

PYQSide

JEE MAIN DIFFERENTIAL EQUATIONS — PYQS

Max. Marks: 152

Questions: 38

Section A (MCQ)

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

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

$x \in (0, 1)$, $\lim_{x \rightarrow 1^-} y(x) = 1$. 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

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

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.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** Let for some function $y = f(x)$, $\int_0^x t f(t) dt = x^2 f(x)$, $x > 0$ 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 

Section B (Numerical)

- Q.28** 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]

Scan or tap for the full solution 

- Q.29** 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.30** 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.31** 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.32** 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]

Scan or tap for the
full solution



- Q.33** 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.34** 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.35** 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.36** 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.37** 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.38** 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



ANSWER KEY

Section A (MCQ)

Ques.	1	2	3	4	5	6	7	8	9	10	11
Ans.	1	3	2	3	4	3	4	2	4	3	3
Ques.	12	13	14	15	16	17	18	19	20	21	22
Ans.	4	2	2	1	2	1	2	3	2	4	3
Ques.	23	24	25	26	27						
Ans.	1	1	3	4	1						

Section B (Numerical)

Ques.	28	29	30	31	32	33	34
Ans.	3	11	48	5	64	1565	16
Ques.	35	36	37	38			
Ans.	36	21	112	4			