

Q1. JEE Main 2026 (21 January Shift 2)

If the area of the region $\{(x, y) : 1 - 2x \leq y \leq 4 - x^2, x \geq 0, y \geq 0\}$ is $\frac{\alpha}{\beta}$, $\alpha, \beta \in \mathbf{N}$, $\gcd(\alpha, \beta) = 1$, then the value of $(\alpha + \beta)$ is :

- (1) 67 (2) 91 (3) 73 (4) 85

Q2. JEE Main 2026 (23 January Shift 1)

Let the area of the region bounded by the curve $y = \max\{\sin x, \cos x\}$, lines $x = 0, x = \frac{3\pi}{2}$, and the x -axis be A .

Then, $A + A^2$ is equal to _____.

Q3. JEE Main 2026 (28 January Shift 2)

Let $P_1 : y = 4x^2$ and $P_2 : y = x^2 + 27$ be two parabolas. If the area of the bounded region enclosed between P_1 and P_2 is six times the area of the bounded region enclosed between the line $y = \alpha x$, $\alpha > 0$ and P_1 , then α is equal to :

- (1) 12 (2) 6 (3) 15 (4) 8

Q4. JEE Main 2026 (24 January Shift 2)

Let $f(\alpha)$ denote the area of the region in the first quadrant bounded by $x = 0, x = 1, y^2 = x$ and $y = |\alpha x - 5| - |1 - \alpha x| + \alpha x^2$. Then $(f(0) + f(1))$ is equal to

- (1) 12 (2) 14 (3) 7 (4) 9

Q5. JEE Main 2026 (22 January Shift 2)

The area of the region $A = \{(x, y) : 4x^2 + y^2 \leq 8 \text{ and } y^2 \leq 4x\}$ is:

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

Q6. JEE Main 2026 (22 January Shift 1)

Let the line $x = -1$ divide the area of the region $\{(x, y) : 1 + x^2 \leq y \leq 3 - x\}$ in the ratio $m : n$, $\gcd(m, n) = 1$.

Then $m + n$ is equal to

- (1) 27 (2) 25 (3) 28 (4) 26

Q7. JEE Main 2026 (23 January Shift 2)

The area of the region enclosed between the circles $x^2 + y^2 = 4$ and $x^2 + (y - 2)^2 = 4$ is:

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

Q8. JEE Main 2026 (21 January Shift 1)

The area of the region, inside the ellipse $x^2 + 4y^2 = 4$ and outside the region bounded by the curves $y = |x| - 1$ and $y = 1 - |x|$, is :

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

Q9. JEE Main 2026 (28 January Shift 1)

The area of the region $R = \{(x, y) : xy \leq 8, 1 \leq y \leq x^2, x \geq 0\}$ is

- (1) $\frac{2}{3}(24 \log_e(2) - 7)$ (2) $\frac{1}{3}(40 \log_e(2) + 27)$
(3) $\frac{2}{3}(20 \log_e(2) + 9)$ (4) $\frac{1}{3}(49 \log_e(2) - 15)$

Q10. JEE Main 2026 (24 January Shift 1)

Let A_1 be the bounded area enclosed by the curves $y = x^2 + 2$, $x + y = 8$ and y -axis that lies in the first quadrant.

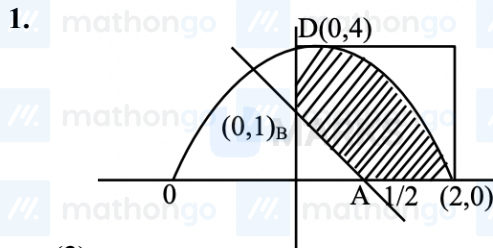
Let A_2 be the bounded area enclosed by the curves $y = x^2 + 2$, $y^2 = x$, $x = 2$, and y -axis that lies in the first quadrant. Then $A_1 - A_2$ is equal to

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

ANSWERS AND SOLUTIONS

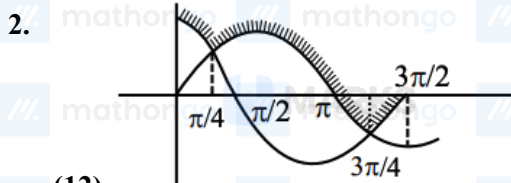
1. (3) 2. 12 3. (1) 4. (3) 5. (2) 6. (1) 7. (3) 8. (4)

9. (1) 10. (2)



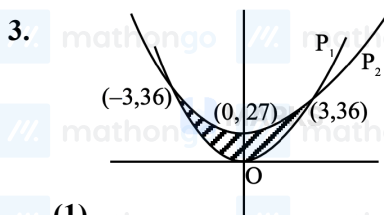
(3)

$$\begin{aligned} \text{Required area} &= \frac{2}{3} \times 8 - \frac{1}{2} \times \frac{1}{2} \times 1 \\ &= \frac{16}{3} - \frac{1}{4} = \frac{61}{12} = \frac{\alpha}{\beta} \\ \Rightarrow \alpha + \beta &= 73 \end{aligned}$$



(12)

$$\begin{aligned} A &= \int_0^{\pi/4} \cos x \, dx + \int_{\pi/4}^{\pi} \sin x \, dx + \int_{\pi}^{5\pi/4} -\sin x \, dx + \int_{5\pi/4}^{3\pi/2} -\cos x \, dx \\ A &= (\sin x)_0^{\pi/4} + (-\cos x)_{\pi/4}^{\pi} + (\cos x)_{\pi}^{5\pi/4} + (\sin x)_{5\pi/4}^{3\pi/2} \\ A &= \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} + 1 + 1 - \frac{1}{\sqrt{2}} + 1 - \frac{1}{\sqrt{2}} = 3 \\ A^2 + A &= 12 \end{aligned}$$



(1)

Area bounded between P_1 & P_2 is

$$\int_{-3}^3 ((x^2 + 27) - (4x^2)) \, dx$$

(P.O.I. of P_1 & P_2 is $x = \pm 3$)

$$\begin{aligned} &= 2 \int_0^3 (27 - 3x^2) \, dx = 2[27x - x^3]_0^3 \\ &= 2[81 - 27] = 108 \end{aligned}$$

$\therefore$ Area bounded between P_1 & L is 18 sq. units

$$(\text{Area between } x^2 = 4ay \text{ \& line } x = my) \text{ is } \frac{8a^2}{3m^3}$$

$\therefore$ Area between $x^2 = \frac{y}{4}$ & $x = \frac{y}{\alpha}$ is

$$\frac{8 \cdot \left(\frac{1}{16}\right)^2}{3 \cdot \left(\frac{1}{\alpha}\right)^3} = 18$$

$$\Rightarrow \frac{16 \cdot 16}{3 \alpha^3} = 18 \Rightarrow \alpha^3 = 2^6 \cdot 3^3$$

$$\Rightarrow \alpha = 12$$

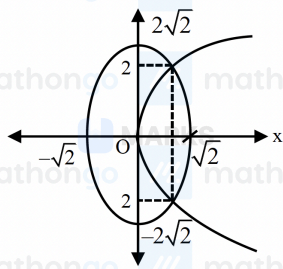
4. (3) For $\alpha = 0$: curve is $y = 5 - 1 = 4$ (horizontal line), area $= \int_0^1 (4 - \sqrt{x}) dx = 4 - \frac{2}{3} = \frac{10}{3}$

For $\alpha = 1$ and $0 \leq x \leq 1$: $|x - 5| = 5 - x$, $|1 - x| = 1 - x$, so $y = 4 + x^2$

$$\text{Area} = \int_0^1 (4 + x^2 - \sqrt{x}) dx = 4 + \frac{1}{3} - \frac{2}{3} = \frac{11}{3}$$

$$f(0) + f(1) = \frac{10}{3} + \frac{11}{3} = 7$$

5.



(2)

$$A = \int_0^2 2\sqrt{x} dx + 2 \int_1^{\sqrt{2}} \sqrt{8 - 4x^2} dx$$

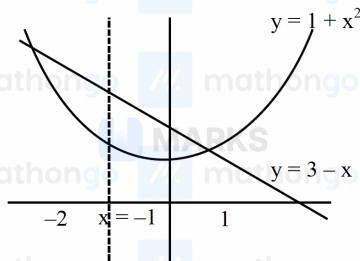
$$= \frac{8}{3} \left(x^{\frac{3}{2}}\right) \Big|_0^1 + 4 \int_1^{\sqrt{2}} \sqrt{2 - x^2} dx$$

$$= \frac{8}{3} + 4 \times \frac{1}{2} \left[x\sqrt{2 - x^2} + 2 \sin^{-1} \left(\frac{x}{\sqrt{2}} \right) \right] \Big|_1^{\sqrt{2}}$$

$$= \frac{8}{3} + 2 \left[2 \times \frac{\pi}{2} - 1 - 2 \times \frac{\pi}{4} \right]$$

$$= \frac{8}{3} + 2\pi - 2 - \pi = \pi + \frac{2}{3} \text{ sq. units}$$

6.



(1)

$$\frac{m}{n} = \frac{\int_{-1}^1 [(3 - x) - (1 + x^2)] dx}{\int_{-2}^1 [(3 - x) - (1 + x^2)] dx} = \frac{20}{7}$$

$$\therefore m + n = 20 + 7$$

$$= 27$$

7. (3) Circle 1: centre $(0, 0)$, $r = 2$. Circle 2: centre $(0, 2)$, $r = 2$. Distance between centres $d = 2$.

$$\text{Intersection: } y^2 = (y - 2)^2 \Rightarrow y = 1, \text{ giving } x = \pm\sqrt{3}.$$

Angle subtended at centre of circle 1 by the chord: $\theta = 2\pi/3$.

$$\text{Segment area} = \frac{1}{2}(4) \left(\frac{2\pi}{3} \right) - \frac{1}{2}(4) \sin \frac{2\pi}{3} = \frac{4\pi}{3} - \sqrt{3}.$$

$$\text{By symmetry, total intersection area} = 2 \left(\frac{4\pi}{3} - \sqrt{3} \right) = \frac{8\pi - 6\sqrt{3}}{3} = \frac{2}{3}(4\pi - 3\sqrt{3}).$$

8. (4) Ellipse: $\frac{x^2}{4} + y^2 = 1$ with $a = 2$, $b = 1$. Area $= \pi ab = 2\pi$.

Curves $y = |x| - 1$ and $y = 1 - |x|$ intersect at $x = \pm 1$, forming a rhombus with vertices $(0, 1)$, $(1, 0)$, $(0, -1)$, $(-1, 0)$.

Vertices $(0, \pm 1)$ lie on ellipse; $(\pm 1, 0)$ are inside ellipse.

$$\text{Area of rhombus} = \frac{1}{2} \times 2 \times 2 = 2.$$

$$\text{Required area} = 2\pi - 2 = 2(\pi - 1).$$

9. (1) The region R is defined by $xy \leq 8$, $1 \leq y \leq x^2$, and $x \geq 0$.

First, find the intersection points of the curves.

$$\text{Intersection of } y = 1 \text{ and } y = x^2: x^2 = 1 \Rightarrow x = 1 \text{ (since } x \geq 0 \text{)}.$$

$$\text{Intersection of } y = x^2 \text{ and } xy = 8: x(x^2) = 8 \Rightarrow x^3 = 8 \Rightarrow x = 2. \text{ At } x = 2, y = 4.$$

$$\text{Intersection of } xy = 8 \text{ and } y = 1: x(1) = 8 \Rightarrow x = 8.$$

The region is bounded below by $y = 1$ from $x = 1$ to $x = 8$.

The upper boundary consists of two parts:

From $x = 1$ to $x = 2$, the upper curve is $y = x^2$.

From $x = 2$ to $x = 8$, the upper curve is $y = \frac{8}{x}$.

The area A is given by:

$$A = \int_1^2 (x^2 - 1)dx + \int_2^8 \left(\frac{8}{x} - 1 \right)dx$$

$$A = \left[\frac{x^3}{3} - x \right]_1^2 + \left[8 \log_e x - x \right]_2^8$$

$$A = \left(\frac{8}{3} - 2 \right) - \left(\frac{1}{3} - 1 \right) + (8 \log_e 8 - 8) - (8 \log_e 2 - 2)$$

$$A = \left(\frac{2}{3} \right) - \left(-\frac{2}{3} \right) + 8(3 \log_e 2) - 8 - 8 \log_e 2 + 2$$

$$A = \frac{4}{3} + 24 \log_e 2 - 8 \log_e 2 - 6$$

$$A = 16 \log_e 2 + \frac{4}{3} - 6$$

$$A = 16 \log_e 2 - \frac{14}{3}$$

$$A = \frac{2}{3}(24 \log_e 2 - 7)$$

10. (2) For A_1 : intersection of $y = x^2 + 2$ and $x + y = 8$ at $x = 2$, $y = 6$

$$A_1 = \int_0^2 (8 - x - (x^2 + 2))dx = \int_0^2 (6 - x - x^2)dx = \left[6x - \frac{x^2}{2} - \frac{x^3}{3} \right]_0^2 = 12 - 2 - \frac{8}{3} = \frac{22}{3}$$

For A_2 : bounded by $y = x^2 + 2$, $y^2 = x$ (i.e., $x = y^2$), $x = 2$, and y -axis.

In first quadrant, $y^2 = x$ goes from $(0, 0)$ to $(2, \sqrt{2})$.

The parabola $y = x^2 + 2$ passes through (0,2) and (2,6).

$$A_2 = \int_0^{\sqrt{2}} (2 - y^2) dy = \left[2y - \frac{y^3}{3} \right]_0^{\sqrt{2}} = 2\sqrt{2} - \frac{2\sqrt{2}}{3} = \frac{4\sqrt{2}}{3}$$

$$A_1 - A_2 = \frac{22}{3} - \frac{4\sqrt{2}}{3} = \frac{2}{3}(2\sqrt{2} + 1)$$