

Q1. JEE Main 2026 (21 January Shift 2)

If the line $\alpha x + 4y = \sqrt{7}$, where $\alpha \in \mathbf{R}$, touches the ellipse $3x^2 + 4y^2 = 1$ at the point P in the first quadrant, then one of the focal distances of P is :

- (1) $\frac{1}{\sqrt{3}} + \frac{1}{2\sqrt{7}}$ (2) $\frac{1}{\sqrt{3}} - \frac{1}{2\sqrt{5}}$
(3) $\frac{1}{\sqrt{3}} + \frac{1}{2\sqrt{5}}$ (4) $\frac{1}{\sqrt{3}} - \frac{1}{2\sqrt{11}}$

Q2. JEE Main 2026 (23 January Shift 1)

Let the line $y - x = 1$ intersect the ellipse $\frac{x^2}{2} + \frac{y^2}{1} = 1$ at the points A and B. Then the angle made by the line segment AB at the center of the ellipse is :

- (1) $\frac{\pi}{2} + \tan^{-1}\left(\frac{1}{4}\right)$ (2) $\frac{\pi}{2} + 2 \tan^{-1}\left(\frac{1}{4}\right)$
(3) $\frac{\pi}{2} - \tan^{-1}\left(\frac{1}{4}\right)$ (4) $\pi - \tan^{-1}\left(\frac{1}{4}\right)$

Q3. JEE Main 2026 (28 January Shift 2)

An ellipse has its center at $(1, -2)$, one focus at $(3, -2)$ and one vertex at $(5, -2)$. Then the length of its latus rectum is :

- (1) 6 (2) $4\sqrt{3}$ (3) $\frac{16}{\sqrt{3}}$ (4) $6\sqrt{3}$

Q4. JEE Main 2026 (28 January Shift 2)

Let the ellipse E : $\frac{x^2}{144} + \frac{y^2}{169} = 1$ and the hyperbola H : $\frac{x^2}{16} - \frac{y^2}{\lambda^2} = -1$ have the same foci. If e and L respectively denote the eccentricity and the length of the latus rectum of H, then the value of $24(e + L)$ is :

- (1) 148 (2) 126 (3) 67 (4) 296

Q5. JEE Main 2026 (24 January Shift 2)

Let the length of the latus rectum of an ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, ($a > b$), be 30. If its eccentricity is the maximum value of the function $f(t) = -\frac{3}{4} + 2t - t^2$, then $(a^2 + b^2)$ is equal to

- (1) 276 (2) 256 (3) 516 (4) 496

Q6. JEE Main 2026 (24 January Shift 2)

Let (h, k) lie on the circle C : $x^2 + y^2 = 4$ and the point $(2h + 1, 3k + 2)$ lie on an ellipse with eccentricity e. Then the value of $\frac{5}{e^2}$ is equal to ____.

Q7. JEE Main 2026 (22 January Shift 2)

Let S and S' be the foci of the ellipse $\frac{x^2}{25} + \frac{y^2}{9} = 1$ and P(α, β) be a point on the ellipse in the first quadrant. If $(SP)^2 + (S'P)^2 - SP \cdot S'P = 37$, then $\alpha^2 + \beta^2$ is equal to :

- (1) 15 (2) 11 (3) 17 (4) 13

Q8. JEE Main 2026 (24 January Shift 1)

Let each of the two ellipses $E_1 : \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1, (a > b)$ and $E_2 : \frac{x^2}{A^2} + \frac{y^2}{B^2} = 1, (A < B)$ have eccentricity $\frac{4}{5}$. Let the lengths of the latus recta of E_1 and E_2 be l_1 and l_2 , respectively, such that $2l_1^2 = 9l_2$. If the distance between the foci of E_1 is 8, then the distance between the foci of E_2 is

- (1) $\frac{32}{5}$ (2) $\frac{8}{5}$ (3) $\frac{16}{5}$ (4) $\frac{96}{5}$

ANSWERS AND SOLUTIONS

1. (1) 2. (1) 3. (1) 4. (4) 5. (4) 6. 9 7. (4) 8. (1)

1. (1) Ellipse $3x^2 + 4y^2 = 1$: $a^2 = \frac{1}{3}$, $b^2 = \frac{1}{4}$, $e = \frac{1}{2}$.

Tangent at (x_0, y_0) : $3x_0x + 4y_0y = 1$.

Comparing with $\alpha x + 4y = \sqrt{7}$:

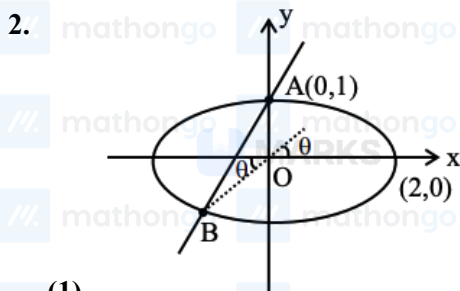
$$4y_0 = \frac{4}{\sqrt{7}} \Rightarrow y_0 = \frac{1}{\sqrt{7}} \text{ and } 3x_0 = \frac{\alpha}{\sqrt{7}}.$$

Substituting in ellipse equation: $\frac{\alpha^2}{21} + \frac{4}{7} = 1 \Rightarrow \alpha^2 = 9 \Rightarrow \alpha = 3$.

$$P = \left(\frac{1}{\sqrt{7}}, \frac{1}{\sqrt{7}} \right).$$

$$\text{Focal distances} = a \pm ex_0 = \frac{1}{\sqrt{3}} \pm \frac{1}{2\sqrt{7}}.$$

One focal distance is $\frac{1}{\sqrt{3}} + \frac{1}{2\sqrt{7}}$.



(1)

By solving line & equation of ellipse we get $x = 0$

$$\& x = -\frac{4}{3}$$

$$\therefore B \left(-\frac{4}{3}, -\frac{1}{3} \right)$$

$$m_{OB} = \tan \theta = \frac{1}{4}$$

$$\therefore \angle AOB = \frac{\pi}{2} + \theta = \frac{\pi}{2} + \tan^{-1} \frac{1}{4}$$

3. (1) Center at $(1, -2)$, focus at $(3, -2)$, vertex at $(5, -2)$ lie on horizontal line.

Distance from center to focus: $c = 2$.

Distance from center to vertex: $a = 4$.

$$\text{Since } b^2 = a^2 - c^2 = 16 - 4 = 12.$$

$$\text{Length of latus rectum: } L = \frac{2b^2}{a} = \frac{2(12)}{4} = 6$$

4. (4) Ellipse E: $\frac{x^2}{144} + \frac{y^2}{169} = 1$ has $a^2 = 169$, $b^2 = 144$, so $c_E = \sqrt{25} = 5$ with foci at $(0, \pm 5)$.

Hyperbola H: $\frac{y^2}{x^2} - \frac{x^2}{16} = 1$ has the same foci, so $c_H^2 = x^2 + 16 = 25$, giving $x^2 = 9$.

Thus H is $\frac{y^2}{9} - \frac{x^2}{16} = 1$ with $a = 3$, $b = 4$, $c = 5$.

Eccentricity: $e = \frac{5}{3}$.

Latus rectum: $L = \frac{2b^2}{a} = \frac{32}{3}$.

Therefore $24(e + L) = 24\left(\frac{5}{3} + \frac{32}{3}\right) = 24 \cdot \frac{37}{3} = 296$

5. (4) $f(t) = -t^2 + 2t - \frac{3}{4} = -(t - 1)^2 + \frac{1}{4}$.

Maximum value $= \frac{1}{4}$, so $e = \frac{1}{4}$.

$b^2 = a^2(1 - e^2) = a^2\left(1 - \frac{1}{16}\right) = \frac{15a^2}{16}$.

Latus rectum $= \frac{2b^2}{a} = \frac{2 \cdot 15a^2/16}{a} = \frac{15a}{8} = 30 \Rightarrow a = 16$.

$b^2 = \frac{15 \times 256}{16} = 240$.

$a^2 + b^2 = 256 + 240 = 496$.

6. (9) Since (h, k) lies on circle $x^2 + y^2 = 4$, we have $h = 2 \cos \theta$ and $k = 2 \sin \theta$.

The transformed point is $(2h + 1, 3k + 2) = (4 \cos \theta + 1, 6 \sin \theta + 2)$.

Rearranging: $\frac{(x-1)^2}{16} + \frac{(y-2)^2}{36} = 1$

This is an ellipse with $a^2 = 36$, $b^2 = 16$, so $e^2 = 1 - \frac{b^2}{a^2} = 1 - \frac{16}{36} = \frac{5}{9}$

Therefore $\frac{5}{e^2} = \frac{5}{5/9} = 9$

7. (4) For the ellipse $\frac{x^2}{25} + \frac{y^2}{9} = 1$, we have $a = 5$, $b = 3$, $c = 4$.

So foci are at $S(\pm 4, 0)$.

For point P on the ellipse: $SP + S'P = 10$.

Given $(SP)^2 + (S'P)^2 - SP \cdot S'P = 37$

Let $r_1 = SP$ and $r_2 = S'P$.

From $(r_1 + r_2)^2 = 100$, we get $r_1^2 + r_2^2 = 100 - 2r_1r_2$.

Substituting into the given equation: $100 - 3r_1r_2 = 37$, so $r_1r_2 = 21$.

Thus $r_1 = 3$, $r_2 = 7$.

From $(\alpha + 4)^2 + \beta^2 = 9$ and $(\alpha - 4)^2 + \beta^2 = 49$, subtracting gives $16\alpha = -40$, so $\alpha = -\frac{5}{2}$.

From the ellipse equation: $\beta^2 = \frac{27}{4}$.

Therefore $\alpha^2 + \beta^2 = \frac{25}{4} + \frac{27}{4} = 13$.

8. (1) Both ellipses have $e = 4/5$.

For E_1 ($a > b$):

$b^2 = a^2(1 - e^2) = 9a^2/25$.

Latus rectum $l_1 = 2b^2/a = 18a/25$.

Distance between foci of E_1 :

$2ae = 8a/5 = 8 \Rightarrow a = 5$, so $l_1 = 18/5$.

For E_2 ($A < B$, major axis along y):

$A^2 = B^2(1 - e^2) = 9B^2/25$.

Latus rectum $l_2 = 2A^2/B = 18B/25$.

Given $2l_1^2 = 9l_2$:

$$2 \cdot \frac{324}{25} = 9 \cdot \frac{18B}{25} \Rightarrow 648 = 162B \Rightarrow B = 4.$$

$$\text{Distance between foci of } E_2 = 2Be = 2 \cdot 4 \cdot \frac{4}{5} = \frac{32}{5}$$