

**Q1. JEE Main 2026 (21 January Shift 2)**

Let  $y^2 = 12x$  be the parabola with its vertex at O. Let P be a point on the parabola and A be a point on the  $x$ -axis such that  $\angle OPA = 90^\circ$ . Then the locus of the centroid of such triangles OPA is :

- (1)  $y^2 - 2x + 8 = 0$  (2)  $y^2 - 9x + 6 = 0$   
(3)  $y^2 - 4x + 8 = 0$  (4)  $y^2 - 6x + 4 = 0$

**Q2. JEE Main 2026 (21 January Shift 2)**

Let one end of a focal chord of the parabola  $y^2 = 16x$  be  $(16, 16)$ . If  $P(\alpha, \beta)$  divides this focal chord internally in the ratio 5 : 2, then the minimum value of  $\alpha + \beta$  is equal to :

- (1) 16 (2) 5 (3) 7 (4) 22

**Q3. JEE Main 2026 (28 January Shift 2)**

Let A be the focus of the parabola  $y^2 = 8x$ . Let the line  $y = mx + c$  intersect the parabola at two distinct points B and C. If the centroid of the triangle ABC is  $(\frac{7}{3}, \frac{4}{3})$ , then  $(BC)^2$  is equal to :

- (1) 80 (2) 41 (3) 89 (4) 32

**Q4. JEE Main 2026 (24 January Shift 2)**

Let the image of parabola  $x^2 = 4y$ , in the line  $x - y = 1$  be  $(y + a)^2 = b(x - c)$ ,  $a, b, c \in \mathbb{N}$ . Then  $a + b + c$  is equal to

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

**Q5. JEE Main 2026 (22 January Shift 2)**

Let the locus of the mid-point of the chord through the origin O of the parabola  $y^2 = 4x$  be the curve S. Let P be any point on S. Then the locus of the point, which internally divides OP in the ratio 3 : 1, is :

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

**Q6. JEE Main 2026 (22 January Shift 1)**

If the chord joining the points  $P_1(x_1, y_1)$  and  $P_2(x_2, y_2)$  on the parabola  $y^2 = 12x$  subtends a right angle at the vertex of the parabola, then  $x_1x_2 - y_1y_2$  is equal to

- (1) 284 (2) 280 (3) 288 (4) 292

**Q7. JEE Main 2026 (23 January Shift 2)**

An equilateral triangle OAB is inscribed in the parabola  $y^2 = 4x$  with the vertex O at the vertex of the parabola. Then the minimum distance of the circle having AB as a diameter from the origin is

- (1)  $2(8 - 3\sqrt{3})$  (2)  $2(3 + \sqrt{3})$   
(3)  $4(6 + \sqrt{3})$  (4)  $4(3 - \sqrt{3})$

**Q8. JEE Main 2026 (21 January Shift 1)**

Let O be the vertex of the parabola  $x^2 = 4y$  and Q be any point on it. Let the locus of the point P, which divides the line segment OQ internally in the ratio 2 : 3 be the conic C. Then the equation of the chord of C, which is bisected at the point (1, 2), is :

(1)  $5x + 4y + 3 = 0$

(2)  $5x - y - 3 = 0$

(3)  $4x - 5y + 6 = 0$

(4)  $x - 2y + 3 = 0$

## ANSWERS AND SOLUTIONS

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

1. (1) Parabola  $y^2 = 12x$ ,  $a = 3$ . Let  $P = (3t^2, 6t)$ ,  $O = (0, 0)$ ,  $A = (h, 0)$ .

$$\angle OPA = 90^\circ \Rightarrow \vec{PO} \cdot \vec{PA} = 0:$$

$$(-3t^2)(h - 3t^2) + (-6t)(-6t) = 0 \Rightarrow h = 3t^2 + 12.$$

$$\text{Centroid } G = \left( \frac{0+3t^2+h}{3}, \frac{0+6t+0}{3} \right) = (2t^2 + 4, 2t).$$

$$\text{Let } G = (X, Y): t = Y/2, X = Y^2/2 + 4.$$

$$\text{Locus: } y^2 - 2x + 8 = 0.$$

2. (3) Parabola  $y^2 = 16x$ ,  $a = 4$ , focus at  $(4, 0)$ . Point  $(16, 16)$  has parameter  $t_1 = 2$ .

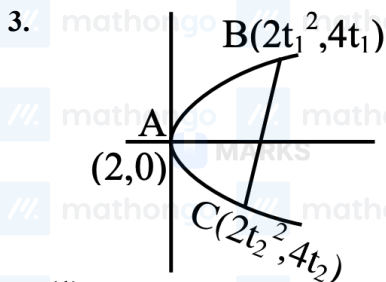
Other end of focal chord:  $t_2 = -1/t_1 = -1/2$ , giving  $(4 \cdot 1/4, 8 \cdot (-1/2)) = (1, -4)$ .

P divides the chord in ratio 5:2 internally (two cases):

$$\text{From } (16, 16) \text{ to } (1, -4): P = \left( \frac{37}{7}, \frac{12}{7} \right), \alpha + \beta = 7.$$

$$\text{From } (1, -4) \text{ to } (16, 16): P = \left( \frac{82}{7}, \frac{72}{7} \right), \alpha + \beta = 22.$$

Minimum value of  $\alpha + \beta = 7$ .



(1)

Coordinates of centroid of triangle ABC are

$$\frac{2}{3}(t_1^2 + t_2^2 + 1) = \frac{7}{3} \Rightarrow t_1^2 + t_2^2 = \frac{5}{2}$$

$$\frac{4}{3}(t_1 + t_2) = \frac{4}{3} \Rightarrow t_1 + t_2 = 1$$

$$(t_1 + t_2)^2 = t_1^2 + t_2^2 + 2t_1t_2 \Rightarrow t_1t_2 = \frac{-3}{4}$$

$$(t_1 - t_2)^2 = (t_1 + t_2)^2 - 4t_1t_2 = 4$$

$$(BC)^2 = 4(t_1^2 - t_2^2)^2 + 16(t_1 - t_2)^2$$

$$\Rightarrow (BC)^2 = 80$$

4. (2) Reflection of point  $(h, k)$  in line  $x - y - 1 = 0$ :

$$\frac{x-h}{1} = \frac{y-k}{-1} = \frac{-2(h-k-1)}{2} = k - h + 1.$$

Image:  $(k + 1, h - 1)$ .

Let  $(X, Y) = (k + 1, h - 1)$ , so  $h = Y + 1$ ,  $k = X - 1$ .

$$\text{From } h^2 = 4k: (Y + 1)^2 = 4(X - 1).$$

Comparing with  $(y + a)^2 = b(x - c)$ :  $a = 1$ ,  $b = 4$ ,  $c = 1$ .

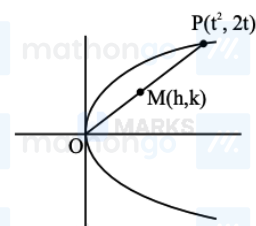
$$a + b + c = 1 + 4 + 1 = 6.$$

5. (3)  $y^2 = 4x$

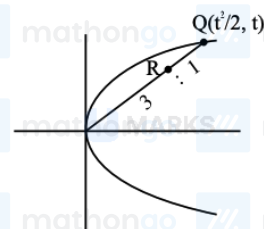
Locus of mid point of OP

$$M(h, k) \Rightarrow h = \frac{t^2}{2}, k = t$$

$$\Rightarrow k^2 = 2h \Rightarrow y^2 = 2x$$



$$S : y^2 = 2x$$



$$R(h, k)$$

$$\Rightarrow h = \frac{3t^2}{4}, k = \frac{3t}{4}$$

$$t^2 = \frac{8h}{3}, t = \frac{4k}{3}$$

$$\Rightarrow \frac{16k^2}{9} = \frac{8h}{3} \Rightarrow 2k^2 = 3h$$

$$\text{Locus of R : } 2y^2 = 3x$$

6. (3) Parabola  $y^2 = 12x$  has  $4a = 12$ , so  $a = 3$ .

Parametric points:  $P_1 = (3t_1^2, 6t_1)$ ,  $P_2 = (3t_2^2, 6t_2)$ .

Chord subtends right angle at vertex  $O(0, 0)$ :  $\vec{OP}_1 \cdot \vec{OP}_2 = 0$ .

$$9t_1^2 t_2^2 + 36t_1 t_2 = 0$$

$$\Rightarrow t_1 t_2 (t_1 t_2 + 4) = 0$$

$$\Rightarrow t_1 t_2 = -4.$$

$$x_1 x_2 - y_1 y_2 = 9(t_1 t_2)^2 - 36(t_1 t_2)$$

$$= 9(16) - 36(-4) = 144 + 144 = 288.$$

7. (4) Parabola  $y^2 = 4x$  has vertex  $O = (0, 0)$ . By symmetry, let  $A = (t^2, 2t)$ ,  $B = (t^2, -2t)$ .

$$OA = t\sqrt{t^2 + 4}, AB = 4t.$$

$$\text{For equilateral: } OA = AB \Rightarrow t\sqrt{t^2 + 4} = 4t \Rightarrow t^2 = 12 \Rightarrow t = 2\sqrt{3}.$$

$$A = (12, 4\sqrt{3}), B = (12, -4\sqrt{3}).$$

Circle with  $AB$  as diameter: centre  $(12, 0)$ , radius  $= 4\sqrt{3}$ .

Minimum distance from origin  $= 12 - 4\sqrt{3} = 4(3 - \sqrt{3})$ .

8. (1) Parabola  $x^2 = 4y$ , vertex  $O = (0, 0)$ ,  $Q = (2t, t^2)$  on parabola.

$P$  divides  $OQ$  in ratio  $2:3$ :  $P = \left(\frac{4t}{5}, \frac{2t^2}{5}\right)$ .

Eliminating  $t$ :  $x^2 = \frac{8y}{5}$  (conic  $C$  with  $a = \frac{2}{5}$ ).

For chord with midpoint  $(h, k)$ :  $hx - 2ay = h^2 - 2ak$ .

At  $(1, 2)$ :  $x - \frac{4y}{5} = 1 - \frac{8}{5} = -\frac{3}{5}$ .

$5x - 4y + 3 = 0$ .