right)$

Answer: (B) $\left(\frac{1}{2}, \frac{1}{2}\right)$ · Key from source paper

Q186 JEE Main 2016 · 10 Apr · Online MCQ

Let C be a curve given by $y(x)=1+\sqrt{4x-3}, x>\frac{3}{4}$. If P is a point on C, such that the tangent at P has slope $\frac{2}{3}$, then a point through which the normal at P passes, is :

(A) $(1,\ 7)$
(B) $(3,\ -4)$
(C) $(4,\ -3)$
(D) $(2,\ 3)$

Answer: (A) $(1,\ 7)$ · Key from source paper

Q187 JEE Main 2016 · 10 Apr · Online MCQ

Let $f(x)=\sin^4 x+\cos^4 x$. Then, f is an increasing function in the interval:

(A) $\left]\frac{5\pi}{8}, \frac{3\pi}{4}\right[$
(B) $\left]\frac{\pi}{2}, \frac{5\pi}{8}\right[$
(C) $\left]\frac{\pi}{4}, \frac{\pi}{2}\right[$
(D) $\left]0, \frac{\pi}{4}\right[$

Answer: (C) $\left]\frac{\pi}{4}, \frac{\pi}{2}\right[$ · Key from source paper

EdLoop JEE

Q188 JEE Main 2016 · 9 Apr · Online MCQ

The minimum distance of a point on the curve $y = x^2 - 4$ from the origin is

(A) $\frac{\sqrt{15}}{2}$ units
(B) $\sqrt{\frac{19}{2}}$ units
(C) $\sqrt{\frac{15}{2}}$ units
(D) $\frac{\sqrt{19}}{2}$ units

Answer: (A) $\frac{\sqrt{15}}{2}$ units · Key from source paper

Q189 JEE Main 2016 · 9 Apr · Online MCQ

If the tangent at a point P, with parameter t, on the curve $x = 4t^2 + 3,\ y = 8t^3 - 1,\ t \in R$, meets the curve again at a point Q, then the coordinates of Q are :

(A) $(16t^2 + 3,\ -64t^3 - 1)$
(B) $(4t^2 + 3,\ -8t^3 - 1)$
(C) $(t^2 + 3,\ t^3 - 1)$
(D) $(t^2 + 3,\ -t^3 - 1)$

Answer: (D) $(t^2 + 3,\ -t^3 - 1)$ · Key from source paper

Q190 JEE Main 2016 · 3 Apr · Offline MCQ

Consider $f(x) = \tan^{-1}\left(\sqrt{\frac{1+\sin x}{1-\sin x}}\right),\ x \in \left(0, \frac{\pi}{2}\right)$. A normal to $y = f(x)$ at $x = \frac{\pi}{6}$ also passes through the point

(A) $\left(\frac{\pi}{6},\ 0\right)$
(B) $\left(\frac{\pi}{4},\ 0\right)$
(C) $(0,\ 0)$
(D) $\left(0,\ \frac{2\pi}{3}\right)$

Answer: (D) $\left(0,\ \frac{2\pi}{3}\right)$ · Key from source paper

Q191 JEE Main 2016 · 3 Apr · Offline MCQ

A wire of length 2 units is cut into two parts which are bent respectively to form a square of side $= x$ units and a circle of radius $= r$ units. If the sum of the areas of the square and the circle so formed is minimum, then

(A) $x = 2r$
(B) $2x = r$
(C) $2x = (\pi + 4)r$
(D) $(4 - \pi)x = \pi r$

Answer: (A) $x = 2r$ · Key from source paper

EdLoop JEE

Q192 JEE Main 2015 · 11 Apr · Online MCQ

The equation of a normal to the curve, $\sin y = x \sin\left(\frac{\pi}{3} + y\right)$ at $x = 0$, is:

(A) $2x - \sqrt{3}\,y = 0$
(B) $2y - \sqrt{3}\,x = 0$
(C) $2y + \sqrt{3}\,x = 0$
(D) $2x + \sqrt{3}\,y = 0$

Answer: (D) $2x + \sqrt{3}\,y = 0$ · Key from source paper

Q193 JEE Main 2015 · 11 Apr · Online MCQ

Let k and K be the minimum and the maximum values of the function $f(x) = \frac{(1+x)^{0.6}}{1+x^{0.6}}$ in $[0,\ 1]$, respectively, then the ordered pair $(k,\ K)$ is equal to:

(A) $\left(2^{-0.4}, 1\right)$
(B) $\left(2^{-0.6},\ 1\right)$
(C) $\left(2^{-0.4}, 2^{0.6}\right)$
(D) $\left(1, 2^{0.6}\right)$

Answer: (A) $\left(2^{-0.4}, 1\right)$ · Key from source paper

Q194 JEE Main 2015 · 10 Apr · Online MCQ

Let the tangents drawn to the circle, $x^2 + y^2 = 16$ from the point $P(0, h)$ meet the x-axis at points A and B. If the area of ΔAPB is minimum, then positive value of h is:

(A) $4\sqrt{2}$
(B) $3\sqrt{2}$
(C) $4\sqrt{3}$
(D) $3\sqrt{3}$

Answer: (A) $4\sqrt{2}$ · Key from source paper

Q195 JEE Main 2015 · 10 Apr · Online MCQ

The distance from the origin, of the normal to the curve, $x = 2\cos t + 2t \sin t$, $y = 2\sin t - 2t\cos t$ at $t = \frac{\pi}{4}$, is :

(A) $\sqrt{2}$
(B) $2\sqrt{2}$
(C) 4
(D) 2

Answer: (D) 2 · Key from source paper

Q196 JEE Main 2015 · 4 Apr · Offline MCQ

The normal to the curve $x^2 + 2xy - 3y^2 = 0$, at $(1,\ 1)$

(A) Meets the curve again in the fourth quadrant
(B) Does not meet the curve again
(C) Meets the curve again in the second quadrant
(D) Meets the curve again in the third quadrant

Answer: (A) Meets the curve again in the fourth quadrant · Key from source paper

Q197 JEE Main 2015 · 4 Apr · Offline MCQ

Let $f(x)$ be a polynomial of degree four and having its extreme values at $x = 1$ and $x = 2$. If $\lim\limits_{x \to 0} \left[1 + \dfrac{f(x)}{x^2}\right] = 3$, then $f(2)$ is equal to

(A) 4
(B) -8
(C) -4
(D) 0

Answer: (D) 0 · Key from source paper

Q198 JEE Main 2014 · 19 Apr · Online MCQ

If the volume of a spherical ball is increasing at the rate of 4π cc / sec then the rate of increase of its radius (in cm / sec), when the volume is 288π cc is

(A) $\frac{1}{9}$
(B) $\frac{1}{6}$
(C) $\frac{1}{24}$
(D) $\frac{1}{36}$

Answer: (D) $\frac{1}{36}$ · Key from source paper

Q199 JEE Main 2014 · 12 Apr · Online MCQ

Let f and g be two differentiable functions on R such that $f'(x) > 0$ and $g'(x) < 0$ for all $x \in R$. Then for all x :

(A) $f(g(x)) > f(g(x-1))$
(B) $f(g(x)) > f(g(x+1))$
(C) $g(f(x)) > g(f(x-1))$
(D) $g(f(x)) < g(f(x+1))$

Answer: (B) $f(g(x)) > f(g(x+1))$ · Key from source paper

EdLoop JEE

Q200 JEE Main 2014 · 11 Apr · Online MCQ

Two ships A and B are sailing straight away from a fixed point O along routes such that $\angle AOB$ is always 120° . At a certain instance, $OA = 8\ km$, $OB = 6\ km$ and the ship A is sailing at the rate of $20\ km/hr$ while the ship B sailing at the rate of $30\ km/hr$. Then the distance between A and B is changing at the rate (in km/hr):

(A) $\frac{260}{\sqrt{37}}$
(B) $\frac{260}{37}$
(C) $\frac{80}{\sqrt{37}}$
(D) $\frac{80}{37}$

Answer: (A) $\frac{260}{\sqrt{37}}$ · Key from source paper

Q201 JEE Main 2014 · 11 Apr · Online MCQ

For the curve $y = 3\sin\theta\cos\theta, x = e^{\theta}\sin\theta,\ 0 \le \theta \le \pi$, the tangent is parallel to x-axis when θ is:

(A) $\frac{3\pi}{4}$
(B) $\frac{\pi}{2}$
(C) $\frac{\pi}{4}$
(D) $\frac{\pi}{6}$

Answer: (C) $\frac{\pi}{4}$ · Key from source paper

Q202 JEE Main 2014 · 11 Apr · Online MCQ

The volume of the largest possible right circular cylinder that can be inscribed in a sphere of radius $= \sqrt{3}$ is:

(A) $\frac{4}{3}\sqrt{3}\pi$
(B) $\frac{8}{3}\sqrt{3}\pi$
(C) 4π
(D) 2π

Answer: (C) 4π · Key from source paper

Q203 JEE Main 2014 · 6 Apr · Offline MCQ

If $x = -1$ and $x = 2$ are extreme points of $f(x) = \alpha\log|x| + \beta x^2 + x$, then

(A) $\alpha = 2, \beta = -\frac{1}{2}$
(B) $\alpha = 2, \beta = \frac{1}{2}$
(C) $\alpha = -6, \beta = \frac{1}{2}$
(D) $\alpha = -6, \beta = -\frac{1}{2}$

Answer: (A) $\alpha = 2, \beta = -\frac{1}{2}$ · Key from source paper

EdLoop JEE

Q204 JEE Main 2013 · 25 Apr · Online MCQ

A spherical balloon is being inflated at the rate of 35cc/min. The rate of increase in the surface area (in cm^2/min.) of the balloon when its diameter is 14 cm, is :

(A) 10
(B) $\sqrt{10}$
(C) 100
(D) $10\sqrt{10}$

Answer: (A) 10 · Key from source paper

Q205 JEE Main 2013 · 25 Apr · Online MCQ

If an equation of a tangent to the curve, $y = \cos(x + y)$, $-1 \le x \le 1 + \pi$, is $x + 2y = k$ then k is equal to :

(A) 1
(B) 2
(C) $\frac{\pi}{4}$
(D) $\frac{\pi}{2}$

Answer: (D) $\frac{\pi}{2}$ · Key from source paper

Q206 JEE Main 2013 · 23 Apr · Online MCQ

If the curves $\frac{x^2}{\alpha} + \frac{y^2}{4} = 1$ and $y^3 = 16x$ intersect at right angles, then a value of α is :

(A) 2
(B) $\frac{4}{3}$
(C) $\frac{1}{2}$
(D) $\frac{3}{4}$

Answer: (B) $\frac{4}{3}$ · Key from source paper

Q207 JEE Main 2013 · 23 Apr · Online MCQ

The cost of running a bus from A to B is Rs. $(av + b/v)$ where vkm/h is the average speed of the bus. When the bus travels at 30 km/h, the cost comes out to be Rs. 75 while at 40 km/h, it is Rs. 65. Then the most economical speed (in km/h) of the bus is :

(A) 45
(B) 50
(C) 60
(D) 40

Answer: (C) 60 · Key from source paper

Q208 JEE Main 2013 · 22 Apr · Online MCQ

Statement-1: The function $x^2\left(e^x+e^{-x}\right)$ is increasing for all $x>0$. Statement-2: The functions x^2e^x and x^2e^{-x} are increasing for all $x>0$ and the sum of two increasing functions in any interval (a,b) is an increasing function in (a,b).

(A) Statement-1 is false; Statement-2 is true.
(B) Statement-1 is true; Statement-2 is true; Statement-2 is not a correct explanation for Statement-1.
(C) Statement-1 is true; Statement-2 is false.
(D) Statement-1is true; Statement-2 is true; Statement-2 is a correct explanation for statement-1.

Answer: (C) Statement-1 is true; Statement-2 is false. · Key from source paper

Q209 JEE Main 2013 · 22 Apr · Online MCQ

The maximum area of a right angled triangle with hypotenuse h is :

(A) $\frac{h^2}{2\sqrt{2}}$
(B) $\frac{h^2}{2}$
(C) $\frac{h^2}{\sqrt{2}}$
(D) $\frac{h^2}{4}$

Answer: (D) $\frac{h^2}{4}$ · Key from source paper

Q210 JEE Main 2013 · 9 Apr · Online MCQ

If the surface area of a sphere of radius r is increasing uniformly at the rate $8\ \mathrm{cm}^2/\mathrm{s}$, then the rate of change of its volume is:

(A) constant
(B) proportional to $\sqrt{r}$
(C) proportional to r^2
(D) proportional to r

Answer: (D) proportional to r · Key from source paper

Q211 JEE Main 2013 · 7 Apr · Offline MCQ

The real number k for which the equation, $2x^3+3x+k=0$ has two distinct real roots in $[0,\ 1]$ belongs to

(A) lies between -1 and 0.
(B) does not exist.
(C) lies between 1 and 2.
(D) lies between 2 and 3.

Answer: (B) does not exist. · Key from source paper

Q212 JEE Main 2013 · 7 Apr · Offline MCQ

The intercepts on the x-axis made by tangents to the curve, $y = \int_0^x |t|\, dt$, $x \in R$, which are parallel to the line $y = 2x$, are equal to

(A) ± 3
(B) ± 4
(C) ± 1
(D) ± 2

Answer: (C) ± 1 · Key from source paper

Q213 AIEEE 2012 · 26 May · Online MCQ

Let $f : (-\infty, \infty) \to (-\infty, \infty)$ be defined by $f(x) = x^3 + 1$ Statement 1: The function fhas (sic) a local extremum at $x = 0$ Statement 2: The function f is continuous and differentiable on $(-\infty, \infty)$ and $f'(0) = 0$

(A) Statement 1 is true, Statement 2 is false.
(B) Statement 1 is true, Statement 2 is true, Statement 2 is a correct explanation for Statement 1.
(C) Statement 1 is true, Statement 2 is true, Statement 2 is not the correct explanation for Statement 1.
(D) Statement 1 is false, Statement 2 is true.

Answer: (D) Statement 1 is false, Statement 2 is true. · Key from source paper

Q214 AIEEE 2012 · 26 May · Online MCQ

If a metallic circular plate of radius 50 cm is heated so that its radius increases at the rate of 1 mm per hour, then the rate at which, the area of the plate increases (in cm^2/ hour) is

(A) 5π
(B) 10π
(C) 100π
(D) 50π

Answer: (B) 10π · Key from source paper

Q215 AIEEE 2012 · 19 May · Online MCQ

The weight W of a certain stock of fish is given by $W = nw$, where n is the size of stock and w is the average weight of a fish. If n and w change with time t as $n = 2t^2 + 3$ and $w = t^2 - t + 2$, then the rate of change of W with respect to t at $t = 1$ is

(A) 1
(B) 8
(C) 13
(D) 5

Answer: (C) 13 · Key from source paper

Q216 AIEEE 2012 · 12 May · Online MCQ

Consider a rectangle whose length is increasing at the uniform rate of 2 m/sec, breadth is decreasing at the uniform rate of 3 m/sec and the area is decreasing at the uniform rate of $5\ \mathrm{m}^2$/sec. If after some time the breadth of the rectangle is 2 m then the length of the rectangle is

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

Answer: (D) 3 m · Key from source paper

Q217 AIEEE 2012 · 12 May · Online MCQ

If $f(x) = xe^{x(1-x)}, x \in R$, then $f(x)$ is

(A) decreasing on $[-1/2, 1]$
(B) decreasing on R
(C) increasing on $[-1/2, 1]$
(D) increasing on R

Answer: (C) increasing on $[-1/2, 1]$ · Key from source paper

Q218 AIEEE 2012 · 7 May · Online MCQ

Let $f(x) = \sin x, g(x) = x$. Statement 1: $f(x) \leqslant gx($ for $)$x in $(0, \infty)$ Statement 2: $f(x) \leq 1$ for x in $(0, \infty)$ but $g(x) \to \infty$ as $x \to \infty$.

(A) Statement 1 is true, Statement 2 is false.
(B) Statement 1 is true, Statement 2 is true, Statement 2 is a correct explanation for Statement 1.
(C) Statement 1 is true, Statement 2 is true, Statement 2 is not a correct explanation for Statement 1.
(D) Statement 1 is false, Statement 2 is true.

Answer: (C) Statement 1 is true, Statement 2 is true, Statement 2 is not a correct explanation for Statement 1. · Key from source paper

Q219 AIEEE 2012 · 7 May · Online MCQ

If a circular iron sheet of radius 30 cm is heated such that its area increases at the uniform rate of $6\pi \mathrm{cm}^2/\mathrm{hr}$, then the rate (in mm/hr) at which the radius of the circular sheet increases is

(A) 1.0
(B) 0.1
(C) 1.1
(D) 2.0

Answer: (A) 1.0 · Checked by our team

Q220 AIEEE 2012 · Offline MCQ

A line is drawn through the point $(1, 2)$ to meet the coordinate axes at P and Q such that it forms a triangle OPQ, where O is the origin. If the area of the triangle OPQ is least, then the slope of the line PQ is

(A) $-\frac{1}{4}$
(B) -4
(C) -2
(D) $-\frac{1}{2}$

Answer: (C) -2 · Key from source paper

Q221 AIEEE 2012 · Offline MCQ

A spherical balloon is filled with $4500\ \pi$ cubic meters of helium gas. If a leak in the balloon causes the gas to escape at the rate of $72\ \pi$ cubic meters per minute, then the rate (in meters per minute) at which the radius of the balloon decreases 49 minutes after the leakage began is

(A) $\frac{9}{7}$
(B) $\frac{7}{9}$
(C) $\frac{2}{9}$
(D) $\frac{9}{2}$

Answer: (C) $\frac{2}{9}$ · Key from source paper

Q222 AIEEE 2012 · Offline MCQ

Let $a, b \in R$ be such that the function f given by $f(x) = \ln|x| + bx^2 + ax, x \neq 0$ has extreme values at $x = -1$ and $x = 2$. Statement 1: f has local maximum at $x = -1$ and at $x = 2$. Statement 2: $\mathrm{a} = \frac{1}{2}$ and $\mathrm{b} = \frac{-1}{4}$

(A) Statement 1 is false, statement 2 is true
(B) Statement 1 is true, statement 2 is true; statement 2 is a correct explanation for statement 1
(C) Statement 1 is true, statement 2 is true; statement 2 is not a correct explanation for statement 1
(D) Statement 1 is true, statement 2 is false

Answer: (B) Statement 1 is true, statement 2 is true; statement 2 is a correct explanation for statement 1 · Key from source paper

Q223 AIEEE 2011 MCQ

The shortest distance between line $y - x = 1$ and curve $x = y^2$ is

(A) $\frac{3\sqrt{2}}{8}$
(B) $\frac{8}{3\sqrt{2}}$
(C) $\frac{4}{\sqrt{3}}$
(D) $\frac{\sqrt{3}}{4}$

Answer: (A) $\frac{3\sqrt{2}}{8}$ · Key from source paper

Q224 AIEEE 2011 MCQ

For $x \in \left(0, \frac{5\pi}{2}\right)$, define $f(x) = \int_0^x \sqrt{t} \sin t \, dt$. Then f has

(A) local minimum at π and 2π
(B) local minimum at π and local maximum at 2π
(C) local maximum at π and local minimum at 2π
(D) local maximum at π and 2π

Answer: (C) local maximum at π and local minimum at 2π · Key from source paper

Q225 AIEEE 2010 MCQ

The equation of the tangent to the curve $y = x + \frac{4}{x^2}$, that is parallel to the x-axis, is

(A) $y = 1$
(B) $y = 2$
(C) $y = 3$
(D) $y = 0$

Answer: (C) $y = 3$ · Key from source paper

Q226 AIEEE 2010 MCQ

Let $f : R \to R$ be defined by $f(x) = \begin{cases} k - 2x, & \text{if } x \leq -1 \\ 2x + 3, & \text{if } x > -1 \end{cases}$. If f has a local minimum at $x = -1$, then a possible value of k is

(A) 0
(B) $-\frac{1}{2}$
(C) -1
(D) 1

Answer: (C) -1 · Key from source paper

Q227 AIEEE 2009 MCQ

Given $P(x) = x^4 + ax^3 + bx^2 + cx + d$ such that $x = 0$ is the only real root of $P'(x) = 0$. If $P(-1) < P(1)$, then in the interval $[-1, 1]$

(A) $P(-1)$ is the minimum and $P(1)$ is the maximum of P
(B) $P(-1)$ is not minimum but $P(1)$ is the maximum of P
(C) $P(-1)$ is the minimum and $P(1)$ is not the maximum of P
(D) neither $P(-1)$ is the minimum nor $P(1)$ is the maximum of P

Answer: (B) $P(-1)$ is not minimum but $P(1)$ is the maximum of P · Key from source paper

Q228 AIEEE 2009 MCQ

The shortest distance between the line y − x = 1 and the curve x = y^2 is

(A) $\frac{3\sqrt{2}}{8}$
(B) $\frac{2\sqrt{3}}{8}$
(C) $\frac{3\sqrt{2}}{5}$
(D) $\frac{\sqrt{3}}{4}$

Answer: (A) $\frac{3\sqrt{2}}{8}$ · Key from source paper

Q229 AIEEE 2008 MCQ

Suppose the cube $x^3 - px + q$ has three distinct real roots where $p > 0$ and $q > 0$. Then which one of the following holds?

(A) The cubic has minima at $\sqrt{\frac{p}{3}}$ and maxima at $-\sqrt{\frac{p}{3}}$
(B) The cubic has minima at $-\sqrt{\frac{p}{3}}$ and maxima at $\sqrt{\frac{p}{3}}$
(C) The cubic has minima at both $\sqrt{\frac{p}{3}}$ and $-\sqrt{\frac{p}{3}}$
(D) The cubic has maxima at both $\sqrt{\frac{p}{3}}$ and $-\sqrt{\frac{p}{3}}$

Answer: (A) The cubic has minima at $\sqrt{\frac{p}{3}}$ and maxima at $-\sqrt{\frac{p}{3}}$ · Key from source paper

Q230 AIEEE 2007 MCQ

The function $f(x) = \tan^{-1}(\sin x + \cos x)$ is an increasing function in

(A) $\left(\frac{\pi}{4}, \frac{\pi}{2}\right)$
(B) $\left(-\frac{\pi}{2}, \frac{\pi}{4}\right)$
(C) $\left(0, \frac{\pi}{2}\right)$
(D) $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

Answer: (B) $\left(-\frac{\pi}{2}, \frac{\pi}{4}\right)$ · Key from source paper

Q231 AIEEE 2006 MCQ

Angle between the tangents to the curve $y = x^2 - 5x + 6$ at the points $(2, 0)$ and $(3, 0)$ is

(A) $\frac{\pi}{3}$
(B) $\frac{\pi}{2}$
(C) $\frac{\pi}{6}$
(D) $\frac{\pi}{4}$

Answer: (B) $\frac{\pi}{2}$ · Key from source paper

Q232 AIEEE 2006 MCQ

A triangular park is enclosed on two sides by a fence and on the third side by a straight river bank. The two sides having fence are of same length x. The maximum area enclosed by the park is

(A) $\frac{3}{2}x^2$
(B) $\sqrt{\frac{x^3}{8}}$
(C) $\frac{1}{2}x^2$
(D) πx^2

Answer: (C) $\frac{1}{2}x^2$ · Key from source paper

Q233 AIEEE 2006 MCQ

The function $f(x) = \frac{x}{2} + \frac{2}{x}$ has a local minimum at

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

Answer: (A) x = 2 · Key from source paper

Q234 AIEEE 2005 MCQ

Area of the greatest rectangle that can be inscribed in the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is

(A) $2ab$
(B) ab
(C) $3ab$
(D) $\frac{a}{b}$

Answer: (A) $2ab$ · Key from source paper

Q235 AIEEE 2005 MCQ

A function is matched below against an interval where it is supposed to be increasing. Which of the following pairs is incorrectly matched? $Interval \rightarrow Function$

(A) $(-\infty, \infty) \rightarrow x^3 - 3x^2 + 3x + 3$
(B) $[2, \infty) \rightarrow 2x^3 - 3x^2 - 12x + 6$
(C) $\left(-\infty, \frac{1}{3}\right] \rightarrow \ 3x^2 - 2x + 1$
(D) $(-\infty, -4] \rightarrow x^3 + 6x^2 + 6$

Answer: (C) $\left(-\infty, \frac{1}{3}\right] \rightarrow \ 3x^2 - 2x + 1$ · Key from source paper

Q236 AIEEE 2005 MCQ

A spherical iron ball $10\ \mathrm{cm}$ in radius is coated with a layer of ice of uniform thickness than melts at a rate of $50\ \mathrm{cm}^3/\mathrm{min}$. When the thickness of ice is $5\ \mathrm{cm}$, then the rate at which the thickness of ice decreases, is

(A) $\frac{1}{36\pi}\mathrm{cm/min}$
(B) $\frac{1}{18\pi}\mathrm{cm/min}$
(C) $\frac{1}{54\pi}\mathrm{cm/min}$
(D) $\frac{5}{6\pi}\mathrm{cm/min}$

Answer: (B) $\frac{1}{18\pi}\mathrm{cm/min}$ · Key from source paper

Q237 AIEEE 2004 MCQ

A point on the parabola $y^2 = 18x$ at which the ordinate increases at twice the rate of the abscissa is

(A) $(2, 4)$
(B) $(2, -4)$
(C) $\left(\frac{-9}{8}, \frac{9}{2}\right)$
(D) $\left(\frac{9}{8}, \frac{9}{2}\right)$

Answer: (D) $\left(\frac{9}{8}, \frac{9}{2}\right)$ · Key from source paper

Q238 AIEEE 2004 MCQ

The normal to the curve $x = a(1 + \cos\theta)$, $y = a\sin\theta$ at ' θ ' always passes through the fixed point

(A) $(a, 0)$
(B) $(0, a)$
(C) $(0, 0)$
(D) (a, a)

Answer: (A) $(a, 0)$ · Key from source paper

Q239 AIEEE 2003 MCQ

If the function $\mathrm{f(x)} = 2\mathrm{x}^3 - 9a\mathrm{x}^2 + 12\mathrm{a}^2\mathrm{x} + 1$, where a > 0, attains its maximum and minimum at p and q respectively such that $\mathrm{p}^2 = \mathrm{q}$, then a equals

(A) $\frac{1}{2}$
(B) 3
(C) 1
(D) 2

Answer: (D) 2 · Key from source paper

Q240 AIEEE 2003 MCQ

The real number x when added to its inverse gives the minimum value of the sum at x equal to

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

Answer: (C) 1 · Key from source paper

Q241 AIEEE 2002 MCQ

The maximum distance from origin of a point on the curve $x = a\sin t - b\sin\left(\frac{at}{b}\right)$ $y = a\cos t - b\cos\left(\frac{at}{b}\right)$, both $a, b > 0$ is

(A) a - b
(B) a + b
(C) $\sqrt{a^2 + b^2}$
(D) $\sqrt{a^2 - b^2}$

Answer: (B) a + b · Checked by our team

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