

PYQSide

JEE MAIN DIFFERENTIAL EQUATIONS — LINEAR DIFFERENTIAL EQUATIONS — PYQS

Max. Marks: 96

Questions: 24

Section A (MCQ)

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

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

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

[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 $y = y(x)$ 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.4 Let $y = y(x)$ be the solution of the differential equation

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

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.5 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

$$6y\left(\frac{\pi}{6}\right) - 8y\left(\frac{\pi}{4}\right) \text{ is equal to :}$$

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

- (1) -3π (2) 3π (3) $-\pi$ (4) π

Scan or tap for the full solution



Q.6 Let $y = y(x)$ be a differentiable function in the interval $(0, \infty)$ such that $y(1) = 2$, and

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

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

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

Scan or tap for the full solution



Q.7 Let $y = y(x)$ be the solution of the differential equation

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

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.8 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.9** 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.10** 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.11** 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.12** 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.13** 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.14** If a curve $y = y(x)$ passes through the point $\left(1, \frac{\pi}{2}\right)$ and satisfies the differential equation $(7x^4 \cot y - e^x \operatorname{cosec} y) \frac{dx}{dy} = x^5$, $x \geq 1$, 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.15** 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 $\frac{dy}{dx} - y \tan x = 2(x+1)\sec x g(x)$, $x \in \left[0, \frac{\pi}{2}\right)$. 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.16** Let $y = y(x)$ be the solution of the differential equation $\frac{dy}{dx} + 3(\tan^2 x)y + 3y = \sec^2 x$, $y(0) = \frac{1}{3} + e^3$. 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.17** 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.18** 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



Section B (Numerical)

- Q.19** Let $y = y(x)$ be the solution of the differential equation

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

If $y(1) = 1$, then the greatest integer less than $y(\sqrt{5})$ is _____.

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

Scan or tap for the
full solution



- Q.20** Let $y = y(x)$ be the solution of the differential equation

$$(\tan x)^{1/2} dy = (\sec^3 x - (\tan x)^{3/2} y) dx, \quad 0 < x < \frac{\pi}{2},$$

$$y\left(\frac{\pi}{4}\right) = \frac{6\sqrt{2}}{5}. \quad \text{If } y\left(\frac{\pi}{3}\right) = \frac{4}{5}\alpha, \quad \text{then } \alpha^4 \text{ equals}$$

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

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full solution



- Q.21** Let f be a twice differentiable function such that
- $$f(x) = \int_0^x \tan(t - x) dt - \int_0^x f(t) \tan t dt, \quad x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right).$$

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.22** If the solution curve $y = f(x)$ of the differential equation

$$(x^2 - 4)y' - 2xy + 2x(4 - x^2)^2 = 0, \quad x > 2,$$

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.23** 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.24** If $y = y(x)$ is the solution of the differential equation,

$$\sqrt{4 - x^2} \frac{dy}{dx} = \left(\left(\sin^{-1} \left(\frac{x}{2} \right) \right)^2 - y \right) \sin^{-1} \left(\frac{x}{2} \right), \quad -2 \leq x \leq 2,$$

$$y(2) = \frac{\pi^2 - 8}{4}, \quad \text{then } y^2(0) \text{ is equal to}$$

_____.

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

Scan or tap for the
full solution



ANSWER KEY

Section A (MCQ)

Ques.	1	2	3	4	5	6	7	8	9	10	11
Ans.	1	3	4	4	3	3	4	2	2	1	2
Ques.	12	13	14	15	16	17	18				
Ans.	2	4	3	1	1	3	4				

Section B (Numerical)

Ques.	19	20	21	22	23	24					
Ans.	3	48	5	16	21	4					