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MATHEMATICS · JEE MAIN

Differential Equations

Previous Year Questions with answers

255 questions · **191** papers · **2002–2026** · newest paper first

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What is in this PDF: every Differential Equations 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

4.6%
of Mathematics questions, 2019–2026

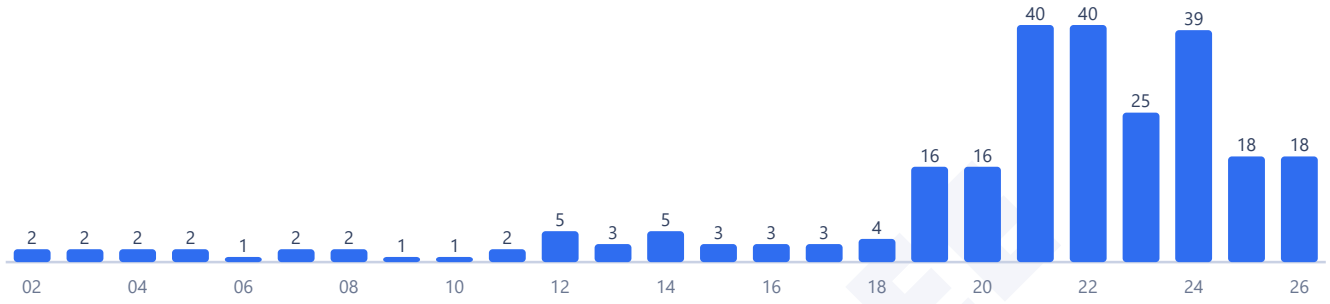
255
questions, 2002–2026

155 of 162
papers asked it, 2019–2026

205 / 50
MCQ / numerical, 2002–2026

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

Questions per year



Counts are the questions we hold: 255 in 191 papers. No question in this chapter was found repeated across papers.

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

First Order Equations	**226**
Basics & Formation	**18**
Applications	**11**

How often it comes up

Differential equations is a prominent calculus chapter under Unit 9: Differential Equations in the Class 12 curriculum, securing rank 8 among the 29 chapters in the subject. Between 2019 and 2026, the examination presented 212 questions from this chapter across 162 papers, representing 4.6 percent of all mathematics questions. It appeared in 155 of those 162 papers and has been tested every single year since 2019. Over the recent 2024 to 2026 test cycles, it accounted for 75 questions across 58 papers, averaging 1.3 questions per paper with a 4.8 percent subject share. Comparing its earlier 2002 to 2018 share of 3.3 percent against 2024 to 2026 reveals that its long-term share is up, while comparing 2019 to 2026 with 2024 to 2026 shows it is about the same. Across the complete archive from 2002 to 2026 spanning 200 papers, 255 questions were asked in 191 papers, including 50 numerical answer questions between 2019 and 2026.

In the 2024, 2025, and 2026 testing periods, the counts stood at 39, 18, and 18 questions respectively, highlighting its sustained prominence.

The overwhelming majority of problems require solving a first-order differential equation subject to an initial value condition, followed by evaluating the resulting particular solution at a specified coordinate. Because these questions end in a concrete numerical value, they frequently appear in the numerical response section.

Most-asked topics

Questions in this chapter are concentrated heavily within a single primary subtopic:

1. **First Order Equations (197 questions, 2019-2026; 226 total, last asked 2026)** The vast majority of questions fall here. The dominant mathematical forms are linear differential equations solved via integrating factors, homogeneous equations resolved by substituting y equals vx, separable equations, and exact differential forms where groups of terms collapse into total differentials.

2. **Applications (8 questions, 2019-2026; 11 total, last asked 2024)** Focuses on geometric curves whose tangents or normals possess specified coordinate intercept properties, or physical rates of growth, decay, and cooling. Formation of differential equations from geometric descriptions was recently curtailed.

3. **Basics & Formation (7 questions, 2019-2026; 18 total, last asked 2024)** Deals with finding the order and degree of given equations, eliminating arbitrary constants to formulate family equations, and verifying given solutions. Note that the formation of differential equations was explicitly excised in recent syllabus updates.

What the questions look like

Examiners repeatedly use well-defined structures when composing problems:

- **First-Order Linear Form in y or x**: An equation presented in standard or disguised linear format where finding the integrating factor e to the power of the integral of P resolves the general solution. In several problems, swapping the roles of dependent and independent variables to form dx over dy linear in x provides the only viable path.
- **Total Differential Recognition**: Expressions containing combinations like x dy plus y dx, or x dy minus y dx divided by x squared or x squared plus y squared, which can be integrated immediately by inspection as exact differentials.
- **Homogeneous Substitution**: Differential equations where terms share uniform polynomial degree, solvable by setting y equal to vx and separating variables in v and x.
- **Initial Value Followed by Functional Evaluation**: Given dy over dx with an initial condition like y of one equals zero, solve for the particular solution and evaluate the functional value or local extrema of the resulting curve.

How to practise it

Solving differential equations efficiently requires swift identification of the underlying type:

- **Check for linear form first**: Look for single occurrences of y and dy over dx. If both appear linearly, divide by the coefficient of the derivative to put the equation in standard form and compute the integrating factor. If y appears in higher powers while x appears linearly, test whether dx over dy is linear in x.
- **Spot exact differentials**: Train your eye to recognize groupings such as d of xy, d of y over x, or d of the square root of x squared plus y squared. Grouping these terms on one side allows immediate integration without formal substitution.
- **Substitute boundary conditions immediately**: Determine the constant of integration as soon as the general solution is obtained, prior to attempting any algebraic rearrangement of the curve equation.
- **Watch out for integrating factor traps**: When computing the integrating factor, ensure that minus signs or numerical constants multiplying the integral are brought into the exponent as logarithms before cancelling the exponential base.

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Q1 JEE Main 2026 · 8 Apr · Shift 2 MCQ

Let $y = y(x)$ be the solution of the differential equation

$x\sqrt{1-x^2}\,dy + \left(y\sqrt{1-x^2} - x\cos^{-1}x\right)dx = 0$, $x \in (0,1)$, $\lim_{x\to 1^-} y(x) = 1$. Then $y\left(\frac{1}{2}\right)$ equals :

(A) $3 - \frac{\pi}{\sqrt{3}}$

(B) $4 - \sqrt{3}\pi$

(C) $4 - \frac{2\pi}{\sqrt{3}}$

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

Answer: (A) $3 - \frac{\pi}{\sqrt{3}}$ · Official NTA final key

Q2 JEE Main 2026 · 6 Apr · Shift 1 Numerical

Let $y = y(x)$ be the solution of the differential equation

$\left(x^2 - x\sqrt{x^2-1}\right)dy + \left(y\left(x - \sqrt{x^2-1}\right) - x\right)dx = 0$, $x \geq 1$. If $y(1) = 1$, then the greatest integer less than $y(\sqrt{5})$ is _____.

Numerical value type: the answer is a number.

Answer: 3. · Official NTA final key

Q3 JEE Main 2026 · 5 Apr · Shift 1 Numerical

Let $y = y(x)$ be the solution of the differential equation

$x\sin\left(\frac{y}{x}\right)dy = \left(y\sin\left(\frac{y}{x}\right) - x\right)dx$, $y(1) = \frac{\pi}{2}$ and let $\alpha = \cos\left(\frac{y(e^{12})}{e^{12}}\right)$. Then the number of integral value of p, for which the equation $x^2 + y^2 - 2px + 2py + \alpha + 2 = 0$ represents a circle of radius $r \leq 6$, is _____.

Numerical value type: the answer is a number.

Any attempt was accepted. Full marks for attempting. · Official NTA final key

Q4 JEE Main 2026 · 5 Apr · Shift 2 Numerical

Let $y = y(x)$ be the solution of the differential equation

$(\tan x)^{1/2}\,dy = \left(\sec^3 x - (\tan x)^{3/2}\,y\right)dx$, $0 < x < \frac{\pi}{2}$, $y\left(\frac{\pi}{4}\right) = \frac{6\sqrt{2}}{5}$. If $y\left(\frac{\pi}{3}\right) = \frac{4}{5}\alpha$, then α^4 equals _____.

Numerical value type: the answer is a number.

Answer: 48. · Official NTA final key

Q5 JEE Main 2026 · 4 Apr · Shift 1 MCQ

Let $y = y(x)$ be the solution of the differential equation $\frac{dy}{dx} = \left(1 + x + x^2\right)\left(1 - y + y^2\right)$, $y(0) = \frac{1}{2}$. Then $(2y(1) - 1)$ is equal to

(A) $\sqrt{3}\tan\left(\frac{11\sqrt{3}}{6}\right)$

(B) $\frac{\sqrt{3}}{2}\tan\left(\frac{11\sqrt{3}}{12}\right)$

(C) $\sqrt{3}\tan\left(\frac{11\sqrt{3}}{12}\right)$

(D) $\frac{\sqrt{3}}{2}\tan\left(\frac{11\sqrt{3}}{6}\right)$

Answer: (C) $\sqrt{3}\tan\left(\frac{11\sqrt{3}}{12}\right)$ · Official NTA final key

Q6 JEE Main 2026 · 4 Apr · Shift 2 MCQ

Let $y = y(x)$ be the solution of the differential equation:

$\frac{dy}{dx} + \left(\frac{6x^2 + \left(3x^2 + 2x^3 + 4\right)e^{-2x}}{(x^3+2)(2+e^{-2x})}\right) y = 2 + e^{-2x}$,

$x \in (-1, 2)$, satisfying $y(0) = \frac{3}{2}$. If $y(1) = \alpha\left(2 + e^{-2}\right)$, then α is equal to:

(A) $\frac{13}{8}$

(B) $\frac{6}{13}$

(C) $\frac{12}{13}$

(D) $\frac{13}{12}$

Answer: (D) $\frac{13}{12}$ · Official NTA final key

Q7 JEE Main 2026 · 2 Apr · Shift 1 MCQ

If the curve $y = f(x)$ passes through the point $(1, \mathrm{e})$ and satisfies the differential equation $dy = y\left(2 + \log_e x\right)dx$, $x > 0$, then $f(\mathrm{e})$ is equal to :

(A) e^{e}

(B) $\mathrm{e}^{\mathrm{e}^2}$

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

(D) $\mathrm{e}^{2^{\mathrm{e}}}$

Answer: (C) $\mathrm{e}^{2\mathrm{e}}$ · Official NTA final key

Q8 JEE Main 2026 · 2 Apr · Shift 1 MCQ

Let $y = y(x)$ be the solution curve of the differential equation $(1 + \sin x)\frac{dy}{dx} + (y + 1)\cos x = 0$, $y(0) = 0$. If the curve $y = y(x)$ passes through the point $\left(\alpha, \frac{-1}{2}\right)$, then a value of α is :

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

Answer: (D) $\frac{\pi}{2}$ · Official NTA final key

Q9 JEE Main 2026 · 2 Apr · Shift 2 MCQ

Let $x = x(y)$ be the solution of the differential equation $2y^2\frac{dx}{dy} - 2xy + x^2 = 0$, $y > 1$, $x(\mathrm{e}) = \mathrm{e}$. Then $x(\mathrm{e}^2)$ is equal to :

(A) $\frac{3}{2}\mathrm{e}^2$
(B) $\frac{2}{3}\mathrm{e}^2$
(C) e^2
(D) $2\mathrm{e}^2$

Answer: (B) $\frac{2}{3}\mathrm{e}^2$ · Official NTA final key

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Q10 JEE Main 2026 · 28 Jan · Shift 1 MCQ

Let $y = y(x)$ be the solution of the differential equation

$$x\frac{dy}{dx} - \sin 2y = x^3\left(2 - x^3\right)\cos^2 y,\ x \neq 0.$$

If $y(2) = 0$, then $\tan(y(1))$ is equal to

(A) $\frac{3}{4}$
(B) $-\frac{3}{4}$
(C) $\frac{7}{4}$
(D) $-\frac{7}{4}$

Answer: (C) $\frac{7}{4}$ · Official NTA final key

Q11 JEE Main 2026 · 28 Jan · Shift 2 MCQ

Let $y = y(x)$ be the solution of the differential equation $x\frac{dy}{dx} - y = x^2\cot x$, $x \in (0, \pi)$. If $y\left(\frac{\pi}{2}\right) = \frac{\pi}{2}$, then $6y\left(\frac{\pi}{6}\right) - 8y\left(\frac{\pi}{4}\right)$ is equal to :

(A) 3π
(B) -3π
(C) π
(D) $-\pi$

Answer: (D) $-\pi$ · Official NTA final key

Q12 JEE Main 2026 · 24 Jan · Shift 2 MCQ

Let $y = y(x)$ be a differentiable function in the interval $(0, \infty)$ such that $y(1) = 2$, and $\lim\limits_{t \to x} \left(\dfrac{t^2 y(x) - x^2 y(t)}{x - t} \right) = 3$ for each $x > 0$. Then $2y(2)$ is equal to

(A) 23
(B) 12
(C) 18
(D) 27

Answer: (A) 23 · Official NTA final key

Q13 JEE Main 2026 · 23 Jan · Shift 1 MCQ

Let $y = y(x)$ be the solution of the differential equation $x^4 dy + (4x^3 y + 2\sin x) dx = 0$, $x > 0$, $y\left(\dfrac{\pi}{2}\right) = 0$. Then $\pi^4 y\left(\dfrac{\pi}{3}\right)$ is equal to :

(A) 92
(B) 81
(C) 72
(D) 64

Answer: (B) 81 · Official NTA final key

Q14 JEE Main 2026 · 23 Jan · Shift 2 Numerical

If the solution curve $y = f(x)$ of the differential equation $(x^2 - 4)y' - 2xy + 2x(4 - x^2)^2 = 0$, $x > 2$, passes through the point $(3, 15)$, then the local maximum value of f is _____.

Numerical value type: the answer is a number.

Answer: 16. · Official NTA final key

Q15 JEE Main 2026 · 22 Jan · Shift 1 MCQ

Let the solution curve of the differential equation $x\,dy - y\,dx = \sqrt{x^2 + y^2}\,dx$, $x > 0$, $y(1) = 0$, be $y = y(x)$. Then $y(3)$ is equal to

(A) 4
(B) 2
(C) 1
(D) 6

Answer: (A) 4 · Official NTA final key

Q16 JEE Main 2026 · 22 Jan · Shift 2 MCQ

If $y = y(x)$ satisfies the differential equation

$16\left(\sqrt{x+9\sqrt{x}}\right)\left(4+\sqrt{9+\sqrt{x}}\right)\cos y\,dy=(1+2\sin y)dx$, $x>0$ and $y(256)=\frac{\pi}{2}$, $y(49)=\alpha$, then $2\sin\alpha$ is equal to :

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

Dropped by NTA. Full marks to everyone. · Official NTA final key

Q17 JEE Main 2026 · 21 Jan · Shift 1 MCQ

Let $y=y(x)$ be the solution curve of the differential equation $(1+x^2)\,dy+(y-\tan^{-1}x)\,dx=0$, $y(0)=1$. Then the value of $y(1)$ is :

(A) $\frac{4}{e^{\pi/4}}-\frac{\pi}{2}-1$
(B) $\frac{2}{e^{\pi/4}}+\frac{\pi}{4}-1$
(C) $\frac{2}{e^{\pi/4}}-\frac{\pi}{4}-1$
(D) $\frac{4}{e^{\pi/4}}+\frac{\pi}{2}-1$

Answer: (B) $\frac{2}{e^{\pi/4}}+\frac{\pi}{4}-1$ · Official NTA final key

Q18 JEE Main 2026 · 21 Jan · Shift 2 MCQ

Let $y=y(x)$ be the solution of the differential equation $\sec x\frac{dy}{dx}-2y=2+3\sin x$, $x\in\left(-\frac{\pi}{2},\frac{\pi}{2}\right)$, $y(0)=-\frac{7}{4}$. Then $y\left(\frac{\pi}{6}\right)$ is equal to :

(A) $-\frac{5}{2}$
(B) $-\frac{5}{4}$
(C) $-3\sqrt{2}-7$
(D) $-3\sqrt{3}-7$

Answer: (A) $-\frac{5}{2}$ · Official NTA final key

Q19 JEE Main 2025 · 8 Apr · Shift 2 MCQ

Let $f(x)=x-1$ and $g(x)=e^x$ for $x\in\mathbb{R}$. If $\frac{dy}{dx}=\left(e^{-2\sqrt{x}}g(f(f(x)))-\frac{y}{\sqrt{x}}\right)$, $y(0)=0$, then $y(1)$ is

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

Answer: (B) $\frac{e-1}{e^4}$ · Key from source paper

Q20 JEE Main 2025 · 7 Apr · Shift 1 MCQ

Let $y = y(x)$ be the solution curve of the differential equation $x\left(x^2 + e^x\right)dy + \left(e^x(x-2)y - x^3\right)dx = 0, x > 0$, passing through the point $(1, 0)$. Then $y(2)$ is equal to

(A) $\frac{4}{4+e^2}$
(B) $\frac{2}{2+e^2}$
(C) $\frac{2}{2-e^2}$
(D) $\frac{4}{4-e^2}$

Answer: (A) $\frac{4}{4+e^2}$ · Key from source paper

Q21 JEE Main 2025 · 7 Apr · Shift 2 MCQ

Let $y = y(x)$ be the solution of the differential equation $\left(x^2+1\right)y' - 2xy = \left(x^4 + 2x^2 + 1\right)\cos x$, $y(0) = 1$. Then $\int_{-3}^{3} y(x)dx$ is :

(A) 24
(B) 30
(C) 18
(D) 36

Answer: (A) 24 · Key from source paper

Q22 JEE Main 2025 · 4 Apr · Shift 2 MCQ

If a curve $y = y(x)$ passes through the point $\left(1, \frac{\pi}{2}\right)$ and satisfies the differential equation $\left(7x^4 \cot y - e^x \operatorname{cosec} y\right)\frac{dx}{dy} = x^5, x \geq 1$, then at $x = 2$, the value of $\cos y$ is :

(A) $\frac{2e^2-e}{128}$
(B) $\frac{2e^2-e}{64}$
(C) $\frac{2e^2+e}{128}$
(D) $\frac{2e^2+e}{64}$

Answer: (A) $\frac{2e^2-e}{128}$ · Key from source paper

Q23 JEE Main 2025 · 3 Apr · Shift 1 MCQ

Let g be a differentiable function such that $\int_0^x g(t)dt = x - \int_0^x tg(t)dt, x \geq 0$ and let $y = y(x)$ satisfy the differential equation $\frac{dy}{dx} - y\tan x = 2(x+1)\sec x\, g(x), x \in \left[0, \frac{\pi}{2}\right)$. If $y(0) = 0$, then $y\left(\frac{\pi}{3}\right)$ is equal to

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

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

Q24 JEE Main 2025 · 3 Apr · Shift 2 MCQ

Let $y = y(x)$ be the solution of the differential equation

$\frac{dy}{dx} + 3\left(\tan^2 x\right) y + 3y = \sec^2 x, y(0) = \frac{1}{3} + e^3$. Then $y\left(\frac{\pi}{4}\right)$ is equal to

(A) $\frac{2}{3}$
(B) $\frac{4}{3} + e^3$
(C) $\frac{4}{3}$
(D) $\frac{2}{3} + e^3$

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

Q25 JEE Main 2025 · 2 Apr · Shift 2 Numerical

Let $y = y(x)$ be the solution of the differential equation $\frac{dy}{dx} + 2y\sec^2 x = 2\sec^2 x + 3\tan x \cdot \sec^2 x$ such that $y(0) = \frac{5}{4}$. Then $12\left(y\left(\frac{\pi}{4}\right) - e^{-2}\right)$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 21. · Key from source paper

Q26 JEE Main 2025 · 29 Jan · Shift 1 MCQ

Let $y = y(x)$ be the solution of the differential equation $\cos x(\log_e(\cos x))^2 dy + (\sin x - 3y\sin x \log_e(\cos x))dx = 0, x \in \left(0, \frac{\pi}{2}\right)$. If $y\left(\frac{\pi}{4}\right) = \frac{-1}{\log_e 2}$, then $y\left(\frac{\pi}{6}\right)$ is equal to :

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

Answer: (A) $\frac{1}{\log_e(3) - \log_e(4)}$ · Key from source paper

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Q27 JEE Main 2025 · 29 Jan · Shift 2 MCQ

If for the solution curve $y = f(x)$ of the differential equation $\frac{dy}{dx} + (\tan x)y = \frac{2 + \sec x}{(1 + 2\sec x)^2}, x \in \left(\frac{-\pi}{2}, \frac{\pi}{2}\right), f\left(\frac{\pi}{3}\right) = \frac{\sqrt{3}}{10}$, then $f\left(\frac{\pi}{4}\right)$ is equal to :

(A) $\frac{\sqrt{3}+1}{10(4+\sqrt{3})}$
(B) $\frac{5-\sqrt{3}}{2\sqrt{2}}$
(C) $\frac{9\sqrt{3}+3}{10(4+\sqrt{3})}$
(D) $\frac{4-\sqrt{2}}{14}$

Answer: (D) $\frac{4-\sqrt{2}}{14}$ · Key from source paper

Q28 JEE Main 2025 · 28 Jan · Shift 2 Numerical

If $y = y(x)$ is the solution of the differential equation, $\sqrt{4-x^2}\frac{dy}{dx} = \left(\left(\sin^{-1}\left(\frac{x}{2}\right)\right)^2 - y\right)\sin^{-1}\left(\frac{x}{2}\right)$, $-2 \le x \le 2$, $y(2) = \frac{\pi^2-8}{4}$, then $y^2(0)$ is equal to _____ .

Numerical value type: the answer is a number.

Answer: 4. · Key from source paper

Q29 JEE Main 2025 · 24 Jan · Shift 1 MCQ

Let y = y(x) be the solution of the differential equation $\left(xy - 5x^2\sqrt{1+x^2}\right)dx + (1+x^2)dy = 0$, $y(0) = 0$. Then $y(\sqrt{3})$ is equal to

(A) $\sqrt{\frac{15}{2}}$
(B) $\frac{5\sqrt{3}}{2}$
(C) $2\sqrt{2}$
(D) $\sqrt{\frac{14}{3}}$

Answer: (B) $\frac{5\sqrt{3}}{2}$ · Key from source paper

Q30 JEE Main 2025 · 24 Jan · Shift 2 MCQ

Let $f : (0, \infty) \to \mathbf{R}$ be a function which is differentiable at all points of its domain and satisfies the condition $x^2 f'(x) = 2xf(x) + 3$, with $f(1) = 4$. Then $2f(2)$ is equal to :

(A) 39
(B) 19
(C) 29
(D) 23

Answer: (A) 39 · Key from source paper

Q31 JEE Main 2025 · 24 Jan · Shift 2 Numerical

Let $y = y(x)$ be the solution of the differential equation $2\cos x \frac{dy}{dx} = \sin 2x - 4y\sin x$, $x \in \left(0, \frac{\pi}{2}\right)$. If $y\left(\frac{\pi}{3}\right) = 0$, then $y'\left(\frac{\pi}{4}\right) + y\left(\frac{\pi}{4}\right)$ is equal to _____ .

Numerical value type: the answer is a number.

Answer: 1. · Key from source paper

Q32 JEE Main 2025 · 23 Jan · Shift 1 MCQ

Let a curve $y = f(x)$ pass through the points $(0, 5)$ and $(\log_e 2, k)$. If the curve satisfies the differential equation $2(3 + y)e^{2x}dx - \left(7 + e^{2x}\right) dy = 0$, then k is equal to

(A) 4
(B) 32
(C) 8
(D) 16

Answer: (C) 8 · Key from source paper

Q33 JEE Main 2025 · 23 Jan · Shift 2 MCQ

Let $x = x(y)$ be the solution of the differential equation $y = \left(x - y\frac{dx}{dy}\right) \sin\left(\frac{x}{y}\right)$, $y > 0$ and $x(1) = \frac{\pi}{2}$. Then $\cos(x(2))$ is equal to :

(A) $1 - 2\left(\log_e 2\right)^2$
(B) $1 - 2\left(\log_e 2\right)$
(C) $2\left(\log_e 2\right) - 1$
(D) $2\left(\log_e 2\right)^2 - 1$

Answer: (D) $2\left(\log_e 2\right)^2 - 1$ · Key from source paper

Q34 JEE Main 2025 · 22 Jan · Shift 1 MCQ

Let $x = x(y)$ be the solution of the differential equation $y^2\,dx + \left(x - \frac{1}{y}\right) dy = 0$. If $x(1) = 1$, then $x\left(\frac{1}{2}\right)$ is :

(A) $\frac{1}{2} + \mathrm{e}$
(B) $3 + \mathrm{e}$
(C) $3 - e$
(D) $\frac{3}{2} + e$

Answer: (C) $3 - e$ · Key from source paper

Q35 JEE Main 2025 · 22 Jan · Shift 2 MCQ

If $x = f(y)$ is the solution of the differential equation $(1 + y^2) + \left(x - 2\mathrm{e}^{\tan^{-1} y}\right) \frac{\mathrm{dy}}{\mathrm{dx}} = 0$, $y \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ with $f(0) = 1$, then $f\left(\frac{1}{\sqrt{3}}\right)$ is equal to :

(A) $e^{\pi/12}$

(B) $e^{\pi/4}$

(C) $e^{\pi/3}$

(D) $e^{\pi/6}$

Answer: (D) $e^{\pi/6}$ · Key from source paper

Q36 JEE Main 2025 · 22 Jan · Shift 2 Numerical

Let $y = f(x)$ be the solution of the differential equation $\frac{dy}{dx} + \frac{xy}{x^2-1} = \frac{x^6+4x}{\sqrt{1-x^2}}$, $-1 < x < 1$ such that $f(0) = 0$. If $6\int_{-1/2}^{1/2} f(x)\mathrm{d}x = 2\pi - \alpha$ then α^2 is equal to _____ .

Numerical value type: the answer is a number.

Answer: 27. · Key from source paper

Q37 JEE Main 2024 · 9 Apr · Shift 1 MCQ

The solution curve, of the differential equation $2y\frac{\mathrm{dy}}{\mathrm{dx}} + 3 = 5\frac{\mathrm{dy}}{\mathrm{dx}}$, passing through the point $(0, 1)$ is a conic, whose vertex lies on the line:

(A) $2x + 3y = 9$

(B) $2x + 3y = -9$

(C) $2x + 3y = -6$

(D) $2x + 3y = 6$

Answer: (A) $2x + 3y = 9$ · Key from source paper

Q38 JEE Main 2024 · 9 Apr · Shift 1 MCQ

The solution of the differential equation $(x^2 + y^2)\mathrm{dx} - 5xy\,\mathrm{dy} = 0$, $y(1) = 0$, is :

(A) $|x^2 - 2y^2|^6 = x$

(B) $|x^2 - 4y^2|^6 = x$

(C) $|x^2 - 4y^2|^5 = x^2$

(D) $|x^2 - 2y^2|^5 = x^2$

Answer: (C) $|x^2 - 4y^2|^5 = x^2$ · Key from source paper

Q39 JEE Main 2024 · 9 Apr · Shift 2 Numerical

For a differentiable function $f : \mathbb{R} \to \mathbb{R}$, suppose $f'(x) = 3f(x) + \alpha$, where $\alpha \in \mathbb{R}$, $f(0) = 1$ and $\lim_{x\to-\infty} f(x) = 7$. Then $9f(-\log_e 3)$ is equal to _____

Numerical value type: the answer is a number.

Answer: 61. · Key from source paper

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Q40 JEE Main 2024 · 8 Apr · Shift 1 MCQ

Let $f(x)$ be a positive function such that the area bounded by $y = f(x), y = 0$ from $x = 0$ to $x = a > 0$ is $e^{-a} + 4a^2 + a - 1$. Then the differential equation, whose general solution is $y = c_1 f(x) + c_2$, where c_1 and c_2 are arbitrary constants, is

(A) $(8e^x - 1)\frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$
(B) $(8e^x - 1)\frac{d^2y}{dx^2} - \frac{dy}{dx} = 0$
(C) $(8e^x + 1)\frac{d^2y}{dx^2} - \frac{dy}{dx} = 0$
(D) $(8e^x + 1)\frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$

Answer: (D) $(8e^x + 1)\frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$ · Key from source paper

Q41 JEE Main 2024 · 8 Apr · Shift 1 MCQ

Let $y = y(x)$ be the solution of the differential equation $(1 + y^2)e^{\tan x}dx + \cos^2 x\left(1 + e^{2\tan x}\right)dy = 0, y(0) = 1$. Then $y\left(\frac{\pi}{4}\right)$ is equal to

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

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

Q42 JEE Main 2024 · 8 Apr · Shift 2 MCQ

Let $y = y(x)$ be the solution curve of the differential equation $\sec y\frac{dy}{dx} + 2x\sin y = x^3\cos y, y(1) = 0$. Then $y(\sqrt{3})$ is equal to :

(A) $\frac{\pi}{3}$
(B) $\frac{\pi}{6}$
(C) $\frac{\pi}{12}$
(D) $\frac{\pi}{4}$

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

Q43 JEE Main 2024 · 8 Apr · Shift 2 Numerical

Let $\alpha|x| = |y|e^{xy-\beta}, \alpha, \beta \in \mathbf{N}$ be the solution of the differential equation $x\,dy - y\,dx + xy(x\,dy + y\,dx) = 0, y(1) = 2$. Then $\alpha + \beta$ is equal to _____

Numerical value type: the answer is a number.

Answer: 4. · Key from source paper

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Q44 JEE Main 2024 · 6 Apr · Shift 1 MCQ

Let $y = y(x)$ be the solution of the differential equation $(1+x^2)\frac{dy}{dx} + y = e^{\tan^{-1}x}$, $y(1) = 0$. Then $y(0)$ is

(A) $\frac{1}{2}\left(e^{\pi/2} - 1\right)$
(B) $\frac{1}{2}\left(1 - e^{\pi/2}\right)$
(C) $\frac{1}{4}\left(1 - e^{\pi/2}\right)$
(D) $\frac{1}{4}\left(e^{\pi/2} - 1\right)$

Answer: (B) $\frac{1}{2}\left(1 - e^{\pi/2}\right)$ · Key from source paper

Q45 JEE Main 2024 · 6 Apr · Shift 1 MCQ

Let $y = y(x)$ be the solution of the differential equation $(2x\log_e x)\frac{dy}{dx} + 2y = \frac{3}{x}\log_e x$, $x > 0$ and $y\left(e^{-1}\right) = 0$. Then, $y(e)$ is equal to

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

Answer: (A) $-\frac{3}{e}$ · Key from source paper

Q46 JEE Main 2024 · 6 Apr · Shift 1 Numerical

Let a conic C pass through the point $(4, -2)$ and $P(x, y)$, $x \geq 3$, be any point on C. Let the slope of the line touching the conic C only at a single point P be half the slope of the line joining the points P and $(3, -5)$. If the focal distance of the point $(7, 1)$ on C is d, then $12d$ equals _____

Numerical value type: the answer is a number.

Answer: 75. · Key from source paper

Q47 JEE Main 2024 · 6 Apr · Shift 2 MCQ

Suppose the solution of the differential equation $\frac{dy}{dx} = \frac{(2+\alpha)x - \beta y + 2}{\beta x - 2\alpha y - (\beta\gamma - 4\alpha)}$ represents a circle passing through origin. Then the radius of this circle is :

(A) 2
(B) $\sqrt{17}$
(C) $\frac{1}{2}$
(D) $\frac{\sqrt{17}}{2}$

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

Q48 JEE Main 2024 · 6 Apr · Shift 2 Numerical

If the solution $y(x)$ of the given differential equation $(e^y + 1)\cos x\, dx + e^y \sin x\, dy = 0$ passes through the point $(\frac{\pi}{2}, 0)$, then the value of $e^{y(\frac{\pi}{6})}$ is equal to _____

Numerical value type: the answer is a number.

Answer: 3. · Key from source paper

Q49 JEE Main 2024 · 5 Apr · Shift 1 MCQ

If $y = y(x)$ is the solution of the differential equation $\frac{dy}{dx} + 2y = \sin(2x), y(0) = \frac{3}{4}$, then $y\left(\frac{\pi}{8}\right)$ is equal to:

(A) $e^{\pi/8}$

(B) $e^{\pi/4}$

(C) $e^{-\pi/4}$

(D) $e^{-\pi/8}$

Answer: (C) $e^{-\pi/4}$ · Key from source paper

Q50 JEE Main 2024 · 5 Apr · Shift 1 Numerical

Let f be a differentiable function in the interval $(0, \infty)$ such that $f(1) = 1$ and $\lim_{t \to x} \frac{t^2 f(x) - x^2 f(t)}{t - x} = 1$ for each $x > 0$. Then $2f(2) + 3f(3)$ is equal to _____

Numerical value type: the answer is a number.

Answer: 24. · Key from source paper

Q51 JEE Main 2024 · 5 Apr · Shift 2 MCQ

The differential equation of the family of circles passing through the origin and having centre at the line $y = x$ is :

(A) $(x^2 - y^2 + 2xy)\, dx = (x^2 - y^2 - 2xy)\, dy$

(B) $(x^2 + y^2 + 2xy)\, dx = (x^2 + y^2 - 2xy)\, dy$

(C) $(x^2 + y^2 - 2xy)\, dx = (x^2 + y^2 + 2xy)\, dy$

(D) $(x^2 - y^2 + 2xy)\, dx = (x^2 - y^2 + 2xy)\, dy$

Answer: (A) $(x^2 - y^2 + 2xy)\, dx = (x^2 - y^2 - 2xy)\, dy$ · Key from source paper

Q52 JEE Main 2024 · 5 Apr · Shift 2 Numerical

Let $y = y(x)$ be the solution of the differential equation $\frac{dy}{dx} + \frac{2x}{(1+x^2)^2} y = x e^{\frac{1}{(1+x^2)}}$; $y(0) = 0$. Then the area enclosed by the curve $f(x) = y(x) e^{-\frac{1}{(1+x^2)}}$ and the line $y - x = 4$ is _____

Numerical value type: the answer is a number.

Answer: 18. · Key from source paper

Q53 JEE Main 2024 · 4 Apr · Shift 1 MCQ

If the solution $y = y(x)$ of the differential equation $(x^4 + 2x^3 + 3x^2 + 2x + 2)dy - (2x^2 + 2x + 3)dx = 0$ satisfies $y(-1) = -\frac{\pi}{4}$, then $y(0)$ is equal to :

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

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

Q54 JEE Main 2024 · 4 Apr · Shift 1 Numerical

Let the solution $y = y(x)$ of the differential equation $\frac{dy}{dx} - y = 1 + 4\sin x$ satisfy $y(\pi) = 1$. Then $y\left(\frac{\pi}{2}\right) + 10$ is equal to _____

Numerical value type: the answer is a number.

Answer: 7. · Key from source paper

Q55 JEE Main 2024 · 4 Apr · Shift 2 MCQ

Let $y = y(x)$ be the solution of the differential equation $(x^2 + 4)^2 dy + (2x^3 y + 8xy - 2)dx = 0$. If $y(0) = 0$, then $y(2)$ is equal to

(A) $\frac{\pi}{32}$
(B) 2π
(C) $\frac{\pi}{8}$
(D) $\frac{\pi}{16}$

Answer: (A) $\frac{\pi}{32}$ · Key from source paper

Q56 JEE Main 2024 · 4 Apr · Shift 2 Numerical

Let $y = y(x)$ be the solution of the differential equation $(x + y + 2)^2 dx = dy$, $y(0) = -2$. Let the maximum and minimum values of the function $y = y(x)$ in $\left[0, \frac{\pi}{3}\right]$ be α and β, respectively. If $(3\alpha + \pi)^2 + \beta^2 = \gamma + \delta\sqrt{3}, \gamma, \delta \in \mathbb{Z}$, then $\gamma + \delta$ equals _____

Numerical value type: the answer is a number.

Answer: 31. · Key from source paper

Q57 JEE Main 2024 · 1 Feb · Shift 1 MCQ

Let $y = yx$ be the solution of the differential equation $\frac{dy}{dx} = 2xx + y^3 - xx + y - 1, y0 = 1$. Then, $\frac{1}{\sqrt{2}} + y\frac{1}{\sqrt{2}}^2$ equals:

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

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

Q58 JEE Main 2024 · 1 Feb · Shift 1 Numerical

If $x = xt$ is the solution of the differential equation $t + 1dx = 2x + t + 1^4dt, x0 = 2$, then $x1$ equals _____

Numerical value type: the answer is a number.

Answer: 14. · Key from source paper

Q59 JEE Main 2024 · 1 Feb · Shift 2 MCQ

Let α be a non-zero real number. Suppose $f : R \to R$ is a differentiable function such that $f0 = 1$ and $\lim_{x\to-\infty} fx = 1$. If $f'x = \alpha fx + 3$, for all $x \in R$, then $f - \log_e 2$ is equal to _____.

(A) 1
(B) 5
(C) 9
(D) 7

Answer: (A) 1 · Key from source paper

Q60 JEE Main 2024 · 1 Feb · Shift 2 Numerical

If $\frac{dx}{dy} = \frac{1+x-y^2}{y}$, $x1 = 1$, then $5x2$ is equal to:

Numerical value type: the answer is a number.

Answer: 5. · Key from source paper

Q61 JEE Main 2024 · 31 Jan · Shift 1 MCQ

The solution curve of the differential equation $y\frac{dx}{dy} = x\log_e x - \log_e y + 1$, $x > 0$, $y > 0$ passing through the point $(e, 1)$ is

(A) $\log_e \frac{y}{x} = x$
(B) $\log_e \frac{y}{x} = y^2$
(C) $\log_e \frac{x}{y} = y$
(D) $2\log_e \frac{x}{y} = y + 1$

Answer: (C) $\log_e \frac{x}{y} = y$ · Key from source paper

Q62 JEE Main 2024 · 31 Jan · Shift 1 MCQ

Let $y = y(x)$ be the solution of the differential equation $\frac{dy}{dx} = \frac{\tan x + y}{\sin x \sec x - \sin x \tan x}$, $x \in 0, \frac{\pi}{2}$ satisfying the condition $y\frac{\pi}{4} = 2$. Then, $y\frac{\pi}{3}$ is

(A) $\sqrt{3}\,2 + \log_e \sqrt{3}$
(B) $\frac{\sqrt{3}}{2}\,2 + \log_e 3$
(C) $\sqrt{3}\,1 + 2\log_e 3$
(D) $\sqrt{3}\,2 + \log_e 3$

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

Q63 JEE Main 2024 · 31 Jan · Shift 2 MCQ

The temperature $T(t)$ of a body at time $t = 0$ is 160° F and it decreases continuously as per the differential equation $\frac{dT}{dt} = -KT - 80$, where K is positive constant. If $T(15) = 120^\circ$ F, then $T(45)$ is equal to

(A) 85° F
(B) 95° F
(C) 90° F
(D) 80° F

Answer: (C) 90° F · Key from source paper

Q64 JEE Main 2024 · 31 Jan · Shift 2 Numerical

Let $y = y(x)$ be the solution of the differential equation $\sec^2 x\,dx + (e^{2y}\tan^2 x + \tan x)\,dy = 0$, $0 < x < \frac{\pi}{2}$, $y\left(\frac{\pi}{4}\right) = 0$. If $y\left(\frac{\pi}{6}\right) = \alpha$, then $e^{8\alpha}$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 9. · Key from source paper

Q65 JEE Main 2024 · 30 Jan · Shift 1 MCQ

Let $y = y(x)$ be the solution of the differential equation $\sec x\,dy + \{2(1-x)\tan x + x(2-x)\}dx = 0$ such that $y(0) = 2$. Then $y(2)$ is equal to :

(A) 2
(B) $2\{1 - \sin(2)\}$
(C) $2\{\sin(2) + 1\}$
(D) 1

Answer: (A) 2 · Key from source paper

Q66 JEE Main 2024 · 30 Jan · Shift 1 Numerical

Let $y = y(x)$ be the solution of the differential equation $(1-x^2)dy = \left[xy + (x^3+2)\sqrt{3(1-x^2)}\right] dx$, $-1 < x < 1$, $y(0) = 0$. If $y\left(\frac{1}{2}\right) = \frac{m}{n}$, m and n are coprime numbers, then m + n is equal to _____.

Numerical value type: the answer is a number.

Answer: 97. · Key from source paper

Q67 JEE Main 2024 · 30 Jan · Shift 2 Numerical

Let $Y = Y(X)$ be a curve lying in the first quadrant such that the area enclosed by the line $Y - y = Y'(x)(X - x)$ and the co-ordinate axes, where (x, y) is any point on the curve, is always $\frac{-y^2}{2Y'(x)} + 1$, $Y'x \neq 0$. If $Y(1) = 1$, then $12\,Y(2)$ equals _____.

Numerical value type: the answer is a number.

Answer: 20. · Key from source paper

Q68 JEE Main 2024 · 29 Jan · Shift 1 MCQ

A function $y = f(x)$ satisfies $f(x)\sin 2x + \sin x - \left(1 + \cos^2 x\right) f'(x) = 0$ with condition $f(0) = 0$. Then $f\left(\frac{\pi}{2}\right)$ is equal to

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

Answer: (A) 1 · Key from source paper

Q69 JEE Main 2024 · 29 Jan · Shift 1 Numerical

If the solution curve $y = y(x)$ of the differential equation $\left(1 + y^2\right)\left(1 + \log_e x\right) dx + x\, dy = 0$, $x > 0$ passes through the point $(1, 1)$ and $y(e) = \frac{\alpha - \tan\left(\frac{3}{2}\right)}{\beta + \tan\left(\frac{3}{2}\right)}$, then $\alpha + 2\beta$ is

Numerical value type: the answer is a number.

Answer: 3. · Key from source paper

Q70 JEE Main 2024 · 29 Jan · Shift 2 MCQ

If $\sin\left(\frac{y}{x}\right) = \log_e |x| + \frac{\alpha}{2}$ is the solution of the differential equation $x\cos\left(\frac{y}{x}\right)\frac{dy}{dx} = y\cos\left(\frac{y}{x}\right) + x$ and $y(1) = \frac{\pi}{3}$, then α^2 is equal to

(A) 3
(B) 12
(C) 4
(D) 9

Answer: (A) 3 · Key from source paper

Q71 JEE Main 2024 · 29 Jan · Shift 2 · Numerical

Let $f(x)=\sqrt{\lim_{r\to x}\left\{\frac{2r^2[(f(r))^2-f(x)f(r)]}{r^2-x^2}-r^3e^{\frac{f(r)}{r}}\right\}}$ be differentiable in $(-\infty,0)\cup(0,\infty)$ and $f(1)=1$. Then the value of ae, such that $f(a)=0$, is equal to _____.

Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q72 JEE Main 2024 · 27 Jan · Shift 1 · MCQ

Let $x=x(t)$ and $y=y(t)$ be solutions of the differential equations $\frac{dx}{dt}+ax=0$ and $\frac{dy}{dt}+by=0$ respectively, a, b $\in$ R. Given that $x(0)=2$; $y(0)=1$ and $3\,y(1)=2\,x(1)$, the value of t, for which $x(t)=y(t)$, is :

(A) $\log_{\frac{2}{3}}2$
(B) $\log_4 3$
(C) $\log_3 4$
(D) $\log_{\frac{4}{3}}2$

Answer: (D) $\log_{\frac{4}{3}}2$ · Key from source paper

Q73 JEE Main 2024 · 27 Jan · Shift 1 · Numerical

If the solution of the differential equation $(2x+3y-2)dx+(4x+6y-7)dy=0$, $y(0)=3$, is $\alpha x+\beta y+3\log_e|2x+3y-\gamma|=6$, then $\alpha+2\beta+3\gamma$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 29. · Key from source paper

Q74 JEE Main 2024 · 27 Jan · Shift 2 · MCQ

If $y=y(x)$ is the solution curve of the differential equation $x^2-4dy-y^2-3ydx=0$, $x>2$, $y(4)=\frac{3}{2}$ and the slope of the curve is never zero, then the value of $y(10)$ equals :

(A) $\frac{3}{1+(8)^{\frac{1}{4}}}$
(B) $\frac{3}{1+2\sqrt{2}}$
(C) $\frac{3}{1-2\sqrt{2}}$
(D) $\frac{3}{1-(8)^{\frac{1}{4}}}$

Answer: (A) $\frac{3}{1+(8)^{\frac{1}{4}}}$ · Key from source paper

Q75 JEE Main 2024 · 27 Jan · Shift 2 Numerical

If the solution curve, of the differential equation $\frac{dy}{dx}=\frac{x+y-2}{x-y}$ passing through the point $(2,1)$ is $\tan^{-1}\frac{y-1}{x-1}-\frac{1}{\beta}\log_e\alpha+\frac{y-1}{x-1}^2=\log_e x-1$, then $5\beta+\alpha$ is equal to

Numerical value type: the answer is a number.

Answer: 11. · Key from source paper

Q76 JEE Main 2023 · 15 Apr · Shift 1 MCQ

Let $x=x(y)$ be the solution of the differential equation $2(y+2)\log_e(y+2)dx+(x+4-2\log_e(y+2))dy=0$, $y>-1$ with $x(e^4-2)=1$. Then $x(e^9-2)$ is equal to

(A) 3
(B) $\frac{4}{9}$
(C) $\frac{32}{9}$
(D) $\frac{10}{3}$

Answer: (C) $\frac{32}{9}$ · Key from source paper

Q77 JEE Main 2023 · 13 Apr · Shift 1 MCQ

Let $y=y_1(x)$ and $y=y_2(x)$ be the solution curves of the differential equation $\frac{dy}{dx}=y+7$ with initial conditions $y_1(0)=0$ and $y_2(0)=1$ respectively. Then the curves $y=y_1(x)$ and $y=y_2(x)$ intersect at

(A) no point
(B) two points
(C) one point
(D) infinite number of points

Answer: (A) no point · Key from source paper

Q78 JEE Main 2023 · 13 Apr · Shift 2 Numerical

If $y=y(x)$ is the solution of the differential equation $\frac{dy}{dx}+\frac{4x}{x^2-1}y=\frac{x+2}{(x^2-1)^{\frac{5}{2}}}$, $x>1$ such that $y(2)=\frac{2}{9}\log_e 2+\sqrt{3}$ and $y\sqrt{2}=\alpha\log_e\sqrt{\alpha}+\beta+\beta-\sqrt{\gamma}$, $\alpha,\beta,\gamma\in\mathbb{N}$, then $\alpha\beta\gamma$ is equal to

Numerical value type: the answer is a number.

Answer: 6. · Key from source paper

Q79 JEE Main 2023 · 12 Apr · Shift 1 MCQ

Let $y = y(x)$, $y > 0$, be a solution curve of the differential equation $\left(1 + x^2\right) dy = y(x - y)dx$. If $y(0) = 1$ and $y\left(2\sqrt{2}\right) = \beta$, then

(A) $e^{3\beta-1} = e\left(3 + 2\sqrt{2}\right)$

(B) $e^{3\beta-1} = e\left(5 + \sqrt{2}\right)$

(C) $e^{\beta-1} = e^{-2}\left(3 + 2\sqrt{2}\right)$

(D) $e^{\beta-1} = e^{-2}\left(5 + \sqrt{2}\right)$

Answer: (A) $e^{3\beta-1} = e\left(3 + 2\sqrt{2}\right)$ · Key from source paper

Q80 JEE Main 2023 · 11 Apr · Shift 1 MCQ

Let $y = yx$ be a solution curve of the differential equation, $1 - x^2y^2dx = ydx + xdy$, If the line $x = 1$ intersects the curve $y = yx$ at $y = 2$ and the line $x = 2$ intersects the curve $y = yx$ at $y = \alpha$, then a value of α is

(A) $\frac{1-3e^2}{23e^2+1}$

(B) $\frac{1+3e^2}{23e^2-1}$

(C) $\frac{3e^2}{23e^2-1}$

(D) $\frac{3e^2}{23e^2+1}$

Answer: (B) $\frac{1+3e^2}{23e^2-1}$ · Key from source paper

Q81 JEE Main 2023 · 11 Apr · Shift 2 MCQ

Let $y = y(x)$ be the solution of the differential equation $\frac{dy}{dx} + \frac{5}{x(x^5+1)}y = \frac{(x^5+1)^2}{x^7}$, $x > 0$. If $y(1) = 2$, then $y(2)$ is equal to

(A) $\frac{637}{128}$

(B) $\frac{679}{128}$

(C) $\frac{693}{128}$

(D) $\frac{697}{128}$

Answer: (C) $\frac{693}{128}$ · Key from source paper

Q82 JEE Main 2023 · 10 Apr · Shift 1 MCQ

The slope of tangent at any point x, y on a curve $y = yx$ is $\frac{x^2+y^2}{2xy}$, $x > 0$. If $y2 = 0$, then a value of $y8$ is

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

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

Q83 JEE Main 2023 · 10 Apr · Shift 2 Numerical

Let the tangent at any point P on a curve passing through the points $1, 1$ and $\frac{1}{10}, 100$, intersect positive x-axis and y-axis at the points A and B respectively. If $PA : PB = 1 : k$ and $y = yx$ is the solution of the differential equation $e^{\frac{dy}{dx}} = kx + \frac{k}{2}$, $y0 = k$, then $4y1 - 5\log_e 3$ is equal to _____

Numerical value type: the answer is a number.

Answer: 5. · Key from source paper

Q84 JEE Main 2023 · 8 Apr · Shift 1 Numerical

If the solution curve of the differential equation $(y - 2\log_e x)dx + (x\log_e x^2)dy = 0$, $x > 1$ passes through the points $\left(e, \frac{4}{3}\right)$ and (e^4, α), then α is equal to _____

Numerical value type: the answer is a number.

Answer: 3. · Key from source paper

Q85 JEE Main 2023 · 8 Apr · Shift 2 Numerical

Let the solution curve $x = x(y)$, $0 < y < \frac{\pi}{2}$, of the differential equation $(\log_e(\cos y))^2 \cos y\, dx - (1 + 3x\log_e(\cos y))\sin y\, dy = 0$ satisfy $x\left(\frac{\pi}{3}\right) = \frac{1}{2\log_e 2}$. If $x\left(\frac{\pi}{6}\right) = \frac{1}{\log_e m - \log_e n}$, where m and n are coprime, then mn is equal to

Numerical value type: the answer is a number.

Answer: 12. · Key from source paper

Q86 JEE Main 2023 · 6 Apr · Shift 1 Numerical

Let $y = y(x)$ be a solution of the differential equation $(x\cos x)\, dy + (xy\sin x + y\cos x - 1)\, dx = 0$, $0 < x < \frac{\pi}{2}$. If $\frac{\pi}{3}\, y\left(\frac{\pi}{3}\right) = \sqrt{3}$, then $\frac{\pi}{6}\, y''\left(\frac{\pi}{6}\right) + 2y'\left(\frac{\pi}{6}\right)$ is equal to _____ .

Numerical value type: the answer is a number.

Answer: -2. · Checked by our team

Q87 JEE Main 2023 · 6 Apr · Shift 2 Numerical

Let a curve $y = f(x)$, $x \in (0, \infty)$ pass through the points $P\left(1, \frac{3}{2}\right)$ and $Q\left(a, \frac{1}{2}\right)$. If the tangent at any point $R(b, f(b))$ to the given curve cuts the y-axis at the point $S(0, c)$ such that $bc = 3$, then $(PQ)^2$ is equal to _____ .

Numerical value type: the answer is a number.

Answer: 5. · Key from source paper

Q88 JEE Main 2023 · 6 Apr · Shift 2 MCQ

If the solution curve $f(x, y) = 0$ of the differential equation $(1 + \log_e x)\frac{dx}{dy} - x \log_e x = e^y$, $x > 0$, passes through the points $(1, 0)$ and $(a, 2)$, then a^a is equal to

(A) e^{2e^2}

(B) e^{e^2}

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

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

Answer: (A) e^{2e^2} · Key from source paper

Q89 JEE Main 2023 · 1 Feb · Shift 1 MCQ

The area enclosed by the closed curve C given by the differential equation $\frac{dy}{dx} + \frac{x + a}{y - 2} = 0, y1 = 0$ is 4π. Let P and Q be the points of intersection of the curve C and the y-axis. If normals at P and Q on the curve C intersect x-axis at points R and S respectively, then the length of the line segment RS is

(A) $2\sqrt{3}$

(B) $\frac{2\sqrt{3}}{3}$

(C) 2

(D) $\frac{4\sqrt{3}}{3}$

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

Q90 JEE Main 2023 · 1 Feb · Shift 1 MCQ

If $y = yx$ is the solution curve of the differential equation $\frac{dy}{dx} + y \tan x = x \sec x$, $0 \le x \le \frac{\pi}{3}$, $y0 = 1$, then $y\frac{\pi}{6}$ is equal to

(A) $\frac{\pi}{12} - \frac{\sqrt{3}}{2} \log_e \frac{2}{e\sqrt{3}}$

(B) $\frac{\pi}{12} + \frac{\sqrt{3}}{2} \log_e \frac{2\sqrt{3}}{e}$

(C) $\frac{\pi}{12} - \frac{\sqrt{3}}{2} \log_e \frac{2\sqrt{3}}{e}$

(D) $\frac{\pi}{12} + \frac{\sqrt{3}}{2} \log_e \frac{2}{e\sqrt{3}}$

Answer: (A) $\frac{\pi}{12} - \frac{\sqrt{3}}{2} \log_e \frac{2}{e\sqrt{3}}$ · Key from source paper

Q91 JEE Main 2023 · 1 Feb · Shift 2 MCQ

Let $\alpha x = \exp(x^{\beta}y^{\gamma})$ be the solution of the differential equation $2x^2ydy - (1 - xy^2)dx = 0$, $x > 0, y(2) = \sqrt{\log_e 2}$. Then $\alpha + \beta - \gamma$ equals :

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

Answer: (A) 1 · Key from source paper

Q92 JEE Main 2023 · 31 Jan · Shift 2 MCQ

Let $y = y(x)$ be the solution of the differential equation $\left(3y^2 - 5x^2\right) y\,dx + 2x\left(x^2 - y^2\right) dy = 0$ such that $y(1) = 1$. Then $|(y(2))^3 - 12y(2)|$ is equal to :

(A) 64
(B) $32\sqrt{2}$
(C) 32
(D) $16\sqrt{2}$

Answer: (B) $32\sqrt{2}$ · Key from source paper

Q93 JEE Main 2023 · 30 Jan · Shift 1 MCQ

Let the solution curve $y = y(x)$ of the differential equation $\frac{dy}{dx} - \frac{3x^5 \tan^{-1} x^3}{1+x^{6\frac{3}{2}}}y = 2x\ \exp\frac{x^3 - \tan^{-1} x^3}{\sqrt{(1+x)^6}}$ pass through the origin. Then $y(1)$ is equal to:

(A) $\exp\frac{4-\pi}{4\sqrt{2}}$
(B) $\exp\frac{\pi-4}{4\sqrt{2}}$
(C) $\exp\frac{1-\pi}{4\sqrt{2}}$
(D) $\exp\frac{4+\pi}{4\sqrt{2}}$

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

Q94 JEE Main 2023 · 30 Jan · Shift 2 MCQ

The solution of the differential equation $\frac{dy}{dx} = -\left(\frac{x^2+3y^2}{3x^2+y^2}\right)$, $y(1) = 0$ is

(A) $\log_e|x+y| - \frac{xy}{(x+y)^2} = 0$
(B) $\log_e|x+y| + \frac{xy}{(x+y)^2} = 0$
(C) $\log_e|x+y| + \frac{2xy}{(x+y)^2} = 0$
(D) $\log_e|x+y| - \frac{2xy}{(x+y)^2} = 0$

Answer: (C) $\log_e|x+y| + \frac{2xy}{(x+y)^2} = 0$ · Key from source paper

Q95 JEE Main 2023 · 29 Jan · Shift 1 MCQ

Let $\mathrm{y} = f(\mathrm{x})$ be the solution of the differential equation $y(x+1)dx - x^2dy = 0$, $y(1) = e$. Then $\lim_{x\to 0^+} f\,(x)$ is equal to

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

Answer: (A) 0 · Key from source paper

Q96 JEE Main 2023 · 29 Jan · Shift 2 MCQ

Let $y = y(x)$ be the solution of the differential equation $x\log_e x\frac{dy}{dx} + y = x^2\log_e x$, $(x > 1)$. If $y(2) = 2$, then $y(e)$ is equal to

(A) $\frac{4+e^2}{4}$
(B) $\frac{1+e^2}{4}$
(C) $\frac{2+e^2}{2}$
(D) $\frac{1+e^2}{2}$

Answer: (A) $\frac{4+e^2}{4}$ · Key from source paper

Q97 JEE Main 2023 · 25 Jan · Shift 1 MCQ

Let $\mathrm{y} = \mathrm{y}(\mathrm{x})$ be the solution curve of the differential equation $\frac{dy}{dx} = \frac{y}{x}\left(1 + x^2(1+\log_e x)\right)$, $\mathrm{x} > 0$, $\mathrm{y}(1) = 3$. Then $\frac{y^2(x)}{9}$ is equal to :

(A) $\frac{x^2}{5-2x^3(2+\log_e x^3)}$
(B) $\frac{x^2}{2x^3(2+\log_e x^3)-3}$
(C) $\frac{x^2}{3x^3(1+\log_e x^2)-2}$
(D) $\frac{x^2}{7-3x^3(2+\log_e x^2)}$

Answer: (A) $\frac{x^2}{5-2x^3(2+\log_e x^3)}$ · Key from source paper

Q98 JEE Main 2023 · 25 Jan · Shift 2 MCQ

Let $y = y(t)$ be a solution of the differential equation $\frac{dy}{dt} + \alpha y = \gamma e^{-\beta t}$ Where, $\alpha > 0$, $\beta > 0$ and $\gamma > 0$. Then $\lim_{t\to\infty} y(t)$

(A) is 0
(B) does not exist
(C) is 1
(D) is -1

Answer: (A) is 0 · Key from source paper

Q99 JEE Main 2023 · 24 Jan · Shift 1 MCQ

Let $y = y(x)$ be the solution of the differential equation $x^3dy + (xy - 1)dx = 0$, $x > 0$, $y\left(\frac{1}{2}\right) = 3 - e$. Then $y(1)$ is equal to

(A) 1
(B) e
(C) $2 - e$
(D) 3

Answer: (A) 1 · Key from source paper

Q100 JEE Main 2023 · 24 Jan · Shift 2 MCQ

Let y = y(x) be the solution of the differential equation $(x^2 - 3y^2)dx + 3xy\,dy = 0$, $y(1) = 1$. Then $6y^2(e)$ is equal to

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

Answer: (C) $2e^2$ · Key from source paper

Q101 JEE Main 2022 · 29 Jul · Shift 1 MCQ

Let the solution curve $y = y(x)$ of the differential equation $(1 + e^{2x})\left(\frac{dy}{dx} + y\right) = 1$ pass through the point $\left(0, \frac{\pi}{2}\right)$. Then, $\lim_{x\to\infty} e^x y(x)$ is equal to

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

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

Q102 JEE Main 2022 · 29 Jul · Shift 2 MCQ

If the solution curve of the differential equation $\frac{dy}{dx} = \frac{x+y-2}{x-y}$ passes through the point $2, 1$ and $k + 1, 2$, $k > 0$, then

(A) $2\tan^{-1}\frac{1}{k} = \log_e k^2 + 1$
(B) $\tan^{-1}\frac{1}{k} = \log_e k^2 + 1$
(C) $2\tan^{-1}\frac{1}{k+1} = \log_e k^2 + 2k + 2$
(D) $2\tan^{-1}\frac{1}{k} = \log_e \frac{k^2+1}{k^2}$

Answer: (A) $2\tan^{-1}\frac{1}{k} = \log_e k^2 + 1$ · Key from source paper

EdLoop JEE

Q103 JEE Main 2022 · 29 Jul · Shift 2 MCQ

Let $y = yx$ be the solution curve of the differential equation $\frac{dy}{dx} + \frac{2x^2+11x+13}{x^3+6x^2+11x+6}y = \frac{x+3}{x+1}, x > -1$, which passes through the point $0, 1$. Then $y1$ is equal to

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

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

Q104 JEE Main 2022 · 28 Jul · Shift 1 MCQ

Let the solution curve of the differential equation $xdy = \sqrt{x^2+y^2} + ydx, x > 0$, intersect the line $x = 1$ at $y = 0$ and the line $x = 2$ at $y = \alpha$. Then the value of α is

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

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

Q105 JEE Main 2022 · 28 Jul · Shift 1 MCQ

If $y = yx, x \in 0, \frac{\pi}{2}$ be the solution curve of the differential equation $\sin^2 2x\frac{dy}{dx} + 8\sin^2 2x + 2\sin 4xy = 2e^{-4x}2\sin 2x + \cos 2x$, with $y\frac{\pi}{4} = e^{-\pi}$, then $y\frac{\pi}{6}$ is equal to

(A) $\frac{2}{\sqrt{3}}e^{-\frac{2\pi}{3}}$
(B) $\frac{2}{\sqrt{3}}e^{\frac{2\pi}{3}}$
(C) $\frac{1}{\sqrt{3}}e^{-\frac{2\pi}{3}}$
(D) $\frac{1}{\sqrt{3}}e^{\frac{2\pi}{3}}$

Answer: (A) $\frac{2}{\sqrt{3}}e^{-\frac{2\pi}{3}}$ · Key from source paper

Q106 JEE Main 2022 · 28 Jul · Shift 2 MCQ

Let $y = y(x)$ be the solution curve of the differential equation $\frac{dy}{dx} + \frac{1}{x^2-1}y = \left(\frac{x-1}{x+1}\right)^{\frac{1}{2}}, x > 1$ passing through the point $\left(2, \sqrt{\frac{1}{3}}\right)$. Then $\sqrt{7}y(8)$ is equal to

(A) $11 + 6\log_e 3$
(B) 19
(C) $12 - 2\log_e 3$
(D) $19 - 6\log_e 3$

Answer: (D) $19 - 6\log_e 3$ · Key from source paper

Q107 JEE Main 2022 · 28 Jul · Shift 2 MCQ

The differential equation of the family of circles passing through the points $(0, 2)$ and $(0, -2)$ is

(A) $2xy\frac{dy}{dx} + \left(x^2 - y^2 + 4\right) = 0$
(B) $2xy\frac{dy}{dx} + \left(x^2 + y^2 - 4\right) = 0$
(C) $2xy\frac{dy}{dx} + \left(y^2 - x^2 + 4\right) = 0$
(D) $2xy\frac{dy}{dx} - \left(x^2 - y^2 + 4\right) = 0$

Answer: (A) $2xy\frac{dy}{dx} + \left(x^2 - y^2 + 4\right) = 0$ · Key from source paper

Q108 JEE Main 2022 · 27 Jul · Shift 1 MCQ

Let $y = y_1(x)$ and $y = y_2(x)$ be two distinct solutions of the differential equation $\frac{dy}{dx} = x + y$, with $y_1(0) = 0$ and $y_2(0) = 1$ respectively. Then, the number of points of intersection of $y = y_1(x)$ and $y = y_2(x)$ is

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

Answer: (A) 0 · Key from source paper

Q109 JEE Main 2022 · 27 Jul · Shift 1 Numerical

Let $y = y(x)$ be the solution curve of the differential equation $\sin(2x^2)\log_e(\tan x^2)dy + \left(4xy - 4\sqrt{2}x\sin\left(x^2 - \frac{\pi}{4}\right)\right)dx = 0$, $0 < x < \sqrt{\frac{\pi}{2}}$, which passes through the point $\left(\sqrt{\frac{\pi}{6}}, 1\right)$. Then $\left|y\left(\sqrt{\frac{\pi}{3}}\right)\right|$ is equal to _____ .

Numerical value type: the answer is a number.

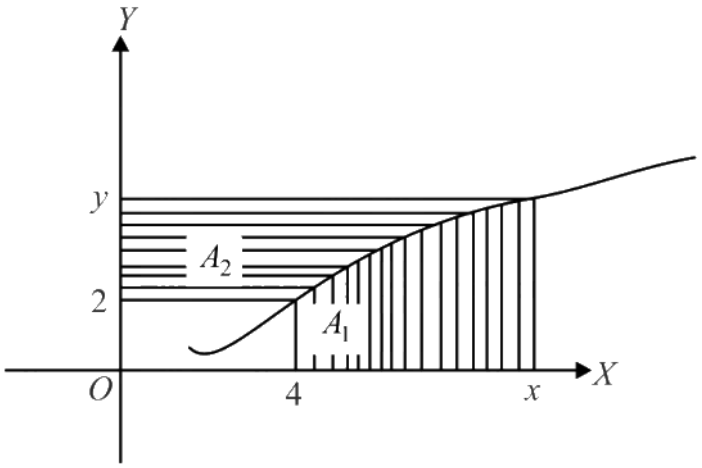
Answer: 1. · Key from source paper

Q110 JEE Main 2022 · 27 Jul · Shift 2 MCQ

Consider a curve $y = y(x)$ in the first quadrant as shown in the figure. Let the area A_1 is twice the area A_2. Then the normal to the curve perpendicular to the line $2x - 12y = 15$ does NOT pass through the point _____

(see the figure above)

Q76. Consider a curve $y = y(x)$ in the first quadrant as shown in the figure. Let the area A_1 is twice the area A_2. Then the normal to the curve perpendicular to the line $2x - 12y = 15$ does NOT pass through the point __



(1) $(6, 21)$
(2) $(8, 9)$
(3) $(10, -4)$
(4) $(12, -15)$

(A) $(6, 21)$
(B) $(8, 9)$
(C) $(10, -4)$
(D) $(12, -15)$

Answer: (C) $(10, -4)$ · Key from source paper

Q111 JEE Main 2022 · 26 Jul · Shift 1 MCQ

If $\frac{dy}{dx} + 2y \tan x = \sin x$, $0 < x < \frac{\pi}{2}$ and $y\left(\frac{\pi}{3}\right) = 0$, then the maximum value of $y(x)$ is

(A) $\frac{1}{8}$
(B) $\frac{3}{4}$
(C) $\frac{1}{4}$
(D) $\frac{3}{8}$

Answer: (A) $\frac{1}{8}$ · Key from source paper

Q112 JEE Main 2022 · 26 Jul · Shift 1 Numerical

Let a curve $y = y(x)$ pass through the point $(3, 3)$ and the area of the region under this curve, above the x-axis and between the abscissae 3 and $x(> 3)$ be $\left(\frac{y}{x}\right)^3$. If this curve also passes through the point $\left(\alpha, 6\sqrt{10}\right)$ in the first quadrant, then α is equal to _____ .

Numerical value type: the answer is a number.

Answer: 6. · Key from source paper

Q113 JEE Main 2022 · 26 Jul · Shift 2 MCQ

Let the solution curve $y = fx$ of the differential equation $\frac{dy}{dx} + \frac{xy}{x^2-1} = \frac{x^4+2x}{\sqrt{1-x^2}}$, $x \in -1, 1$ pass through the origin. Then $\int_{-\frac{\sqrt{3}}{2}}^{\frac{\sqrt{3}}{2}} fx\,dx$ is equal to

(A) $\frac{\pi}{3} - \frac{1}{4}$
(B) $\frac{\pi}{3} - \frac{\sqrt{3}}{4}$
(C) $\frac{\pi}{6} - \frac{\sqrt{3}}{4}$
(D) $\frac{\pi}{6} - \frac{\sqrt{3}}{2}$

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

Q114 JEE Main 2022 · 26 Jul · Shift 2 Numerical

Suppose $y = yx$ be the solution curve to the differential equation $\frac{dy}{dx} - y = 2 - e^{-x}$ such that $\lim_{x\to\infty} yx$ is finite. If a and b are respectively the x - and y - intercept of the tangent to the curve at $x = 0$, then the value of $a - 4b$ is equal to _____ .

Numerical value type: the answer is a number.

Answer: 3. · Key from source paper

Q115 JEE Main 2022 · 25 Jul · Shift 1 MCQ

The slope of the tangent to a curve C: $y = yx$ at any point $[x, y)$ on it is $\frac{2e^{2x}-6e^{-x}+9}{2+9e^{-2x}}$. If C passes through the points $0, \frac{1}{2} + \frac{\pi}{2\sqrt{2}}$ and $\alpha, \frac{1}{2}e^{2\alpha}$ then e^{α} is equal to

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

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

Q116 JEE Main 2022 · 25 Jul · Shift 1 MCQ

The general solution of the differential equation $x - y^2dx + y5x + y^2dy = 0$ is

(A) $y^2 + x^4 = Cy^2 + 2x^3$
(B) $y^2 + 2x^4 = Cy^2 + x^3$
(C) $y^2 + x^3 = C2y^2 + x^4$
(D) $y^2 + 2x^3 = C2y^2 + x^4$

Answer: (A) $y^2 + x^4 = Cy^2 + 2x^3$ · Key from source paper

Q117 JEE Main 2022 · 25 Jul · Shift 2 MCQ

Let a smooth curve $y = f(x)$ be such that the slope of the tangent at any point (x, y) on it is directly proportional to $\left(\frac{-y}{x}\right)$. If the curve passes through the points $(1, 2)$ and $(8, 1)$, then $\left|y\left(\frac{1}{8}\right)\right|$ is equal to

(A) $2\log_e 2$
(B) 4
(C) 1
(D) $4\log_e 2$

Answer: (B) 4 · Key from source paper

Q118 JEE Main 2022 · 25 Jul · Shift 2 Numerical

Let $y = y(x)$ be the solution of the differential equation $\frac{dy}{dx} = \frac{4y^3+2yx^2}{3xy^2+x^3}$, $y(1) = 1$. If for some $n \in N$, $y(2) \in [n-1, n)$, then n is equal to _____.

Numerical value type: the answer is a number.

Answer: 3. · Key from source paper

Q119 JEE Main 2022 · 29 Jun · Shift 1 MCQ

Let the solution curve of the differential equation $x\frac{dy}{dx} - y = \sqrt{y^2 + 16x^2}$, $y(1) = 3$ be $y = y(x)$. Then $y(2)$ is equal to

(A) 15
(B) 11
(C) 14
(D) 17

Answer: (A) 15 · Key from source paper

Q120 JEE Main 2022 · 29 Jun · Shift 1 Numerical

Let $y = y(x)$ be the solution of the differential equation $\frac{dy}{dx} + \frac{\sqrt{2}y}{2\cos^4 x - \cos 2x} = xe^{\tan^{-1}\left(\sqrt{2}\cot 2x\right)}$, $0 < x < \frac{\pi}{2}$ with $y\left(\frac{\pi}{4}\right) = \frac{\pi^2}{32}$. If $y\left(\frac{\pi}{3}\right) = \frac{\pi^2}{18}e^{-\tan^{-1}(\alpha)}$, then the value of $3\alpha^2$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q121 JEE Main 2022 · 29 Jun · Shift 2 MCQ

If $y = y(x)$ is the solution of the differential equation $\left(1 + e^{2x}\right)\frac{dy}{dx} + 2\left(1 + y^2\right)e^x = 0$ and $y(0) = 0$, then $6\left(y'(0) + \left(y\left(\log_e \sqrt{3}\right)\right)^2\right)$ is equal to:

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

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

Q122 JEE Main 2022 · 29 Jun · Shift 2 Numerical

Let $y = y(x),\ x > 1$, be the solution of the differential equation $(x-1)\dfrac{dy}{dx} + 2xy = \dfrac{1}{x-1}$, with $y(2) = \dfrac{1+e^4}{2e^4}$. If $y(3) = \dfrac{e^\alpha + 1}{\beta e^\alpha}$. then the value of $\alpha + \beta$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 14. · Key from source paper

Q123 JEE Main 2022 · 28 Jun · Shift 1 MCQ

Let the solution curve $y = y(x)$ of the differential equation, $\left[\dfrac{x}{\sqrt{x^2-y^2}} + e^{\frac{y}{x}}\right] x\dfrac{dy}{dx} = x + \left[\dfrac{x}{\sqrt{x^2-y^2}} + e^{\frac{y}{x}}\right] y$ pass through the points $(1, 0)$ and $(2\alpha, \alpha)$, $\alpha > 0$. Then α is equal to

(A) $\dfrac{1}{2}\exp\left(\dfrac{\pi}{6} + \sqrt{e} - 1\right)$
(B) $\dfrac{1}{2}\exp\left(\dfrac{\pi}{3} + \sqrt{e} - 1\right)$
(C) $\exp\left(\dfrac{\pi}{6} + \sqrt{e} + 1\right)$
(D) $2\exp\left(\dfrac{\pi}{3} + \sqrt{e} - 1\right)$

Answer: (A) $\dfrac{1}{2}\exp\left(\dfrac{\pi}{6} + \sqrt{e} - 1\right)$ · Key from source paper

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Q124 JEE Main 2022 · 28 Jun · Shift 1 MCQ

Let $y = y(x)$ be the solution of the differential equation $x(1-x^2)\dfrac{dy}{dx} + \left(3x^2y - y - 4x^3\right) = 0,\ x > 1$ with $y(2) = -2$. Then $y(3)$ is equal to

(A) -18
(B) -12
(C) -6
(D) -3

Answer: (A) -18 · Key from source paper

Q125 JEE Main 2022 · 28 Jun · Shift 2 MCQ

Let $x = x(y)$ be the solution of the differential equation $2ye^{\frac{x}{y^2}}\,dx + \left(y^2 - 4xe^{\frac{x}{y^2}}\right)dy = 0$ such that $x(1) = 0$. Then, $x(e)$ is equal to

(A) $e\log_e(2)$
(B) $-e\log_e(2)$
(C) $e^2\log_e(2)$
(D) $-e^2\log_e(2)$

Answer: (D) $-e^2\log_e(2)$ · Key from source paper

Q126 JEE Main 2022 · 28 Jun · Shift 2 MCQ

Let the slope of the tangent to a curve $y = f(x)$ at (x, y) be given by $2\tan x(\cos x - y)$. if the curve passes through the point $\left(\frac{\pi}{4}, 0\right)$, then the value of $\int_0^{\frac{\pi}{2}} y\,dx$ is equal to

(A) $\left(2 - \sqrt{2}\right) + \frac{\pi}{\sqrt{2}}$
(B) $2 - \frac{\pi}{\sqrt{2}}$
(C) $\left(2 + \sqrt{2}\right) + \frac{\pi}{\sqrt{2}}$
(D) $2 + \frac{\pi}{\sqrt{2}}$

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

Q127 JEE Main 2022 · 27 Jun · Shift 1 MCQ

Let $\frac{dy}{dx} = \frac{ax-by+a}{bx+cy+a}$, where a, b, c are constants. represent a circle passing through the point $(2, 5)$. Then the shortest distance of the point $(11, 6)$ from this circle is

(A) 10
(B) 8
(C) 7
(D) 5

Answer: (B) 8 · Key from source paper

Q128 JEE Main 2022 · 27 Jun · Shift 1 MCQ

If $\frac{dy}{dx} + \frac{2^{x-y}(2^y-1)}{2^x-1} = 0,\ x, y > 0,\ y(1) = 1$, then $y(2)$ is equal to

(A) $2 + \log_2 3$
(B) $2 + \log_2 2$
(C) $2 - \log_{-2} 3$
(D) $2 - \log_2 3$

Answer: (D) $2 - \log_2 3$ · Key from source paper

EdLoop JEE

Q129 JEE Main 2022 · 27 Jun · Shift 2 MCQ

If the solution curve of the differential equation $\left(\left(\tan^{-1} y\right) - x\right) dy = \left(1 + y^2\right) dx$ passes through the point $(1, 0)$ then the abscissa of the point on the curve whose ordinate is $\tan(1)$ is

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

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

Q130 JEE Main 2022 · 27 Jun · Shift 2 Numerical

Let $y = y(x)$ be the solution of the differential equation
$(1 - x^2)dy = \left(xy + (x^3 + 2)\sqrt{1 - x^2}\right) dx,\ -1 < x < 1$
and $y(0) = 0$. If $\int_{-\frac{1}{2}}^{\frac{1}{2}} \sqrt{1 - x^2}\, y(x)dx = k$ then k^{-1} is equal to

Numerical value type: the answer is a number.

Answer: 320. · Key from source paper

Q131 JEE Main 2022 · 26 Jun · Shift 1 Numerical

Let the solution curve $y = y(x)$ of the differential equation $(4 + x^2)dy - 2x(x^2 + 3y + 4)dx = 0$ pass through the origin. Then $y(2)$ is equal to _____ .

Numerical value type: the answer is a number.

Answer: 12. · Key from source paper

Q132 JEE Main 2022 · 26 Jun · Shift 1 Numerical

Let $S = (0, 2\pi) - \left\{\frac{\pi}{2}, \frac{3\pi}{4}, \frac{3\pi}{2}, \frac{7\pi}{4}\right\}$. Let $y = y(x)$, $x \in S$, be the solution curve of the differential equation $\frac{dy}{dx} = \frac{1}{1+\sin 2x}$, $y\left(\frac{\pi}{4}\right) = \frac{1}{2}$. If the sum of abscissas of all the points of intersection of the curve $y = y(x)$ with the curve $y = \sqrt{2}\sin x$ is $\frac{k\pi}{12}$, then k is equal to _____ .

Numerical value type: the answer is a number.

Answer: 42. · Key from source paper

Q133 JEE Main 2022 · 26 Jun · Shift 2 MCQ

If $y = y(x)$ is the solution of the differential equation $x\frac{dy}{dx} + 2y = xe^x, y(1) = 0$ then the local maximum value of the function $z(x) = x^2y(x) - e^x, x \in R$ is

(A) $1-e$

(B) 0

(C) $\frac{1}{2}$

(D) $\frac{4}{e}-e$

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

Q134 JEE Main 2022 · 26 Jun · Shift 2 MCQ

If $\frac{dy}{dx}+e^x(x^2-2)y=(x^2-2x)(x^2-2)e^{2x}$ and $y(0)=0$, then the value of $y(2)$ is

(A) -1

(B) 1

(C) 0

(D) e

Answer: (C) 0 · Key from source paper

Q135 JEE Main 2022 · 25 Jun · Shift 1 MCQ

Let $y=yx$ be the solution of the differential equation $x+1y'-y=e^{3x}x+1^2$, with $y0=\frac{1}{3}$. Then, the point $x=-\frac{4}{3}$ for the curve $y=yx$ is

(A) not a critical point

(B) a point of local minima

(C) a point of local maxima

(D) a point of inflection

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

Q136 JEE Main 2022 · 25 Jun · Shift 1 MCQ

If the solution curve $y=yx$ of the differential equation $y^2dx+x^2-xy+y^2dy=0$, which passes through the point $1,1$ and intersects the line $y=\sqrt{3}x$ at the point $\alpha,\sqrt{3}\alpha$, then value of $\log_e\sqrt{3}\alpha$ is equal to

(A) $\frac{\pi}{2}$

(B) $\frac{\pi}{4}$

(C) $\frac{\pi}{6}$

(D) $\frac{\pi}{12}$

Answer: (D) $\frac{\pi}{12}$ · Key from source paper

Q137 JEE Main 2022 · 25 Jun · Shift 2 MCQ

If $y=yx$ is the solution of the differential equation $2x^2\frac{dy}{dx}-2xy+3y^2=0$ such that $ye=\frac{e}{3}$, then $y1$ is equal to

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

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

Q138 JEE Main 2022 · 24 Jun · Shift 1 MCQ

If $x = x(y)$ is the solution of the differential equation $y\frac{dx}{dy} = 2x + y^3(y+1)e^y$, $x(1) = 0$; then $x(e)$ is equal to

(A) $e^e\left(e^3 - 1\right)$
(B) $e^3\left(e^e - 1\right)$
(C) $e^e - 1$
(D) $e^e\left(e^2 - 1\right)$

Answer: (B) $e^3\left(e^e - 1\right)$ · Key from source paper

Q139 JEE Main 2022 · 24 Jun · Shift 2 MCQ

A particle is moving in the xy-plane along a curve C passing through the point $(3, 3)$. The tangent to the curve C at the point P meets the x-axis at Q. If the y-axis bisects the segment PQ, then C is a parabola with

(A) length of latus rectum 3
(B) length of latus rectum 6
(C) focus $\left(\frac{4}{3}, 0\right)$
(D) focus $\left(0, \frac{3}{3}\right)$

Answer: (A) length of latus rectum 3 · Key from source paper

Q140 JEE Main 2022 · 24 Jun · Shift 2 MCQ

The slope of normal at any point (x, y), $x > 0, y > 0$ on the curve $y = y(x)$ is given by $\frac{x^2}{xy - x^2y^2 - 1}$. If the curve passes through the point $(1, 1)$, then $e \cdot y(e)$ is equal to

(A) $\frac{1-\tan(1)}{1+\tan(1)}$
(B) $\tan(1)$
(C) 1
(D) $\frac{1+\tan(1)}{1-\tan(1)}$

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

Q141 JEE Main 2021 · 1 Sep · Shift 2 MCQ

If $y = y(x)$ is the solution curve of the differential equation $x^2\,dy + y - \frac{1}{x}dx = 0$; $x > 0$ and $y(1) = 1$, then $y\frac{1}{2}$ is equal to :

(A) $3 + \mathrm{e}$

(B) $3 - \mathrm{e}$

(C) $\frac{3}{2} - \frac{1}{\sqrt{\mathrm{e}}}$

(D) $3 + \frac{1}{\sqrt{\mathrm{e}}}$

Answer: (B) $3 - \mathrm{e}$ · Key from source paper

Q142 JEE Main 2021 · 31 Aug · Shift 1 MCQ

If $\frac{dy}{dx} = \frac{2^{x+y} - 2^x}{2^y}$, $y(0) = 1$, then $y(1)$ is equal to :

(A) $\log_2\left(1 + \mathrm{e}^2\right)$

(B) $\log_2(2\mathrm{e})$

(C) $\log_2(2 + \mathrm{e})$

(D) $\log_2(1 + e)$

Answer: (D) $\log_2(1 + e)$ · Key from source paper

Q143 JEE Main 2021 · 31 Aug · Shift 2 MCQ

If $y\frac{dy}{dx} = x\left[\frac{y^2}{x^2} + \frac{\phi\left(\frac{y^2}{x^2}\right)}{\phi'\left(\frac{y^2}{x^2}\right)}\right]$, $x > 0$, $\phi > 0$, and $y(1) = -1$, then $\phi\left(\frac{y^2}{4}\right)$ is equal to:

(A) $2\phi(1)$

(B) $\phi(1)$

(C) $4\phi(2)$

(D) $4\phi(1)$

Answer: (D) $4\phi(1)$ · Key from source paper

Q144 JEE Main 2021 · 31 Aug · Shift 2 MCQ

If $\frac{dy}{dx} = \frac{2^x y + 2^y \cdot 2^x}{2^x + 2^{x+y}\log_e 2}$, $y0 = 0$, then for $y = 1$, the value of x lies in the interval :

(A) $1, 2$

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

(C) $2, 3$

(D) $0, \frac{1}{2}$

Answer: (A) $1, 2$ · Key from source paper

EdLoop JEE

Q145 JEE Main 2021 · 27 Aug · Shift 1 MCQ

Let us consider a curve, $y = f(x)$ passing through the point $(-2, 2)$ and the slope of the tangent to the curve at any point $(x, f(x))$ is given by $f(x) + xf'(x) = x^2$. Then

(A) $x^3 - 3xf(x) - 4 = 0$
(B) $x^2 + 2xf(x) - 12 = 0$
(C) $x^3 + xf(x) + 12 = 0$
(D) $x^2 + 2xf(x) + 4 = 0$

Answer: (A) $x^3 - 3xf(x) - 4 = 0$ · Key from source paper

Q146 JEE Main 2021 · 27 Aug · Shift 1 MCQ

Let $y = y(x)$ be the solution of the differential equation $\frac{dy}{dx} = 2(y + 2\sin x - 5)x - 2\cos x$ such that $y(0) = 7$. Then $y(\pi)$ is equal to

(A) $7e^{\pi^2} + 5$
(B) $e^{\pi^2} + 5$
(C) $2e^{\pi^2} + 5$
(D) $3e^{\pi^2} + 5$

Answer: (C) $2e^{\pi^2} + 5$ · Key from source paper

Q147 JEE Main 2021 · 27 Aug · Shift 2 MCQ

If the solution curve of the differential equation $\left(2x - 10y^3\right) dy + ydx = 0$, passes through the points $(0, 1)$ and $(2, \beta)$, then β is a root of the equation?

(A) $y^5 - 2y - 2 = 0$
(B) $y^5 - y^2 - 1 = 0$
(C) $2y^5 - y^2 - 2 = 0$
(D) $2y^5 - 2y - 1 = 0$

Answer: (B) $y^5 - y^2 - 1 = 0$ · Key from source paper

Q148 JEE Main 2021 · 27 Aug · Shift 2 MCQ

A differential equation representing the family of parabolas with axis parallel to $y-$axis and whose length of latus rectum is the distance of the point $(2, -3)$ from the line $3x + 4y = 5$, is given by:

(A) $11\frac{d^2x}{dy^2} = 10$
(B) $11\frac{d^2y}{dx^2} = 10$
(C) $10\frac{d^2y}{dx^2} = 11$
(D) $10\frac{d^2x}{dy^2} = 11$

Answer: (B) $11\frac{d^2y}{dx^2} = 10$ · Key from source paper

Q149 JEE Main 2021 · 26 Aug · Shift 1 MCQ

Let $y = y(x)$ be a solution curve of the differential equation $(y+1)\tan^2 x\,dx + \tan x\,dy + y\,dx = 0$, $x \in \left(0, \frac{\pi}{2}\right)$. If $\lim_{x\to 0^+} xy(x) = 1$, then the value of $y\left(\frac{\pi}{4}\right)$ is:

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

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

Q150 JEE Main 2021 · 26 Aug · Shift 2 MCQ

Let $y(x)$ be the solution of the differential equation $2x^2\,dy + (e^y - 2x)\,dx = 0$, $x > 0$. If $y(e) = 1$, then $y(1)$ is equal to:

(A) $\log_e(2e)$
(B) $\log_e 2$
(C) 2
(D) 0

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

Q151 JEE Main 2021 · 27 Jul · Shift 1 MCQ

Let $y = y(x)$ be solution of the differential equation $\log_e\left(\frac{dy}{dx}\right) = 3x + 4y$, with $y(0) = 0$. If $y\left(-\frac{2}{3}\log_e 2\right) = \alpha \log_e 2$, then the value of α is equal to:

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

Answer: (A) $-\frac{1}{4}$ · Key from source paper

Q152 JEE Main 2021 · 27 Jul · Shift 1 Numerical

If $y = y(x)$, $y \in \left[0, \frac{\pi}{2}\right)$ is the solution of the differential equation $\sec y \frac{dy}{dx} - \sin(x+y) - \sin(x-y) = 0$, with $y(0) = 0$, then $5y'\left(\frac{\pi}{2}\right)$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q153 JEE Main 2021 · 27 Jul · Shift 2 MCQ

Let $y = y(x)$ be the solution of the differential equation $(x - x^3)dy = (y + yx^2 - 3x^4)dx$, $x > 2$ If $y(3) = 3$, then $y(4)$ is equal to:

(A) 4
(B) 12
(C) 8
(D) 16

Answer: (B) 12 · Key from source paper

Q154 JEE Main 2021 · 27 Jul · Shift 2 Numerical

Let $y = y(x)$ be the solution of the differential equation $dy = e^{\alpha x + y}dx$; $\alpha \in N$. If $y(\log_e 2) = \log_e 2$ and $y(0) = \log_e\left(\frac{1}{2}\right)$, then the value of α is equal to _____.

Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q155 JEE Main 2021 · 25 Jul · Shift 1 MCQ

Let $y = y(x)$ be the solution of the differential equation $\frac{dy}{dx} = 1 + xe^{y-x}$, $-\sqrt{2} < x < \sqrt{2}$, $y0 = 0$, then the minimum value of yx, $x \in -\sqrt{2}, \sqrt{2}$ is equal to :

(A) $2 - \sqrt{3} - \log_e 2$
(B) $2 + \sqrt{3} + \log_e 2$
(C) $1 + \sqrt{3} - \log_e \sqrt{3} - 1$
(D) $1 - \sqrt{3} - \log_e \sqrt{3} - 1$

Answer: (D) $1 - \sqrt{3} - \log_e \sqrt{3} - 1$ · Key from source paper

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Q156 JEE Main 2021 · 25 Jul · Shift 1 Numerical

Let $y = y(x)$ be solution of the following differential equation $e^y\frac{dy}{dx} - 2e^y \sin x + \sin x \cos^2 x = 0$, $y\frac{\pi}{2} = 0$.
If $y0 = \log_e \alpha + \beta e^{-2}$, then $4(\alpha + \beta)$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 4. · Checked by our team

Q157 JEE Main 2021 · 25 Jul · Shift 2 MCQ

Let $y = y(x)$ be the solution of the differential equation $x\,dy = \left(y + x^3\cos x\right)dx$ with $y(\pi) = 0$, then $y\left(\frac{\pi}{2}\right)$ is equal to:

(A) $\frac{\pi^2}{4} + \frac{\pi}{2}$
(B) $\frac{\pi^2}{2} + \frac{\pi}{4}$
(C) $\frac{\pi^2}{2} - \frac{\pi}{4}$
(D) $\frac{\pi^2}{4} - \frac{\pi}{2}$

Answer: (A) $\frac{\pi^2}{4} + \frac{\pi}{2}$ · Key from source paper

EdLoop JEE

Q158 JEE Main 2021 · 25 Jul · Shift 2 Numerical

Let a curve $y = f(x)$ pass through the point $\left(2, (\log_e 2)^2\right)$ and have slope $\frac{2y}{x \log_e x}$ for all positive real values of x. Then the value of $f(e)$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 1. · Key from source paper

Q159 JEE Main 2021 · 22 Jul · Shift 1 MCQ

Let $y = y(x)$ be the solution of the differential equation $\operatorname{cosec}^2 x\, dy + 2dx = (1 + y\cos 2x)\operatorname{cosec}^2 x\, dx$, with $y\left(\frac{\pi}{4}\right) = 0$. Then, the value of $(y(0) + 1)^2$ is equal to:

(A) $e^{1/2}$

(B) $e^{-1/2}$

(C) e^{-1}

(D) e

Answer: (C) e^{-1} · Key from source paper

Q160 JEE Main 2021 · 20 Jul · Shift 1 MCQ

Let $y = y(x)$ be the solution of the differential equation $x\tan\left(\frac{y}{x}\right)dy = \left(y\tan\left(\frac{y}{x}\right) - x\right)dx$, $-1 \le x \le 1$, $y\left(\frac{1}{2}\right) = \frac{\pi}{6}$. Then the area of the region bounded by the curves $x = 0$, $x = \frac{1}{\sqrt{2}}$ and $y = y(x)$ in the upper half plane is:

(A) $\frac{1}{8}(\pi - 1)$

(B) $\frac{1}{12}(\pi - 3)$

(C) $\frac{1}{4}(\pi - 2)$

(D) $\frac{1}{6}(\pi - 1)$

Answer: (A) $\frac{1}{8}(\pi - 1)$ · Key from source paper

Q161 JEE Main 2021 · 20 Jul · Shift 1 MCQ

Let $y = y(x)$ be the solution of the differential equation $e^x\sqrt{1 - y^2}\,dx + \left(\frac{y}{x}\right)dy = 0$, $y(1) = -1$. Then the value of $(y(3))^2$ is equal to:

(A) $1 - 4e^3$

(B) $1 - 4e^6$

(C) $1 + 4e^3$

(D) $1 + 4e^6$

Answer: (B) $1 - 4e^6$ · Key from source paper

Q162 JEE Main 2021 · 20 Jul · Shift 2 MCQ

Let $y = y(x)$ satisfies the equation $\frac{dy}{dx} - |A| = 0$, for all $x > 0$, where $A = \begin{bmatrix} y & \sin x & 1 \\ 0 & -1 & 1 \\ 2 & 0 & \frac{1}{x} \end{bmatrix}$. If $y(\pi) = \pi + 2$, then the value of $y\left(\frac{\pi}{2}\right)$ is:

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

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

Q163 JEE Main 2021 · 20 Jul · Shift 2 Numerical

Let a curve $y = y(x)$ be given by the solution of the differential equation $\cos\left(\frac{1}{2}\cos^{-1}\left(e^{-x}\right)\right)dx = \left(\sqrt{e^{2x}-1}\right)dy$. If it intersects y-axis at $y = -1$, and the intersection point of the curve with x-axis is $(\alpha, 0)$, then e^{α} is equal to _____ .

Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q164 JEE Main 2021 · 18 Mar · Shift 1 MCQ

The differential equation satisfied by the system of parabolas $y^2 = 4a(x + a)$ is

(A) $y\left(\frac{dy}{dx}\right)^2 - 2x\left(\frac{dy}{dx}\right) - y = 0$
(B) $y\left(\frac{dy}{dx}\right)^2 - 2x\left(\frac{dy}{dx}\right) + y = 0$
(C) $y\left(\frac{dy}{dx}\right)^2 + 2x\left(\frac{dy}{dx}\right) - y = 0$
(D) $y\left(\frac{dy}{dx}\right) + 2x\left(\frac{dy}{dx}\right) - y = 0$

Answer: (C) $y\left(\frac{dy}{dx}\right)^2 + 2x\left(\frac{dy}{dx}\right) - y = 0$ · Key from source paper

Q165 JEE Main 2021 · 18 Mar · Shift 2 MCQ

Let $y = y(x)$ be the solution of the differential equation $\frac{dy}{dx} = (y+1)\left((y+1)e^{x^2/2} - x\right), 0 < x < 2.1$, with $y(2) = 0$. Then the value of $\frac{dy}{dx}$ at $x = 1$ is equal to

(A) $\frac{-e^{3/2}}{(e^2+1)^2}$
(B) $-\frac{2e^2}{(1+e^2)^2}$
(C) $\frac{e^{5/2}}{(1+e^2)^2}$
(D) $\frac{5e^{1/2}}{(e^2+1)^2}$

Answer: (A) $\frac{-e^{3/2}}{(e^2+1)^2}$ · Key from source paper

Q166 JEE Main 2021 · 18 Mar · Shift 2 Numerical

Let $y = y(x)$ be the solution of the differential equation $xdy - ydx = \sqrt{(x^2 - y^2)}dx$, $x \geq 1$, with $y(1) = 0$. If the area bounded by the line $x = 1$, $x = e^{\pi}$, $y = 0$ and $y = y(x)$ is $\alpha e^{2\pi} + \beta$, then the value of $10(\alpha + \beta)$ is equal to _____ .

Numerical value type: the answer is a number.

Answer: 4. · Key from source paper

Q167 JEE Main 2021 · 17 Mar · Shift 1 MCQ

Which of the following is true for $y(x)$ that satisfies the differential equation $\frac{dy}{dx} = xy - 1 + x - y; y(0) = 0$

(A) $y(1) = \mathrm{e}^{-\frac{1}{2}} - 1$

(B) $y(1) = e^{\frac{1}{2}} - e^{-\frac{1}{2}}$

(C) $y(1) = 1$

(D) $y(1) = e^{\frac{1}{2}} - 1$

Answer: (A) $y(1) = \mathrm{e}^{-\frac{1}{2}} - 1$ · Key from source paper

Q168 JEE Main 2021 · 17 Mar · Shift 2 MCQ

Let $y = y(x)$ be the solution of the differential equation $\cos x\,(3\sin x + \cos x + 3)\,dy = (1 + y\sin x(3\sin x + \cos x + 3))dx, 0 \leq x \leq \frac{\pi}{2}, y(0) = 0$. Then, $y\left(\frac{\pi}{3}\right)$ is equal to:

(A) $2\log_e\left(\frac{2\sqrt{3}+9}{6}\right)$

(B) $2\log_e\left(\frac{2\sqrt{3}+10}{11}\right)$

(C) $2\log_e\left(\frac{\sqrt{3}+7}{2}\right)$

(D) $2\log_e\left(\frac{3\sqrt{3}-8}{4}\right)$

Answer: (B) $2\log_e\left(\frac{2\sqrt{3}+10}{11}\right)$ · Key from source paper

Q169 JEE Main 2021 · 17 Mar · Shift 2 MCQ

If the curve $y = y(x)$ is the solution of the differential equation $2\left(x^2 + x^{5/4}\right)dy - y\left(x + x^{1/4}\right)dx = 2x^{9/4}dx, x > 0$ which passes through the point $\left(1, 1 - \frac{4}{3}\log_e 2\right)$, then the value of $y(16)$ is equal to

(A) $4\left(\frac{31}{3} + \frac{8}{3}\log_e 3\right)$

(B) $\left(\frac{31}{3} + \frac{8}{3}\log_e 3\right)$

(C) $4\left(\frac{31}{3} - \frac{8}{3}\log_e 3\right)$

(D) $\left(\frac{31}{3} - \frac{8}{3}\log_e 3\right)$

Answer: (C) $4\left(\frac{31}{3} - \frac{8}{3}\log_e 3\right)$ · Key from source paper

Q170 JEE Main 2021 · 16 Mar · Shift 1 MCQ

If $y = y(x)$ is the solution of the differential equation, $\frac{dy}{dx} + 2y\tan x = \sin x, y\left(\frac{\pi}{3}\right) = 0$, then the maximum value of the function $y(x)$ over R is equal to :

(A) 8
(B) $\frac{1}{2}$
(C) $-\frac{15}{4}$
(D) $\frac{1}{8}$

Answer: (D) $\frac{1}{8}$ · Key from source paper

Q171 JEE Main 2021 · 16 Mar · Shift 2 MCQ

If $y = y(x)$ is the solution of the differential equation $\frac{dy}{dx} + (\tan x)y = \sin x, 0 \le x \le \frac{\pi}{3}$, with $y(0) = 0$, then $y\left(\frac{\pi}{4}\right)$ is equal to

(A) $\frac{1}{4}\log_e 2$
(B) $\left(\frac{1}{2\sqrt{2}}\right)\log_e 2$
(C) $\log_e 2$
(D) $\frac{1}{2}\log_e 2$

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

Q172 JEE Main 2021 · 16 Mar · Shift 2 MCQ

Let C_1 be the curve obtained by the solution of differential equation $2xy\frac{dy}{dx} = y^2 - x^2, x > 0$. Let the curve C_2 be the solution of $\frac{2xy}{x^2-y^2} = \frac{dy}{dx}$. If both the curves pass through $(1, 1)$, then the area (in sq. units) enclosed by the curves C_1 and C_2 is equal to :

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

Answer: (B) $\frac{\pi}{2} - 1$ · Key from source paper

Q173 JEE Main 2021 · 26 Feb · Shift 1 MCQ

The rate of growth of bacteria in a culture is proportional to the number of bacteria present and the bacteria count is 1000 at initial time $t = 0$. The number of bacteria is increased by 20% in 2 hours. If the population of bacteria is 2000 after $\frac{k}{\log_e\left(\frac{6}{5}\right)}$ hours, then $\left(\frac{k}{\log_e 2}\right)^2$ is equal to:

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(A) 8
(B) 4
(C) 16
(D) 2

Answer: (B) 4 · Key from source paper

Q174 JEE Main 2021 · 26 Feb · Shift 1 · Numerical

The difference between degree and order of a differential equation that represents the family of curves given by $y^2 = a\left(x + \frac{\sqrt{a}}{2}\right), a > 0$ is _____.

Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q175 JEE Main 2021 · 26 Feb · Shift 1 · Numerical

If $y = y(x)$ is the solution of the equation $e^{\sin y}\cos y\,\frac{dy}{dx} + e^{\sin y}\cos x = \cos x,\ y(0) = 0$; then $1 + y\left(\frac{\pi}{6}\right) + \frac{\sqrt{3}}{2}y\left(\frac{\pi}{3}\right) + \frac{1}{\sqrt{2}}y\left(\frac{\pi}{4}\right)$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 1. · Key from source paper

Q176 JEE Main 2021 · 26 Feb · Shift 2 · MCQ

Let slope of the tangent line to a curve at any point $P(x, y)$ be given by $\frac{xy^2+y}{x}$. If the curve intersects the line $x + 2y = 4$ at $x = -2$, then the value of y, for which the point $(3, y)$ lies on the curve, is :

(A) $-\frac{4}{3}$
(B) $\frac{18}{35}$
(C) $-\frac{18}{19}$
(D) $-\frac{18}{11}$

Answer: (C) $-\frac{18}{19}$ · Key from source paper

Q177 JEE Main 2021 · 25 Feb · Shift 1 · MCQ

If a curve passes through the origin and the slope of the tangent to it at any point (x, y) is $\frac{x^2-4x+y+8}{x-2}$, then this curve also passes through the point:

(A) $(5, 4)$
(B) $(4, 4)$
(C) $(4, 5)$
(D) $(5, 5)$

Answer: (D) $(5, 5)$ · Key from source paper

EdLoop JEE

Q178 JEE Main 2021 · 25 Feb · Shift 2 Numerical

If the curve, $y = y(x)$ represented by the solution of the differential equation $(2xy^2 - y)dx + x\,dy = 0$, passes through the intersection of the lines, $2x - 3y = 1$ and $3x + 2y = 8$, then $|y(1)|$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 1. · Key from source paper

Q179 JEE Main 2021 · 24 Feb · Shift 1 MCQ

The population $P = Pt$ at time t of a certain species follows the differential equation $\frac{dP}{dt} = 0.5P - 450$. If $P0 = 850$, then the time at which population becomes zero is:

(A) $\log_e 9$
(B) $2\log_e 18$
(C) $\log_e 18$
(D) $\frac{1}{2}\log_e 18$

Answer: (B) $2\log_e 18$ · Key from source paper

Q180 JEE Main 2021 · 24 Feb · Shift 2 MCQ

If a curve $y = f(x)$ passes through the point $(1,\ 2)$ and satisfies $x\frac{dy}{dx} + y = bx^4$, then for what value of b, $\int_1^2 f(x)dx = \frac{62}{5}$?

(A) $\frac{31}{5}$
(B) 10
(C) 5
(D) $\frac{62}{5}$

Answer: (B) 10 · Key from source paper

Q181 JEE Main 2020 · 6 Sep · Shift 1 MCQ

The general solution of the differential equation $\sqrt{1 + x^2 + y^2 + x^2y^2} + xy\frac{dy}{dx} = 0$ (where C is a constant of integration)

(A) $\sqrt{1+y^2} + \sqrt{1+x^2} = \frac{1}{2}\log_e\left(\frac{\sqrt{1+x^2}-1}{\sqrt{1+x^2}+1}\right) + C$
(B) $\sqrt{1+y^2} - \sqrt{1+x^2} = \frac{1}{2}\log_e\left(\frac{\sqrt{1+x^2}-1}{\sqrt{1+x^2}+1}\right) + C$
(C) $\sqrt{1+y^2} + \sqrt{1+x^2} = \frac{1}{2}\log_e\left(\frac{\sqrt{1+x^2}+1}{\sqrt{1+x^2}-1}\right) + C$
(D) $\sqrt{1+y^2} - \sqrt{1+x^2} = \frac{1}{2}\log_e\left(\frac{\sqrt{1+x^2}+1}{\sqrt{1+x^2}-1}\right) + C$

Answer: (C) $\sqrt{1+y^2} + \sqrt{1+x^2} = \frac{1}{2}\log_e\left(\frac{\sqrt{1+x^2}+1}{\sqrt{1+x^2}-1}\right) + C$ · Key from source paper

Q182 JEE Main 2020 · 6 Sep · Shift 2 MCQ

If $y = \left(\frac{2}{\pi}x - 1\right)\ \text{cosec}\ x$ is the solution of the differential equation, $\frac{dy}{dx} + p(x)y = \frac{2}{\pi}\text{cosec}\ x$, $0 < x < \frac{\pi}{2}$, then the function $p(x)$ is equal to :

(A) $\cot x$
(B) $\text{cosec}\ x$
(C) $\sec x$
(D) $\tan x$

Answer: (A) $\cot x$ · Key from source paper

Q183 JEE Main 2020 · 5 Sep · Shift 1 MCQ

If $y = y(x)$ is the solution of the differential equation $\frac{5+e^x}{2+y} \cdot \frac{dy}{dx} + e^x = 0$ satisfying $y(0) = 1$ then value of $y(\log_e 13)$ is

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

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

Q184 JEE Main 2020 · 5 Sep · Shift 2 MCQ

Let $y = y(x)$ be the solution of the differential equation $\cos x \frac{dy}{dx} + 2y \sin x = \sin 2x,\ x \in \left(0, \frac{\pi}{2}\right)$ If $y(\pi/3) = 0$, then $y(\pi/4)$ is equal to :

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

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

Q185 JEE Main 2020 · 4 Sep · Shift 1 MCQ

Let $y = y(x)$ be the solution of the differential equation, $xy' - y = x^2\,(x\cos x + \sin x), x > 0$. If $y(\pi) = \pi$, then $y''\left(\frac{\pi}{2}\right) + y\left(\frac{\pi}{2}\right)$ is equal to :

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

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

Q186 JEE Main 2020 · 4 Sep · Shift 2 MCQ

The solution of the differential equation $\frac{dy}{dx} - \frac{y+3x}{\log_e(y+3x)} + 3 = 0$ is (where C is a constant of integration)

(A) $x - \frac{1}{2}\left(\log_e(y+3x)\right)^2 = C$

(B) $x - \log_e(y+3x) = C$

(C) $y + 3x - \frac{1}{2}\left(\log_e x\right)^2 = C$

(D) $x - 2\log_e(y+3x) = C$

Answer: (A) $x - \frac{1}{2}\left(\log_e(y+3x)\right)^2 = C$ · Key from source paper

Q187 JEE Main 2020 · 3 Sep · Shift 1 MCQ

The solution curve of the differential equation, $(1+e^{-x})(1+y^2)\frac{dy}{dx} = y^2$ which passes through the point $(0,\ 1)$, is

(A) $y^2 + 1 = y\left(\log_e\left(\frac{1+e^{-x}}{2}\right) + 2\right)$

(B) $y^2 + 1 = y\left(\log_e\left(\frac{1+e^{x}}{2}\right) + 2\right)$

(C) $y^2 = 1 + y\log_e\left(\frac{1+e^{x}}{2}\right)$

(D) $y^2 = 1 + y\log_e\left(\frac{1+e^{-x}}{2}\right)$

Answer: (C) $y^2 = 1 + y\log_e\left(\frac{1+e^{x}}{2}\right)$ · Key from source paper

Q188 JEE Main 2020 · 3 Sep · Shift 2 MCQ

If $x^3dy + xy \cdot dx = x^2dy + 2ydx;\ y(2) = e$ and $x > 1$, then $y(4)$ is equal to :

(A) $\frac{\sqrt{e}}{2}$

(B) $\frac{1}{2} + \sqrt{e}$

(C) $\frac{3}{2}\sqrt{e}$

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

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

Q189 JEE Main 2020 · 2 Sep · Shift 1 MCQ

Let $y = y(x)$ be the solution of the differential equation, $\frac{2+\sin x}{y+1} \cdot \frac{dy}{dx} = -\cos x,\ y > 0,\ y(0) = 1$. If $y(\pi) = a$ and $\frac{dy}{dx}$ at $x = \pi$ is b, then the ordered pair (a, b) is equal to

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

(B) $(1, -1)$

(C) $(1, 1)$

(D) $(2, 1)$

Answer: (C) $(1, 1)$ · Key from source paper

Q190 JEE Main 2020 · 2 Sep · Shift 2 MCQ

If a curve $y = f(x)$, passing through the point $(1, 2)$, is the solution of the differential equation $2x^2dy = (2xy + y^2)dx$, then $f\left(\frac{1}{2}\right)$ is equal to

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

Answer: (A) $\frac{1}{1+\log_e 2}$ · Key from source paper

Q191 JEE Main 2020 · 9 Jan · Shift 1 Numerical

If for $x \geq 0, y = y(x)$ is the solution of the differential equation, $(x + 1)dy = \left((x + 1)^2 + y - 3\right) dx, y(2) = 0$ then $y(3)$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 3. · Key from source paper

Q192 JEE Main 2020 · 9 Jan · Shift 2 MCQ

If $\frac{dy}{dx} = \frac{xy}{x^2+y^2}$; $y(1) = 1$; then a value of x satisfying $y(x) = e$ is:

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

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

Q193 JEE Main 2020 · 8 Jan · Shift 1 MCQ

Let $y = y(x)$ be a solution of the differential equation, $\sqrt{1-x^2}\frac{dy}{dx} + \sqrt{1-y^2} = 0, |x| < 1$. If $y\left(\frac{1}{2}\right) = \frac{\sqrt{3}}{2}$, then $y\left(\frac{-1}{\sqrt{2}}\right)$ is equal to

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

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

Q194 JEE Main 2020 · 8 Jan · Shift 2 MCQ

The differential equation of the family of curves, $x^2 = 4b(y + b), b \in R$, is.

(A) $x(y')^2 = x + 2yy'$
(B) $x(y')^2 = 2yy' - x$
(C) $xy'' = y'$
(D) $x(y')^2 = x - 2yy'$

Answer: (A) $x(y')^2 = x + 2yy'$ · Key from source paper

Q195 JEE Main 2020 · 7 Jan · Shift 1 MCQ

If $y = y(x)$ is the solution of the differential equation , $e^y\left(\frac{dy}{dx} - 1\right) = e^x$ such that $y(0) = 0$, then $y(1)$ is equal to

(A) $1 + \log_e 2$
(B) $2 + \log_e 2$
(C) $2e$
(D) $\log_e 2$

Answer: (A) $1 + \log_e 2$ · Key from source paper

Q196 JEE Main 2020 · 7 Jan · Shift 2 MCQ

Let $y = y(x)$ be the solution curve of the differential equation, $(y^2 - x)\frac{dy}{dx} = 1$, satisfying $y(0) = 1$. This curve intersects the $X-$axis at a point whose abscissa is

(A) $2 - e$
(B) $-e$
(C) 2
(D) $2 + e$

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

Q197 JEE Main 2019 · 12 Apr · Shift 1 MCQ

Consider the differential equation, $y^2dx + x - \frac{1}{y}dy = 0$. If value of y is 1 when $x = 1$, then the value of x for which $y = 2$, is

(A) $\frac{3}{2} - \frac{1}{\sqrt{e}}$
(B) $\frac{3}{2} - \sqrt{e}$
(C) $\frac{1}{2} + \frac{1}{\sqrt{e}}$
(D) $\frac{5}{2} + \frac{1}{\sqrt{e}}$

Answer: (A) $\frac{3}{2} - \frac{1}{\sqrt{e}}$ · Key from source paper

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Q198 JEE Main 2019 · 12 Apr · Shift 2 MCQ

The general solution of the differential equation $(y^2 - x^3)dx - xydy = 0,\ (x \neq 0)$ is (where c is a constant of integration)

(A) $y^2 + 2x^2 + cx^3 = 0$
(B) $y^2 - 2x^2 + cx^3 = 0$
(C) $y^2 - 2x^3 + cx^2 = 0$
(D) $y^2 + 2x^3 + cx^2 = 0$

Answer: (D) $y^2 + 2x^3 + cx^2 = 0$ · Key from source paper

Q199 JEE Main 2019 · 10 Apr · Shift 1 MCQ

If $y = y(x)$ is the solution of the differential equation $\frac{dy}{dx} = (\tan x - y)\sec^2 x,\ x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$, such that $y(0) = 0$, then $y\left(-\frac{\pi}{4}\right)$ is equal to:

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

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

Q200 JEE Main 2019 · 10 Apr · Shift 2 MCQ

Let $y = yx$ be the solution of the differential equation, $\frac{dy}{dx} + y\tan x = 2x + x^2\tan x,\ \ x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$, such that $y0 = 1$. Then

(A) $y'\frac{\pi}{4} - y'\text{-}\frac{\pi}{4} = \pi - \sqrt{2}$
(B) $y'\frac{\pi}{4} + y'\text{-}\frac{\pi}{4} = -\sqrt{2}$
(C) $y\frac{\pi}{4} - y\text{-}\frac{\pi}{4} = \sqrt{2}$
(D) $y'\frac{\pi}{4} + y'\text{-}\frac{\pi}{4} = \frac{\pi^2}{2} + 2$

Answer: (A) $y'\frac{\pi}{4} - y'\text{-}\frac{\pi}{4} = \pi - \sqrt{2}$ · Key from source paper

Q201 JEE Main 2019 · 9 Apr · Shift 1 MCQ

The solution of the differential equation $x\dfrac{dy}{dx} + 2y = x^2,\ (x \neq 0)$ with $y(1) = 1$, is

(A) $y = \dfrac{x^3}{5} + \dfrac{1}{5x^2}$
(B) $y = \dfrac{3}{4}x^2 + \dfrac{1}{4x^2}$
(C) $y = \dfrac{x^2}{4} + \dfrac{3}{4x^2}$
(D) $y = \dfrac{4}{5}x^3 + \dfrac{1}{5x^2}$

Answer: (C) $y = \dfrac{x^2}{4} + \dfrac{3}{4x^2}$ · Key from source paper

Q202 JEE Main 2019 · 9 Apr · Shift 2 MCQ

If $\cos x\frac{dy}{dx} - y\sin x = 6x$, $\left(0 < x < \frac{\pi}{2}\right)$ and $y\left(\frac{\pi}{3}\right) = 0$, then $y\left(\frac{\pi}{6}\right)$ is equal to

(A) $-\frac{\pi^2}{4\sqrt{3}}$

(B) $\frac{\pi^2}{2\sqrt{3}}$

(C) $-\frac{\pi^2}{2}$

(D) $-\frac{\pi^2}{2\sqrt{3}}$

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

Q203 JEE Main 2019 · 8 Apr · Shift 1 MCQ

Let $y = y(x)$ be the solution of the differential equation, $x^2 + 1^2\frac{dy}{dx} + 2x\left(x^2+1\right)y = 1$ such that $y0 = 0$. If $\sqrt{a}\,y1 = \frac{\pi}{32}$, then the value of a is

(A) $\frac{1}{16}$

(B) $\frac{1}{2}$

(C) $\frac{1}{4}$

(D) 1

Answer: (A) $\frac{1}{16}$ · Key from source paper

Q204 JEE Main 2019 · 8 Apr · Shift 2 MCQ

Given that the slope of the tangent to a curve $y = y(x)$ at any point x, y is $\frac{2y}{x^2}$. If the curve passes through the centre of the circle $x^2 + y^2 - 2x - 2y = 0$, then its equation is

(A) $x^2\log_e|y| = -2(x-1)$

(B) $x\log_e|y| = 2(x-1)$

(C) $x\log_e|y| = -2(x-1)$

(D) $x\log_e|y| = x - 1$

Answer: (B) $x\log_e|y| = 2(x-1)$ · Key from source paper

Q205 JEE Main 2019 · 12 Jan · Shift 1 MCQ

Let $y = y(x)$ be the solution of the differential equation, $x\frac{dy}{dx} + y = x\log_e x$, $(x > 1)$. If $2y(2) = \log_e 4 - 1$, then $y(e)$ is equal to :

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

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

Q206 JEE Main 2019 · 12 Jan · Shift 2 MCQ

If a curve passes through the point $(1,\ -2)$ and has slope of the tangent at any point $(x,\ y)$ on it as $\frac{x^2-2y}{x}$, then the curve also passes through the point

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

Answer: (A) $(\sqrt{3},\ 0)$ · Key from source paper

Q207 JEE Main 2019 · 11 Jan · Shift 1 MCQ

If $y(x)$ is the solution of the differential equation $\frac{dy}{dx} + \left(\frac{2x+1}{x}\right) y = e^{-2x}$, $x > 0$, where $y(1) = \frac{1}{2}e^{-2}$, then:

(A) $y\,(\log_e 2) = \log_e 4$
(B) $y\,(\log_e 2) = \frac{\log_e 2}{4}$
(C) $y(x)$ is decreasing in $\left(\frac{1}{2}, 1\right)$
(D) $y(x)$ is decreasing in (0,1)

Answer: (C) $y(x)$ is decreasing in $\left(\frac{1}{2}, 1\right)$ · Key from source paper

Q208 JEE Main 2019 · 11 Jan · Shift 2 MCQ

The solution of the differential equation, $\frac{dy}{dx} = (x-y)^2$, when $y(1) = 1$, is:

(A) $\log_e \left|\frac{2-x}{2-y}\right| = x - y$
(B) $-\log_e \left|\frac{1-x+y}{1+x-y}\right| = 2(x-1)$
(C) $-\log_e \left|\frac{1+x-y}{1-x+y}\right| = x + y - 2$
(D) $\log_e \left|\frac{2-y}{2-x}\right| = 2(y-1)$

Answer: (B) $-\log_e \left|\frac{1-x+y}{1+x-y}\right| = 2(x-1)$ · Key from source paper

Q209 JEE Main 2019 · 10 Jan · Shift 1 MCQ

If $\frac{dy}{dx} + \frac{3}{\cos^2 x} y = \frac{1}{\cos^2 x}$, $x \in \left(-\frac{\pi}{3}, \frac{\pi}{3}\right)$, and $y\left(\frac{\pi}{4}\right) = \frac{4}{3}$, then $y\left(-\frac{\pi}{4}\right)$ equals

(A) $\frac{1}{3}$
(B) $\frac{1}{3}+e^3$
(C) $\frac{1}{3}+e^6$
(D) $-\frac{4}{3}$

Answer: (C) $\frac{1}{3}+e^6$ · Key from source paper

Q210 JEE Main 2019 · 10 Jan · Shift 2 MCQ

A curve amongst the family of curves represented by the differential equation, $(x^2-y^2)\,dx+2xy\,dy=0$ which passes through $(1,1)$, is

(A) A circle with centre on the $x-$ axis.
(B) A circle with centre on the $y-$ axis.
(C) A hyperbola with transverse axis along the $x-$ axis.
(D) An ellipse with major axis along the $y-$ axis.

Answer: (A) A circle with centre on the $x-$ axis. · Key from source paper

Q211 JEE Main 2019 · 10 Jan · Shift 2 MCQ

Let $f(x)$ be a differentiable function such that $f'(x)=7-\frac{3}{4}\frac{f(x)}{x}$, $(x>0)$ and $f(1)\neq 4$. Then $\lim\limits_{x\to 0^+} x\,f\left(\frac{1}{x}\right)$

(A) does not exist.
(B) exists and equals 4.
(C) exists and equals $\frac{4}{7}$.
(D) exists and equals 0.

Answer: (B) exists and equals 4. · Key from source paper

Q212 JEE Main 2019 · 9 Jan · Shift 1 MCQ

If $y=y(x)$ is the solution of the differential equation, $x\frac{dy}{dx}+2y=x^2$ satisfying $y1=1$, then $y\frac{1}{2}$ is equal to

(A) $\frac{7}{64}$
(B) $\frac{1}{4}$
(C) $\frac{13}{16}$
(D) $\frac{49}{16}$

Answer: (D) $\frac{49}{16}$ · Key from source paper

Q213 JEE Main 2018 · 16 Apr · Online MCQ

The differential equation representing the family of ellipses having foci either on the x-axis or on the y-axis, center at the origin and passing through the point $(0, 3)$ is

(A) $xyy' - y^2 + 9 = 0$
(B) $xyy'' + x(y')^2 - yy' = 0$
(C) $xyy' + y^2 - 9 = 0$
(D) $x + yy'' = 0$

Answer: (A) $xyy' - y^2 + 9 = 0$ · Key from source paper

Q214 JEE Main 2018 · 15 Apr · Shift 1 MCQ

Let $y = y(x)$ be the solution of the differential equation $\frac{dy}{dx} + 2y = f(x)$, where

$$f(x) = \begin{cases} 1, & x \in [0, 1] \\ 0, & \text{otherwise} \end{cases}$$

If $y(0) = 0$, then $y\left(\frac{3}{2}\right)$ is

(A) $\frac{e^2-1}{2e^3}$
(B) $\frac{e^2-1}{e^3}$
(C) $\frac{1}{2e}$
(D) $\frac{e^2+1}{2e^4}$

Answer: (A) $\frac{e^2-1}{2e^3}$ · Key from source paper

Q215 JEE Main 2018 · 15 Apr · Shift 2 MCQ

The curve satisfying the differential equation, $(x^2 - y^2)dx + 2xy\,dy = 0$ and passing through the point $(1, 1)$ is

(A) a circle of radius two
(B) a circle of radius one
(C) a hyperbola
(D) an ellipse

Answer: (B) a circle of radius one · Key from source paper

Q216 JEE Main 2018 · 8 Apr · Offline MCQ

Let $y = y(x)$ be the solution of the differential equation $\sin x \dfrac{dy}{dx} + y\cos x = 4x,\ x \in (0,\ \pi)$. If $y\left(\dfrac{\pi}{2}\right) = 0$, then $y\left(\dfrac{\pi}{6}\right)$ is equal to

(A) $-\frac{4}{9}\pi^2$
(B) $\frac{4}{9\sqrt{3}}\pi^2$
(C) $\frac{-8}{9\sqrt{3}}\pi^2$
(D) $-\frac{8}{9}\pi^2$

Answer: (D) $-\frac{8}{9}\pi^2$ · Key from source paper

Q217 JEE Main 2017 · 9 Apr · Online MCQ

A tangent to the curve, $y = f(x)$ at $P(x,\ y)$ meets x-axis at A and y-axis at B. If $AP : BP = 1 : 3$ and $f(1) = 1$, then the curve also passes through the point

(A) $\left(\frac{1}{3},\ 24\right)$
(B) $\left(\frac{1}{2},\ 4\right)$
(C) $\left(2,\ \frac{1}{8}\right)$
(D) $\left(3,\ \frac{1}{28}\right)$

Answer: (C) $\left(2,\ \frac{1}{8}\right)$ · Key from source paper

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Q218 JEE Main 2017 · 8 Apr · Online MCQ

The curve satisfying the differential equation, $y\,dx - (x + 3y^2)\,dy = 0$ and passing through the point $(1, 1)$ also passes through the point

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

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

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Q219 JEE Main 2017 · 2 Apr · Offline MCQ

If $(2 + \sin x)\frac{dy}{dx} + (y + 1)\cos x = 0$ and $y(0) = 1$, then $y\left(\frac{\pi}{2}\right)$ is equal to

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

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

Q220 JEE Main 2016 · 10 Apr · Online MCQ

The solution of the differential equation $\frac{dy}{dx} + \frac{y}{2}\sec x = \frac{\tan x}{2y}$, where $0 \le x < \frac{\pi}{2}$ and $y(0) = 1$, is given by

(A) $y^2 = 1 + \frac{x}{\sec x + \tan x}$
(B) $y = 1 + \frac{x}{\sec x + \tan x}$
(C) $y = 1 - \frac{x}{\sec x + \tan x}$
(D) $y^2 = 1 - \frac{x}{\sec x + \tan x}$

Answer: (D) $y^2 = 1 - \frac{x}{\sec x + \tan x}$ · Key from source paper

Q221 JEE Main 2016 · 9 Apr · Online MCQ

If $f(x)$ is a differentiable function in the interval $(0, \infty)$ such that $f(1) = 1$ and $\lim_{t \to x} \frac{t^2 f(x) - x^2 f(t)}{t - x} = 1$,for each $x > 0$, then $f\left(\frac{3}{2}\right)$ is equal to

(A) $\frac{23}{18}$
(B) $\frac{13}{6}$
(C) $\frac{25}{9}$
(D) $\frac{31}{18}$

Answer: (D) $\frac{31}{18}$ · Key from source paper

Q222 JEE Main 2016 · 3 Apr · Offline MCQ

If a curve $y = f(x)$ passes through the point $(1, -1)$ and satisfies the differential equation, $y\,(1 + xy)dx = x\,dy$, then $f\left(-\frac{1}{2}\right)$ is equal to

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

Answer: (B) $\frac{4}{5}$ · Key from source paper

Q223 JEE Main 2015 · 11 Apr · Online MCQ

The solution of the differential equation $y\,dx - \left(x + 2y^2\right)dy = 0$ is $x = f(y)$. If $f(-1) = 1$, then $f(1)$ is equal to

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

Answer: (B) 3 · Key from source paper

Q224 JEE Main 2015 · 10 Apr · Online MCQ

If $y(x)$ is the solution of the differential equation $(x+2)\frac{dy}{dx} = x^2 + 4x - 9$, $x \neq -2$ and $y(0) = 0$, then $y(-4)$ is equal to

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

Answer: (C) 0 · Key from source paper

Q225 JEE Main 2015 · 4 Apr · Offline MCQ

Let $y(x)$ be the solution of the differential equation $(x\log x)\dfrac{dy}{dx} + y = 2x\log x$, $(x \geq 1)$. Then $y(e)$ is equal to

(A) $2e$
(B) e
(C) 0
(D) 2

Answer: (D) 2 · Key from source paper

Q226 JEE Main 2014 · 19 Apr · Online MCQ

If $\frac{dy}{dx} + y\tan x = \sin 2x$ and $y(0) = 1$, then $y(\pi)$ is equal to

(A) -1
(B) 5
(C) 1
(D) -5

Answer: (D) -5 · Key from source paper

Q227 JEE Main 2014 · 12 Apr · Online MCQ

The general solution of the differential equation, $\sin 2x\left(\dfrac{dy}{dx} - \sqrt{\tan x}\right) - y = 0$, is :

(A) $y\sqrt{\tan x} = x + c$
(B) $y\sqrt{\cot x} = \tan x + c$
(C) $y\sqrt{\tan x} = \cot x + c$
(D) $y\sqrt{\cot x} = x + c$

Answer: (D) $y\sqrt{\cot x} = x + c$ · Key from source paper

Q228 JEE Main 2014 · 11 Apr · Online MCQ

If the general solution of the differential equation $y' = \frac{y}{x} + \Phi\left(\frac{x}{y}\right)$, for some function Φ, is given by $y \ln|cx| = x$, where c is an arbitrary constant, then $\Phi(2)$ is equal to:

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

Answer: (D) $-\frac{1}{4}$ · Key from source paper

Q229 JEE Main 2014 · 9 Apr · Online MCQ

If the differential equation representing the family of all circles touching x-axis at the origin is $(x^2 - y^2)\frac{dy}{dx} = g(x)y$, then $g(x)$ equals

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

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

Q230 JEE Main 2014 · 6 Apr · Offline MCQ

Let the population of rabbits surviving at a time t be governed by the differential equation $\frac{dp(t)}{dt} = \frac{1}{2}\{p(t) - 400\}$. If $p(0) = 100$, then $p(t)$ equals

(A) $600 - 500\,e^{\frac{t}{2}}$
(B) $400 - 300\,e^{\frac{-t}{2}}$
(C) $400 - 300\,e^{t/2}$
(D) $300 - 200\,e^{\frac{-t}{2}}$

Answer: (C) $400 - 300\,e^{t/2}$ · Key from source paper

Q231 JEE Main 2013 · 25 Apr · Online MCQ

The equation of the curve passing through the origin and satisfying the differential equation $(1 + x^2)\frac{dy}{dx} + 2xy = 4x^2$ is

(A) $(1 + x^2)y = x^3$
(B) $3(1 + x^2)y = 2x^3$
(C) $(1 + x^2)y = 3x^3$
(D) $3(1 + x^2)y = 4x^3$

Answer: (D) $3(1 + x^2)y = 4x^3$ · Key from source paper

EdLoop JEE

Q232 JEE Main 2013 · 23 Apr · Online MCQ

If a curve passes through the point $\left(2, \frac{7}{2}\right)$ and has slope $\left(1 - \frac{1}{x^2}\right)$ at any point (x, y) on it, then the ordinate of the point on the curve whose abscissa is -2 is :

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

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

Q233 JEE Main 2013 · 22 Apr · Online MCQ

Consider the differential equation :
$\frac{dy}{dx} = \frac{y^3}{2(xy^2 - x^2)}$
Statement-1: The substitution $z = y^2$ transforms the above equation into a first order homogenous differential equation. Statement-2: The solution of this differential equation is $y^2 e^{-y^2/x} = C$.

(A) Both statements are false.
(B) Statement-1 is true and statement- 2 is false.
(C) Statement-1 is false and statement-2 is true.
(D) Both statements are true.

Answer: (D) Both statements are true. · Key from source paper

Q234 AIEEE 2012 · 26 May · Online MCQ

The integrating factor of the differential equation $\left(x^2 - 1\frac{dy}{dx} + 2\right) xy = x$ is

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

Answer: (B) $x^2 - 1$ · Key from source paper

Q235 AIEEE 2012 · 19 May · Online MCQ

The general solution of the differential equation $\frac{dy}{dx} + \frac{2}{x}y = x^2$ is

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

Answer: (D) $y = cx^{-2} + \frac{x^3}{5}$ · Key from source paper

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Q236 AIEEE 2012 · 12 May · Online MCQ

Statement 1: The degrees of the differential equations $\frac{dy}{dx} + y^2 = x$ and $\frac{d^2y}{dx^2} + y = \sin x$ are equal.
Statement 2: The degree of a differential equation, when it is a polynomial equation in derivatives, is the highest positive integral power of the highest order derivative involved in the differential equation, otherwise degree is not defined.

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

Answer: (D) Statement 1 is true, Statement 2 is true; Statement 2 is a correct explanation of Statement 1. · Key from source paper

Q237 AIEEE 2012 · 7 May · Online MCQ

Let $y(x)$ be a solution of $\frac{(2+\sin x)}{(1+y)}\frac{dy}{dx} = \cos x$. If $y(0) = 2$, then $y\left(\frac{\pi}{2}\right)$ equals

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

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

Q238 AIEEE 2012 · Offline MCQ

The population $\mathrm{p}(t)$ at time t of a certain mouse species satisfies the differential equation $\frac{\mathrm{dp}(t)}{\mathrm{dt}} = 0.5\,\mathrm{p}(t) - 450$. If $p(0) = 850$, then the time at which the population becomes zero is

(A) $2\ln 18$
(B) $\ln 9$
(C) $\frac{1}{2}\ln 18$
(D) $\ln 18$

Answer: (A) $2\ln 18$ · Key from source paper

Q239 AIEEE 2011 MCQ

If $\frac{dy}{dx} = y + 3 > 0$ and $y(0) = 2$, then $y(\ln 2)$ is equal to

(A) 5
(B) 13
(C) -2
(D) 7

Answer: (D) 7 · Key from source paper

Q240 AIEEE 2011 MCQ

Let I be the purchase value of an equipment and V(t) be the value after it has been used for t years. The value V(t) depreciates at a rate given by differential equation $\frac{dV(t)}{dt} = -k(T-t)$, where k > 0 is a constant and T is the total life in years of the equipment. Then the scrap value V(T) of the equipment is

(A) $I - \frac{kT^2}{2}$
(B) $1 - \frac{k(T-t)^2}{2}$
(C) e^{-kT}
(D) $T^2 - \frac{1}{k}$

Answer: (A) $I - \frac{kT^2}{2}$ · Key from source paper

Q241 AIEEE 2010 MCQ

Solution of the differential equation $\cos x\, dy = y(\sin x - y)dx$, $0 < x < \frac{\pi}{2}$ is

(A) $y \sec x = \tan x + c$
(B) $y \tan x = \sec x + c$
(C) $\tan x = (\sec x + c)y$
(D) $\sec x = (\tan x + c)y$

Answer: (D) $\sec x = (\tan x + c)y$ · Key from source paper

Q242 AIEEE 2009 MCQ

The differential equation which represents the family of curves $y = c_1 e^{c_2 x}$, where c_1 and c_2 are arbitrary constants is

(A) $y' = y^2$
(B) $y'' = y'y$
(C) $yy'' = y'$
(D) $yy'' = (y')^2$

Answer: (D) $yy'' = (y')^2$ · Key from source paper

Q243 AIEEE 2008 MCQ

The solution of the differential equation $\frac{dy}{dx} = \frac{x+y}{x}$ satisfying the condition $y(1) = 1$ is

(A) $y = \ln x + x$
(B) $y = x \ln x + x^2$
(C) $y = xe^{(x-1)}$
(D) $y = x \ln x + x$

Answer: (D) $y = x \ln x + x$ · Key from source paper

Q244 AIEEE 2008 MCQ

The differential equation of the family of circles with fixed radius 5 units and centre on the line $y = 2$ is

(A) $(x-2)y'^2 = 25 - (y-2)^2$
(B) $(y-2)y'^2 = 25 - (y-2)^2$
(C) $(y-2)^2y'^2 = 25 - (y-2)^2$
(D) $(x-2)^2y'^2 = 25 - (y-2)^2$

Answer: (C) $(y-2)^2y'^2 = 25 - (y-2)^2$ · Key from source paper

Q245 AIEEE 2007 MCQ

The normal to a curve at $P(x, y)$ meets the x-axis at G. If the distance of G from the origin is twice the abscissa of P, then the curve is a

(A) ellipse
(B) parabola
(C) circle
(D) pair of straight lines

Answer: (A) ellipse · Key from source paper

Q246 AIEEE 2007 MCQ

The differential equation of all circles passing through the origin and having their centres on the x-axis is

(A) $x^2 = y^2 + xy\frac{dy}{dx}$
(B) $x^2 = y^2 + 3xy\frac{dy}{dx}$
(C) $y^2 = x^2 + 2xy\frac{dy}{dx}$
(D) $y^2 = x^2 - 2xy\frac{dy}{dx}$

Answer: (C) $y^2 = x^2 + 2xy\frac{dy}{dx}$ · Key from source paper

Q247 AIEEE 2006 MCQ

The differential equation whose solution is $Ax^2 + By^2 = 1$, where A and B are arbitrary constants is of

(A) second order and second degree
(B) first order and second degree
(C) first order and first degree
(D) second order and first degree

Answer: (D) second order and first degree · Key from source paper

Q248 AIEEE 2005 MCQ

The differential equation representing the family of curves $y^2 = 2c(x + \sqrt{c})$, where $c > 0$, is a parameter, is of order and degree as follows:

(A) order 1 , degree 2
(B) order 1, degree 1
(C) order 1, degree 3
(D) order 2, degree 2

Answer: (C) order 1, degree 3 · Key from source paper

Q249 AIEEE 2005 MCQ

If $x\frac{dy}{dx} = y(\log y - \log x + 1)$, then the solution of the equation is

(A) $y \log\left(\frac{x}{y}\right) = cx$
(B) $x \log\left(\frac{y}{x}\right) = cy$
(C) $\log\left(\frac{y}{x}\right) = cx$
(D) $\log\left(\frac{x}{y}\right) = cy$

Answer: (C) $\log\left(\frac{y}{x}\right) = cx$ · Key from source paper

Q250 AIEEE 2004 MCQ

The differential equation for the family of curves $x^2 + y^2 - 2ay = 0$, where a is an arbitrary constant is

(A) $2(x^2 - y^2)y' = xy$
(B) $2(x^2 + y^2)y' = xy$
(C) $(x^2 - y^2)y' = 2xy$
(D) $(x^2 + y^2)y' = 2xy$

Answer: (C) $(x^2 - y^2)y' = 2xy$ · Key from source paper

Q251 AIEEE 2004 MCQ

The solution of the differential equation $ydx + (x + x^2y)dy = 0$ is

(A) $-\frac{1}{xy}=C$
(B) $-\frac{1}{xy}+\log y=C$
(C) $\frac{1}{xy}+\log y=C$
(D) $\log y=Cx$

Answer: (B) $-\frac{1}{xy}+\log y=C$ · Key from source paper

Q252 AIEEE 2003 MCQ

The degree and order of the differential equation of the family of all parabolas whose axis is X-axis, are respectively.

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

Answer: (C) 1,2 · Checked by our team

Q253 AIEEE 2003 MCQ

The solution of the differential equation $\left(1+y^2\right)+\left(x-e^{\tan^{-1}y}\right)\frac{dy}{dx}=0$, is

(A) $xe^{2\tan^{-1}y}=e^{\tan^{-1}y}+k$
(B) $(x-2)=ke^{2\tan^{-1}y}$
(C) $2xe^{\tan^{-1}y}=e^{2\tan^{-1}y}+k$
(D) $xe^{\tan^{-1}y}=\tan^{-1}y+k$

Answer: (C) $2xe^{\tan^{-1}y}=e^{2\tan^{-1}y}+k$ · Key from source paper

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Q254 AIEEE 2002 MCQ

The order and degree of the differential equation $\left(1+3\frac{dy}{dx}\right)^{2/3}=4\frac{d^3y}{dx^3}$ are

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

Answer: (C) (3, 3) · Key from source paper

Q255 AIEEE 2002 MCQ

The solution of the equation $\frac{d^2y}{dx^2}=e^{-2x}$

(A) $\frac{e^{-2x}}{4}$

(B) $\frac{e^{-2x}}{4} + cx + d$

(C) $\frac{1}{4}e^{-2x} + cx^2 + d$

(D) $\frac{1}{4}e^{-4x} + cx + d$

Answer: (B) $\frac{e^{-2x}}{4} + cx + d$ · Key from source paper

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