

JEE MAIN DIFFERENTIAL EQUATIONS — PYQS

Max. Marks: 352

Questions: 88

Section A (MCQ) — 57 questions

Q.1 Let $y = y(x)$ be the solution of the differential equation

$$x\sqrt{1-x^2} dy + (y\sqrt{1-x^2} - x\cos^{-1}x) dx = 0,$$

$x \in (0, 1)$, $\lim_{x \rightarrow 1^-} y(x) = 1$. Then $y\left(\frac{1}{2}\right)$ equals :

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

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

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

Scan or tap for the full solution



Q.2 Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be such that $f(xy) = f(x)f(y)$, for all $x, y \in \mathbb{R}$ and $f(0) \neq 0$. Let $g: [1, \infty) \rightarrow \mathbb{R}$ be a differentiable function such that

$$x^2 g(x) = \int_1^x (t^2 f(t) - t g(t)) dt.$$

Then $g(2)$ is equal to :

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

(1) $\frac{13}{8}$ (2) $\frac{11}{16}$ (3) $\frac{15}{32}$ (4) $\frac{17}{64}$

Scan or tap for the full solution



Q.3 Let $f(x)$ and $g(x)$ be twice differentiable functions satisfying $f''(x) = g''(x)$ for all $x \in \mathbb{R}$, $f'(1) = 2g'(1) = 4$ and $g(2) = 3f(2) = 9$. Then $f(25) - g(25)$ is equal to :

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

(1) 20 (2) 40 (3) -20 (4) -40

Scan or tap for the full solution



Q.4 Let $y = y(x)$ be the solution of the differential equation $\frac{dy}{dx} = (1+x+x^2)(1-y+y^2)$, $y(0) = \frac{1}{2}$.

Then $(2y(1) - 1)$ is equal to :

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

(1) $\sqrt{3} \tan\left(\frac{11\sqrt{3}}{6}\right)$ (2) $\frac{\sqrt{3}}{2} \tan\left(\frac{11\sqrt{3}}{12}\right)$

(3) $\sqrt{3} \tan\left(\frac{11\sqrt{3}}{12}\right)$ (4) $\frac{\sqrt{3}}{2} \tan\left(\frac{11\sqrt{3}}{6}\right)$

Scan or tap for the full solution



Q.5 Let $y = y(x)$ be the solution of the differential equation :

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

$x \in (-1, 2)$, satisfying $y(0) = \frac{3}{2}$. If $y(1) = \alpha(2 + e^{-2})$,

then α is equal to :

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

(1) $\frac{13}{8}$ (2) $\frac{6}{13}$ (3) $\frac{12}{13}$ (4) $\frac{13}{12}$

Scan or tap for the full solution



Q.6 If the curve $y = f(x)$ passes through the point $(1, e)$ and satisfies the differential equation $dy = y(2 + \log_e x) dx$, $x > 0$, then $f(e)$ is equal to :

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

(1) e^e (2) e^{e^2} (3) e^{2e} (4) e^{2^e}

Scan or tap for the full solution



Q.7 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 :

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

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

Scan or tap for the full solution



Q.8 Let $x = x(y)$ be the solution of the differential equation $2y^2 \frac{dx}{dy} - 2xy + x^2 = 0$, $y > 1$, $x(e) = e$.

Then $x(e^2)$ is equal to:

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

(1) $\frac{3}{2}e^2$ (2) $\frac{2}{3}e^2$ (3) e^2 (4) $2e^2$

Scan or tap for the full solution



Q.9 Let $y = y(x)$ be the solution of the differential equation

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

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

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

(1) $-\frac{7}{4}$ (2) $-\frac{3}{4}$ (3) $\frac{3}{4}$ (4) $\frac{7}{4}$

Scan or tap for the full solution



Q.10 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 :

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

(1) -3π (2) 3π (3) $-\pi$ (4) π

Scan or tap for the full solution



Q.11 Let $y = y(x)$ be a differentiable function in the interval $(0, \infty)$ such that $y(1) = 2$, and

$\lim_{t \rightarrow x} \left(\frac{t^2 y(x) - x^2 y(t)}{x - t} \right) = 3$ for each $x > 0$. Then $2y(2)$ is equal to :

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

(1) 27 (2) 18 (3) 23 (4) 12

Scan or tap for the full solution



Q.12 Let $y = y(x)$ be the solution of the differential equation

$x^4 dy + (4x^3 y + 2 \sin x) dx = 0$, $x > 0$, $y\left(\frac{\pi}{2}\right) = 0$.

Then $\pi^4 y\left(\frac{\pi}{3}\right)$ is equal to :

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

(1) 92 (2) 72 (3) 64 (4) 81

Scan or tap for the full solution



Q.13 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

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

(1) 6 (2) 4 (3) 1 (4) 2

Scan or tap for the full solution



Q.14 Let $f: [1, \infty) \rightarrow \mathbb{R}$ be a differentiable function. If $6 \int_1^x f(t) dt = 3xf(x) + x^3 - 4$ for all $x \geq 1$, then the value of $f(2) - f(3)$ is :

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

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

Scan or tap for the full solution



Q.15 If $y = y(x)$ satisfies the differential equation

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

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

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

Scan or tap for the full solution



Q.16 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 :

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

(1) $\frac{4}{e^{\pi/4}} - \frac{\pi}{2} - 1$ (2) $\frac{2}{e^{\pi/4}} + \frac{\pi}{4} - 1$
(3) $\frac{4}{e^{\pi/4}} + \frac{\pi}{2} - 1$ (4) $\frac{2}{e^{\pi/4}} - \frac{\pi}{4} - 1$

Scan or tap for the full solution



Q.17 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 :

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

(1) $-\frac{5}{2}$ (2) $-3\sqrt{2} - 7$
(3) $-\frac{5}{4}$ (4) $-3\sqrt{3} - 7$

Scan or tap for the full solution



Q.18 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

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

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

Scan or tap for the full solution



Q.19 Let $y = y(x)$ be the solution curve of the differential equation $x(x^2 + e^x)dy + (e^x(x-2)y - x^3)dx = 0$, $x > 0$, passing through the point $(1, 0)$. Then $y(2)$ is equal to :

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

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

Scan or tap for the full solution



Q.20 Let $y = y(x)$ be the solution of the differential equation $(x^2 + 1)y' - 2xy = (x^4 + 2x^2 + 1)\cos x$, $y(0) = 1$. Then $\int_{-3}^3 y(x) dx$ is :

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

- (1) 36 (2) 24 (3) 18 (4) 30

Scan or tap for the full solution 

Q.21 Let $f: [0, \infty) \rightarrow \mathbb{R}$ be a differentiable function such that

$$f(x) = 1 - 2x + \int_0^x e^{x-t} f(t) dt \text{ for all } x \in [0, \infty).$$

Then the area of the region bounded by $y = f(x)$ and the coordinate axes is

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

- (1) $\sqrt{5}$ (2) 2 (3) $\sqrt{2}$ (4) $\frac{1}{2}$

Scan or tap for the full solution 

Q.22 If a curve $y = y(x)$ passes through the point $(1, \frac{\pi}{2})$ and satisfies the differential equation

$$(7x^4 \cot y - e^x \operatorname{cosec} y) \frac{dy}{dx} = x^5, \quad x \geq 1, \text{ then at } x = 2,$$

the value of $\cos y$ is :

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

- (1) $\frac{2e^2 + e}{64}$ (2) $\frac{2e^2 - e}{64}$
(3) $\frac{2e^2 - e}{128}$ (4) $\frac{2e^2 + e}{128}$

Scan or tap for the full solution 

Q.23 Let g be a differentiable function such that $\int_0^x g(t) dt = x - \int_0^x t g(t) dt$, $x \geq 0$ and let $y = y(x)$ satisfy the differential equation

$$\frac{dy}{dx} - y \tan x = 2(x+1) \sec x g(x), \quad x \in \left[0, \frac{\pi}{2}\right]. \text{ If}$$

$y(0) = 0$, then $y\left(\frac{\pi}{3}\right)$ is equal to

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

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

Scan or tap for the full solution 

Q.24 Let $y = y(x)$ be the solution of the differential equation

$$\frac{dy}{dx} + 3(\tan^2 x)y + 3y = \sec^2 x, \quad y(0) = \frac{1}{3} + e^3. \text{ Then}$$

$y\left(\frac{\pi}{4}\right)$ is equal to :

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

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

Scan or tap for the full solution 

Q.25 Let $f: [1, \infty) \rightarrow [2, \infty)$ be a differentiable function. If $10 \int_1^x f(t) dt = 5xf(x) - x^5 - 9$ for all $x \geq 1$, then the value of $f(3)$ is :

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

- (1) 22 (2) 26 (3) 32 (4) 18

Scan or tap for the full solution 

Q.26 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 : [JEE Main 2025 (Online) 29th January Morning Shift]

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

Scan or tap for the full solution 

Q.27 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:

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

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

Scan or tap for the full solution 

Q.28 Let for some function $y = f(x)$, $\int_0^x tf(t) dt = x^2 f(x)$, $x > 0$ and $f(2) = 3$. Then $f(6)$ is equal to

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

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

Scan or tap for the full solution 

Q.29 Let $y = y(x)$ be the solution of the differential equation

$$(xy - 5x^2 \sqrt{1+x^2}) dx + (1+x^2) dy = 0, \quad y(0) = 0.$$

Then $y(\sqrt{3})$ is equal to

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

(1) $\frac{5\sqrt{3}}{2}$ (2) $\sqrt{\frac{15}{2}}$ (3) $\sqrt{\frac{14}{3}}$ (4) $2\sqrt{2}$

Scan or tap for the full solution



Q.30 Let $f: (0, \infty) \rightarrow \mathbb{R}$ 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 :

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

(1) 19 (2) 23 (3) 29 (4) 39

Scan or tap for the full solution



Q.31 Let a curve $y = f(x)$ pass through the points $(0, 5)$ and $(\log_e 2, k)$. If the curve satisfies the differential equation $2(3 + y)e^{2x}dx - (7 + e^{2x})dy = 0$, then k is equal to

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

(1) 32 (2) 8 (3) 4 (4) 16

Scan or tap for the full solution



Q.32 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 :

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

(1) $2(\log_e 2) - 1$ (2) $1 - 2(\log_e 2)^2$
(3) $1 - 2(\log_e 2)$ (4) $2(\log_e 2)^2 - 1$

Scan or tap for the full solution



Q.33 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 :

[JEE Main 2025 (Online) 22nd January Morning Shift]

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

Scan or tap for the full solution



Q.34 If $x = f(y)$ is the solution of the differential equation $(1 + y^2) + (x - 2e^{\tan^{-1}y}) \frac{dy}{dx} = 0$, $y \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ with $f(0) = 1$, then $f\left(\frac{1}{\sqrt{3}}\right)$ is equal to :

[JEE Main 2025 (Online) 22nd January Evening Shift]

(1) $e^{\pi/4}$ (2) $e^{\pi/12}$ (3) $e^{\pi/6}$ (4) $e^{\pi/3}$

Scan or tap for the full solution



Q.35 The solution of the differential equation $(x^2 + y^2)dx - 5xy dy = 0$, $y(1) = 0$, is :

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

(1) $|x^2 - 4y^2|^5 = x^2$ (2) $|x^2 - 2y^2|^6 = x$
(3) $|x^2 - 2y^2|^5 = x^2$ (4) $|x^2 - 4y^2|^6 = x$

Scan or tap for the full solution



Q.36 The solution curve, of the differential equation $2y \frac{dy}{dx} + 3 = 5 \frac{dy}{dx}$, passing through the point $(0, 1)$ is a conic, whose vertex lies on the line :

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

(1) $2x + 3y = -9$ (2) $2x + 3y = -6$
(3) $2x + 3y = 9$ (4) $2x + 3y = 6$

Scan or tap for the full solution



Q.37 Let $\int_0^x \sqrt{1 - (y'(t))^2} dt = \int_0^x y(t) dt$, $0 \leq x \leq 3$, $y \geq 0$, $y(0) = 0$. Then at $x = 2$, $y'' + y + 1$ is equal to

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

(1) $\sqrt{2}$ (2) 2 (3) $1/2$ (4) 1

Scan or tap for the full solution



Q.38 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

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

(1) $(8e^x + 1) \frac{d^2y}{dx^2} - \frac{dy}{dx} = 0$
(2) $(8e^x + 1) \frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$
(3) $(8e^x - 1) \frac{d^2y}{dx^2} - \frac{dy}{dx} = 0$
(4) $(8e^x - 1) \frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$

Scan or tap for the full solution



Q.39 Let $y = y(x)$ be the solution of the differential equation

$(1 + y^2)e^{\tan x} dx + \cos^2 x (1 + e^{2 \tan x}) dy = 0$, $y(0) = 1$.

Then $y\left(\frac{\pi}{4}\right)$ is equal to

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

(1) $\frac{1}{e^2}$ (2) $\frac{2}{e^2}$ (3) $\frac{2}{e}$ (4) $\frac{1}{e}$

Scan or tap for the full solution



Q.40 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:

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

- (1) $\frac{\pi}{6}$ (2) $\frac{\pi}{12}$ (3) $\frac{\pi}{3}$ (4) $\frac{\pi}{4}$

Scan or tap for the full solution



Q.41 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 $y(e^{-1}) = 0$. Then, $y(e)$ is equal to

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

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

Scan or tap for the full solution



Q.42 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

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

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

Scan or tap for the full solution



Q.43 Suppose the solution of the differential equation $\frac{dy}{dx} = \frac{(2 + \alpha)x - \beta y + 2}{\beta x - 2\alpha y - (\beta y - 4\alpha)}$ represents a circle passing through origin. Then the radius of this circle is :

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

- (1) $\sqrt{17}$ (2) 2 (3) $\frac{\sqrt{17}}{2}$ (4) $\frac{1}{2}$

Scan or tap for the full solution



Q.44 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 :

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

- (1) $e^{-\pi/8}$ (2) $e^{\pi/4}$ (3) $e^{-\pi/4}$ (4) $e^{\pi/8}$

Scan or tap for the full solution



Q.45 The differential equation of the family of circles passing through the origin and having centre at the line $y = x$ is :

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

- (1) $(x^2 - y^2 + 2xy)dx = (x^2 - y^2 + 2xy)dy$
(2) $(x^2 + y^2 - 2xy)dx = (x^2 + y^2 + 2xy)dy$
(3) $(x^2 + y^2 + 2xy)dx = (x^2 + y^2 - 2xy)dy$

$$(4) (x^2 - y^2 + 2xy)dx = (x^2 - y^2 - 2xy)dy$$

Scan or tap for the full solution



Q.46 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 :

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

- (1) $-\frac{\pi}{12}$ (2) $\frac{\pi}{2}$ (3) 0 (4) $\frac{\pi}{4}$

Scan or tap for the full solution



Q.47 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

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

- (1) 2π (2) $\frac{\pi}{8}$ (3) $\frac{\pi}{16}$ (4) $\frac{\pi}{32}$

Scan or tap for the full solution



Q.48 Let $y = y(x)$ be the solution of the differential equation $\frac{dy}{dx} = 2x(x + y)^3 - x(x + y) - 1$, $y(0) = 1$.

Then, $\left(\frac{1}{\sqrt{2}} + y\left(\frac{1}{\sqrt{2}}\right)\right)^2$ equals :

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

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

Scan or tap for the full solution



Q.49 Let α be a non-zero real number. Suppose $f: \mathbb{R} \rightarrow \mathbb{R}$ is a differentiable function such that $f(0) = 2$ and $\lim_{x \rightarrow -\infty} f(x) = 1$. If $f'(x) = \alpha f(x) + 3$, for all $x \in \mathbb{R}$, then $f(-\log_e 2)$ is equal to :

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

- (1) 7 (2) 9 (3) 3 (4) 5

Scan or tap for the full solution



Q.50 Let $y = y(x)$ be the solution of the differential equation $\frac{dy}{dx} = \frac{(\tan x) + y}{\sin x(\sec x - \sin x \tan x)}$, $x \in \left(0, \frac{\pi}{2}\right)$ satisfying the condition $y\left(\frac{\pi}{4}\right) = 2$. Then, $y\left(\frac{\pi}{3}\right)$ is

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

- (1) $\sqrt{3}(2 + \log_e 3)$
(2) $\sqrt{3}(1 + 2\log_e 3)$
(3) $\sqrt{3}(2 + \log_e \sqrt{3})$

$$(4) \frac{\sqrt{3}}{2}(2 + \log_e 3)$$

Scan or tap for the full solution



- Q.51** 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

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

- (1) $\left| \log_e \frac{y}{x} \right| = y^2$ (2) $\left| \log_e \frac{y}{x} \right| = x$
 (3) $\left| \log_e \frac{x}{y} \right| = y$ (4) $2 \left| \log_e \frac{x}{y} \right| = y + 1$

Scan or tap for the full solution



- Q.52** The temperature $T(t)$ of a body at time $t = 0$ is 160°F and it decreases continuously as per the differential equation $\frac{dT}{dt} = -K(T - 80)$, where K is a positive constant. If $T(15) = 120^\circ\text{F}$, then $T(45)$ is equal to

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

- (1) 90°F (2) 85°F (3) 80°F (4) 95°F

Scan or tap for the full solution



- Q.53** 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:

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

- (1) $2\{\sin(2) + 1\}$ (2) 2
 (3) 1 (4) $2\{1 - \sin(2)\}$

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- Q.54** A function $y = f(x)$ satisfies $f(x)\sin 2x + \sin x - (1 + \cos^2 x)f'(x) = 0$ with condition $f(0) = 0$. Then, $f\left(\frac{\pi}{2}\right)$ is equal to

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

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

Scan or tap for the full solution



- Q.55** 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

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

- (1) 12 (2) 9 (3) 4 (4) 3

Scan or tap for the full solution



- Q.56** 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, $a, b \in \mathbb{R}$. Given that $x(0) = 2$; $y(0) = 1$ and $3y(1) = 2x(1)$, the value of t , for which $x(t) = y(t)$, is :

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

- (1) $\log_{\frac{2}{3}} 2$ (2) $\log_{\frac{4}{3}} 2$ (3) $\log_4 3$ (4) $\log_3 4$

Scan or tap for the full solution



- Q.57** If $y = y(x)$ is the solution curve of the differential equation

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

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

- (1) $\frac{3}{1 + (8)^{1/4}}$ (2) $\frac{3}{1 - (8)^{1/4}}$
 (3) $\frac{3}{1 - 2\sqrt{2}}$ (4) $\frac{3}{1 + 2\sqrt{2}}$

Scan or tap for the full solution



Section B (Numerical) — 31 questions

- Q.58** Let $y = y(x)$ be the solution of the differential equation

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

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

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- Q.59** 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 values of p , for which the equation $x^2 + y^2 - 2px + 2py + \alpha + 2 = 0$ represents a circle of radius $r \leq 6$, is _____.

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

Scan or tap for the full solution



- Q.60** Let $y = y(x)$ be the solution of the differential equation
 $(\tan x)^{1/2} dy = (\sec^3 x - (\tan x)^{3/2} y) dx$, $0 < x < \frac{\pi}{2}$,
 $y\left(\frac{\pi}{4}\right) = \frac{6\sqrt{2}}{5}$. If $y\left(\frac{\pi}{3}\right) = \frac{4}{5}\alpha$, then α^4 equals
 _____. [JEE Main 2026 (Online) 5th April Evening Shift]

Scan or tap for the
full solution



- Q.61** Let f be a twice differentiable function such that
 $f(x) = \int_0^x \tan(t-x) dt - \int_0^x f(t) \tan t dt$, $x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$.
 Then $f''\left(\frac{\pi}{6}\right) + 12f'\left(-\frac{\pi}{6}\right) + f\left(\frac{\pi}{6}\right)$ is equal to _____.
 [JEE Main 2026 (Online) 4th April Evening Shift]

Scan or tap for the
full solution



- Q.62** Let a differentiable function f satisfy the equation
 $\int_0^{36} f\left(\frac{tx}{36}\right) dt = 4\alpha f(x)$. If $y = f(x)$ is a standard
 parabola passing through the points $(2, 1)$ and
 $(-4, \beta)$, then β^α is equal to _____.
 [JEE Main 2026 (Online) 24th January Morning Shift]

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full solution



- Q.63** Let f be a twice differentiable non-negative function
 such that
 $(f(x))^2 = 25 + \int_0^x ((f(t))^2 + (f'(t))^2) dt$. Then the mean of
 $f(\log_e(1)), f(\log_e(2)), \dots, f(\log_e(625))$ is equal to
 _____.
 [JEE Main 2026 (Online) 23rd January Morning Shift]

Scan or tap for the
full solution



- Q.64** 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 _____.
 [JEE Main 2026 (Online) 23rd January Evening Shift]

Scan or tap for the
full solution



- Q.65** Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a thrice differentiable odd
 function satisfying $f'(x) \geq 0$, $f''(x) = f(x)$, $f(0) = 0$,
 $f'(0) = 3$. Then $9f(\log_e 3)$ is equal to _____.
 [JEE Main 2025 (Online) 2nd April Morning Shift]

Scan or tap for the
full solution



- Q.66** 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
 _____.
 [JEE Main 2025 (Online) 2nd April Evening Shift]

Scan or tap for the
full solution



- Q.67** Let $f: (0, \infty) \rightarrow \mathbb{R}$ be a twice differentiable
 function. If for some $a \neq 0$, $\int_0^1 f(\lambda x) d\lambda = af(x)$,
 $f(1) = 1$ and $f(16) = \frac{1}{8}$, then $16 - f\left(\frac{1}{16}\right)$ is equal to
 _____.
 [JEE Main 2025 (Online) 29th January Morning Shift]

Scan or tap for the
full solution



- Q.68** If $y = y(x)$ is the solution of the differential
 equation,
 $\sqrt{4-x^2} \frac{dy}{dx} = \left(\left(\sin^{-1}\left(\frac{x}{2}\right)\right)^2 - y\right) \sin^{-1}\left(\frac{x}{2}\right)$, $-2 \leq$
 $x \leq 2$, $y(2) = \frac{\pi^2 - 8}{4}$, then $y^2(0)$ is equal to
 _____.
 [JEE Main 2025 (Online) 28th January Evening Shift]

Scan or tap for the
full solution



- Q.69** Let f be a differentiable function such that
 $2(x+2)^2 f(x) - 3(x+2)^2 = 10 \int_0^x (t+2) f(t) dt$, $x \geq 0$.
 Then $f(2)$ is equal to _____.
 [JEE Main 2025 (Online) 24th January Morning Shift]

Scan or tap for the
full solution



- Q.70** 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 _____.
 [JEE Main 2025 (Online) 24th January Evening Shift]

Scan or tap for the
full solution



- Q.71** 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 $6 \int_{-1/2}^{1/2} f(x) dx = 2\pi - \alpha$ then α^2 is equal
 to _____.
 [JEE Main 2025 (Online) 22nd January Evening Shift]

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full solution



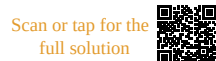
- Q.72** For a differentiable function $f: \mathbb{R} \rightarrow \mathbb{R}$, suppose $f'(x) = 3f(x) + \alpha$, where $\alpha \in \mathbb{R}$, $f(0) = 1$ and $\lim_{x \rightarrow -\infty} f(x) = 7$. Then $9f(-\log_e 3)$ is equal to _____. [JEE Main 2024 (Online) 9th April Evening Shift]



- Q.73** Let $\alpha|x| = |y|e^{xy-\beta}$, $\alpha, \beta \in \mathbb{N}$ 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 _____. [JEE Main 2024 (Online) 8th April Evening Shift]



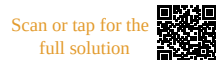
- Q.74** Let a conic C pass through the point $(4, -2)$ and $P(x, y)$, $x \geq 3$, be any point on C . Let the slope of the line touching the conic C only at a single point P be half the slope of the line joining the points P and $(3, -5)$. If the focal distance of the point $(7, 1)$ on C is d , then $12d$ equals _____. [JEE Main 2024 (Online) 6th April Morning Shift]



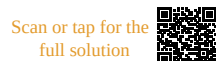
- Q.75** If the solution $y(x)$ of the given differential equation $(e^y + 1)\cos x dx + e^y \sin x dy = 0$ passes through the point $(\frac{\pi}{2}, 0)$, then the value of $e^{y(\frac{\pi}{6})}$ is equal to _____. [JEE Main 2024 (Online) 6th April Evening Shift]



- Q.76** Let f be a differentiable function in the interval $(0, \infty)$ such that $f(1) = 1$ and $\lim_{t \rightarrow x} \frac{t^2 f(x) - x^2 f(t)}{t - x} = 1$ for each $x > 0$. Then $2f(2) + 3f(3)$ is equal to _____. [JEE Main 2024 (Online) 5th April Morning Shift]



- Q.77** 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 _____. [JEE Main 2024 (Online) 5th April Evening Shift]



- Q.78** Let the solution $y = y(x)$ of the differential equation $\frac{dy}{dx} - y = 1 + 4\sin x$ satisfy $y(\pi) = 1$. Then $y(\frac{\pi}{2}) + 10$ is equal to _____. [JEE Main 2024 (Online) 4th April Morning Shift]



- Q.79** 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 $[0, \frac{\pi}{3}]$ 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 _____. [JEE Main 2024 (Online) 4th April Evening Shift]



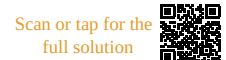
- Q.80** If $x = x(t)$ is the solution of the differential equation $(t+1)dx = (2x + (t+1)^4)dt$, $x(0) = 2$, then $x(1)$ equals _____. [JEE Main 2024 (Online) 1st February Morning Shift]



- Q.81** If $\frac{dx}{dy} = \frac{1+x-y^2}{y}$, $x(1) = 1$, then $5x(2)$ is equal to _____. [JEE Main 2024 (Online) 1st February Evening Shift]



- Q.82** Let $y = y(x)$ be the solution of the differential equation $\sec^2 x dx + (e^{2y} \tan^2 x + \tan x) dy = 0$, $0 < x < \frac{\pi}{2}$, $y(\pi/4) = 0$. If $y(\pi/6) = \alpha$, then $e^{8\alpha}$ is equal to _____. [JEE Main 2024 (Online) 31st January Evening Shift]



- Q.83** Let $y = y(x)$ be the solution of the differential equation $(1-x^2)dy = [xy + (x^3+2)\sqrt{3(1-x^2)}]dx$, $-1 < x < 1$, $y(0) = 0$. If $y(\frac{1}{2}) = \frac{m}{n}$, m and n are co-prime numbers, then $m + n$ is equal to _____. [JEE Main 2024 (Online) 30th January Morning Shift]



- Q.84** 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 $12Y(2)$ equals _____.

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

Scan or tap for the full solution



- Q.85** If the solution curve $y = y(x)$ of the differential equation $(1 + y^2)(1 + \log_e x)dx + x dy = 0, x > 0$ passes through the point $(1, 1)$ and

$$y(e) = \frac{\alpha - \tan\left(\frac{3}{2}\right)}{\beta + \tan\left(\frac{3}{2}\right)}, \text{ then } \alpha + 2\beta \text{ is } \underline{\hspace{2cm}}.$$

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

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- Q.86** Let $f(x) = \sqrt{\lim_{r \rightarrow x} \left\{ \frac{2r^2[(f(r))^2 - f(x)f(r)]}{r^2 - x^2} - r^3 e^{\frac{f(r)}{r}} \right\}}$ be differentiable in $(-\infty, 0) \cup (0, \infty)$ and $f(1) = 1$. Then the value of ea , such that $f(a) = 0$, is equal to _____.

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

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- Q.87** 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 _____.

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

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- Q.88** If the solution curve, of the differential equation $\frac{dy}{dx} = \frac{x+y-2}{x-y}$ passing through the point $(2, 1)$ is $\tan^{-1}\left(\frac{y-1}{x-1}\right) - \frac{1}{\beta} \log_e \left(\alpha + \left(\frac{y-1}{x-1}\right)^2 \right) = \log_e |x-1|$, then $5\beta + \alpha$ is equal to _____.

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

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**ANSWER KEY****Section A (MCQ) — 57 questions**

Ques.	1	2	3	4	5
Ans.	1	3	2	3	4
Ques.	6	7	8	9	10
Ans.	3	4	2	4	3
Ques.	11	12	13	14	15
Ans.	3	4	2	2	1
Ques.	16	17	18	19	20
Ans.	2	1	2	3	2
Ques.	21	22	23	24	25
Ans.	4	3	1	1	3
Ques.	26	27	28	29	30
Ans.	4	2	1	1	4
Ques.	31	32	33	34	35
Ans.	2	4	4	3	1
Ques.	36	37	38	39	40
Ans.	3	4	2	4	4
Ques.	41	42	43	44	45
Ans.	1	2	3	3	4
Ques.	46	47	48	49	50
Ans.	4	4	4	BONUS	3
Ques.	51	52	53	54	55
Ans.	3	1	2	2	4
Ques.	56	57			
Ans.	2	1			

Section B (Numerical) — 31 questions

Ques.	58	59	60	61	62	63	64
Ans.	3	6	48	5	64	1565	16
Ques.	65	66	67	68	69	70	71
Ans.	36	21	112	4	19	1	27
Ques.	72	73	74	75	76	77	78
Ans.	61	4	75	3	24	18	7
Ques.	79	80	81	82	83	84	85
Ans.	31	14	5	9	97	20	3
Ques.	86	87	88				
Ans.	2	29	11				