

# MATHS

## BOOKS - VIKAS GUPTA MATHS (HINGLISH)

### ELLIPSE

#### Exercise 1 Single Choice Problems

1. If CF be the perpendicular from the centre C of the ellipse  $\frac{x^2}{12} + \frac{y^2}{8} = 1$ , on the tangent

at any point P and G is the point where the normal at P meets the major axis, then the value of  $(CF \cdot PG)$  equals to :

A. 5

B. 6

C. 8

D. None of these

**Answer: C**



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2. The minimum length of intercept on any tangent to the ellipse  $\frac{x^2}{4} + \frac{y^2}{9} = 1$  cut by the circle  $x^2 + y^2 = 25$  is :

A. 8

B. 9

C. 2

D. 11

**Answer: A**



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3. Find a point on the curve  $x^2 + 2y^2 = 6$ , whose distance from the line  $x + y = 7$ , is minimum.

A. (2, 3)

B. (2, 1)

C. (1, 0)

D. None of these

**Answer: B**



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4. If lines  $2x + 3y = 10$  and  $2x - 3y = 10$  are tangents at the extremities of a latus rectum of an ellipse, whose centre is origin, then the length of the latus rectum is :

A.  $\frac{110}{27}$

B.  $\frac{98}{27}$

C.  $\frac{100}{27}$

D.  $\frac{120}{27}$

**Answer: C**



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5. Prove that the area bounded by the circle  $x^2 + y^2 = a^2$  and the ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  is equal to the area of another ellipse having semi-axis  $a - b$  and  $b$ ,  $a > b$ .

A.  $a + b$  and  $b$

B.  $a - b$  and  $a$

C.  $a$  and  $b$

D. None of these

**Answer: B**



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6. If  $F_1$  and  $F_2$  are the feet of the perpendiculars from the foci  $S_1$  and  $S_2$  of the ellipse  $\frac{x^2}{25} + \frac{y^2}{16} = 1$  on the tangent at any point  $P$  on the ellipse, then prove that  $S_1F_1 + S_2F_2 \geq 8$ .

A.  $S_1F_1 + S_2F_2 \geq 2$

B.  $S_1F_1 + S_2F_2 \geq 3$

$$C. S_1 F_1 + S_2 F_2 \geq 6$$

$$D. S_1 F_1 + S_2 F_2 \geq 8$$

**Answer: D**



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7. Consider the ellipse

$$\frac{x^2}{f(k^2 + 2k + 5)} + \frac{y^2}{f(k + 11)} = 1. \text{ If } f(x) \text{ is}$$

a positive decreasing function, then the set

of values of  $k$  for which the major axis is the x-

axis is  $(-3, 2)$ . the set of values of  $k$  for



which the major axis is the y-axis is  $(-\infty, 2)$ .

the set of values of  $k$  for which the major axis

is the y-axis is  $(-\infty, -3) \cup (2, \infty)$  the set

of values of  $k$  for which the major axis is the y-

axis is  $(-3, -\infty)$

A.  $k \in (-7, -5)$

B.  $k \in (-5, -3)$

C.  $k \in (-3, 2)$

D. None of these

**Answer: C**



8. If area of the ellipse  $\frac{x^2}{16} + \frac{y^2}{b^2} = 1$  inscribed in a square of side length  $5\sqrt{2}$  is A, then  $\frac{A}{\pi}$  equals to :

A. 12

B. 10

C. 8

D. 11

**Answer: A**



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9. Any chord of the conic  $x^2 + y^2 + xy = 1$  passing through origin is bisected at a point  $(p, q)$ , then  $(p + q + 12)$  equals to :

A. 13

B. 14

C. 11

D. 12

**Answer: D**



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10. Tangents are drawn from the point  $(4, 2)$  to the curve  $x^2 + 9y^2 = 9$ , the tangent of angle between the tangents :

A.  $\frac{3\sqrt{3}}{5\sqrt{17}}$

B.  $\frac{\sqrt{43}}{10}$

C.  $\frac{\sqrt{43}}{5}$

D.  $\sqrt{\frac{3}{17}}$

**Answer: C**



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## Exercise 2 Comprehension Type Problems

1. An ellipse has semi-major axis of length 2 and semi-minor axis of length 1. It sides between the co-ordinate axes in the first quadrant, while maintaining contact with both x-axis and y-axis.

Q. The locus of the centre of ellipse is :

A.  $x^2 + y^2 = 3$

B.  $x^2 + y^2 = 5$

C.  $(x - 2)^2 + (y - 1)^2 = 5$

D.  $(x - 2)^2 + (y - 1)^2 = 3$

**Answer: B**



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2. An ellipse has semi-major axis of length 2 and semi-minor axis of length 1. It sides between the co-ordinate axes in the first quadrant, while maintaining contact with both

x-axis and y-axis.

Q. The locus of the foci of the ellipse is :

A.  $x^2 + y^2 + \frac{1}{x^2} + \frac{1}{y^2} = 16$

B.  $x^2 + y^2 + \frac{1}{x^2} - \frac{1}{y^2} = 2\sqrt{3} + 4$

C.  $x^2 + y^2 - \frac{1}{x^2} - \frac{1}{y^2} = 2\sqrt{3} + 4$

D.  $x^2 - y^2 + \frac{1}{x^2} - \frac{1}{y^2} = 2\sqrt{3} + 4$

**Answer: A**



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**3. Comprehension- I** A coplanar beam of light emerging from a point source have equation  $\lambda x - y + 2(1 + \lambda) = 0, \lambda \in R$ . The rays of the beam strike an elliptical surface and get reflected. The reflected rays form another convergent beam having equation  $\mu x - y + 2(1 - \mu) = 0, \mu \in R$ . Foot of the perpendicular from the point  $(2, 2)$  upon any tangent to the ellipse lies on the circle  $x^2 + y^2 - 4y - 5 = 0$  The eccentricity of the ellipse is equal to



A.  $\frac{1}{3}$

B.  $\frac{1}{\sqrt{3}}$

C.  $\frac{2}{3}$

D.  $\frac{1}{2}$

**Answer: C**



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4. A coplanar beam of light emerging from a point source have the equation

$\lambda x - y + 2(1 + \lambda) - 0, \forall \lambda \in R$  : the rays of

beam strike an elliptical surface and get reflected inside the ellipse. The reflected rays form another convergent beam having the equation  $\mu x - y + 2(1 - \mu) = 0, \forall \mu \in R.$

Further it is found that the foot of the perpendicular from the point (2, 2) upon any tangent to the ellipse lies on the circle  $x^2 + y^2 - 4y - 5 = 0$

Q. The area of the largest that an incident ray and corresponding reflected ray can enclose with the major axis of the ellipse is equal to :

A.  $4\sqrt{5}$

B.  $\sqrt{5}$

C.  $3\sqrt{5}$

D.  $2\sqrt{5}$

**Answer: D**



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5. A coplanar beam of light emerging from a point source have the equation  $\lambda x - y + 2(1 + \lambda) = 0, \forall \lambda \in \mathbb{R}$  : the rays of beam strike an elliptical surface and get

reflected inside the ellipse. The reflected rays form another convergent beam having the equation  $\mu x - y + 2(1 - \mu) = 0, \forall \mu \in R$ .

Further it is found that the foot of the perpendicular from the point (2, 2) upon any tangent to the ellipse lies on the circle  $x^2 + y^2 - 4y - 5 = 0$

Q. The least value of total distance travelled by an incident ray and the corresponding reflected ray is equal to :

A. 6

B. 3

C.  $\sqrt{5}$

D.  $2\sqrt{5}$

**Answer: A**



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## Exercise 4 Subjective Type Problems

1. For the ellipse  $\frac{x^2}{9} + \frac{y^2}{4} = 1$ . Let O be the centre and S and S' be the foci. For any point P on the ellipse the value of  $\frac{PS \cdot PS' \cdot d^2}{9}$  (where

d is the distance of O from the tangent at P) is equal to



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2. Number of perpendicular tangents that can be drawn on the ellipse  $\frac{x^2}{16} + \frac{y^2}{25} = 1$  from point (6, 7) is



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