

EXERCISE - O

SINGLE CORRECT TYPE QUESTIONS

1. Let 'E' be the ellipse  $\frac{x^2}{9} + \frac{y^2}{4} = 1$  & 'C' be the circle  $x^2 + y^2 = 9$ . Let P & Q be the points (1, 2) and (2,1) respectively. Then :  
 (A) Q lies inside C but outside E  
 (B) Q lies outside both C & E  
 (C) P lies inside both C & E  
 (D) P lies inside C but outside E. MEL001
  
2. The equation,  $2x^2 + 3y^2 - 8x - 18y + 35 = K$  represents  
 (A) no locus if  $K > 0$   
 (B) an ellipse if  $K < 0$   
 (C) a point if  $K = 0$   
 (D) a hyperbola if  $K > 0$  MEL002
  
3. If  $P = (x, y)$ ,  $F_1 = (3,0)$ ,  $F_2 = (-3,0)$  and  $16x^2 + 25y^2 = 400$ , then  $PF_1 + PF_2$  equals  
 (A) 8  
 (B) 6  
 (C) 10  
 (D) 12 MEL003
  
4. An ellipse has OB as a semi-minor axis. F and F' are its foci and the angle FBF' is a right angle. Then, the eccentricity of the ellipse is  
 (A)  $\frac{1}{3}$   
 (B)  $\frac{1}{\sqrt{3}}$   
 (C)  $\frac{1}{\sqrt{2}}$   
 (D)  $\frac{1}{2}$  MEL004
  
5. The y –axis is the directrix of the ellipse with eccentricity  $e = 1/2$  and the corresponding focus is at (3,0), equation to its auxiliary circle is  
 (A)  $x^2 + y^2 - 8x + 12 = 0$   
 (B)  $x^2 + y^2 - 8x - 12 = 0$   
 (C)  $x^2 + y^2 - 8x + 9 = 0$   
 (D)  $x^2 + y^2 = 4$  MEL005
  
6. Imagine that you have two thumbtacks placed at two distinct points, A and B. If the ends of a fixed length of string are fastened to the thumbtacks and the string is drawn taut with a pencil, the path traced by the pencil will be a curve called ellipse. The best way to maximise the area surrounded by the curve with a fixed length of string occurs when  
 I the two points A and B have the maximum distance between them.  
 II two points A and B coincide.  
 III A and B are placed vertically.  
 IV The area is always same regardless of the location of A and B.  
 (A) I  
 (B) II  
 (C) III  
 (D) IV MEL006
  
7. The latus rectum of a conic section is the width of the function through the focus. The positive difference between the length of the latus rectum of  $3y = x^2 + 4x - 9$  and  $x^2 + 4y^2 - 6x + 16y = 24$  is-  
 (A)  $\frac{1}{2}$   
 (B) 2  
 (C)  $\frac{3}{2}$   
 (D)  $\frac{5}{2}$  MEL007

8. Let  $S(5,12)$  and  $S'(-12,5)$  are the foci of an ellipse passing through the origin. The eccentricity of ellipse equals -

- (A)  $\frac{1}{2}$                       (B)  $\frac{1}{\sqrt{3}}$                       (C)  $\frac{1}{\sqrt{2}}$                       (D)  $\frac{2}{3}$

MEL008

9. A circle has the same centre as an ellipse & passes through the foci  $F_1$  &  $F_2$  of the ellipse, such that the two curves intersect in 4 points. Let 'P' be any one of their point of intersection. If the major axis of the ellipse is 17 & the area of the triangle  $PF_1F_2$  is 30, then the distance between the foci is :

- (A) 11                      (B) 12                      (C) 13                      (D) none

MEL009

10.  $x - 2y + 4 = 0$  is a common tangent to  $y^2 = 4x$  &  $\frac{x^2}{4} + \frac{y^2}{b^2} = 1$ . Then the value of  $b$  and the other common tangent are given by :

- (A)  $b = \sqrt{3}; x + 2y + 4 = 0$                       (B)  $b = 3; x + 2y + 4 = 0$   
 (C)  $b = \sqrt{3}; x + 2y - 4 = 0$                       (D)  $b = \sqrt{3}; x - 2y - 4 = 0$

MEL010

11. Consider the particle travelling clockwise on the elliptical path  $\frac{x^2}{100} + \frac{y^2}{25} = 1$ . The particle leaves the orbit at the point  $(-8, 3)$  and travels in a straight line tangent to the ellipse. At what point will the particle cross the  $y$  -axis ?

- (A)  $\left(0, \frac{25}{3}\right)$                       (B)  $\left(0, \frac{23}{3}\right)$                       (C)  $(0, 9)$                       (D)  $\left(0, \frac{26}{3}\right)$

MEL011

12. The number of values of  $c$  such that the straight line  $y = 4x + c$  touches the curve  $\frac{x^2}{4} + y^2 = 1$  is

- (A) 0                      (B) 2                      (C) 1                      (D)  $\infty$

MEL012

13. The normal at a variable point  $P$  on an ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  of eccentricity  $e$  meets the axes of the ellipse in  $Q$  and  $R$  then the locus of the mid-point of  $QR$  is a conic with an eccentricity  $e'$  such that :

- (A)  $e'$  is independent of  $e$                       (B)  $e' = 1$   
 (C)  $e' = e$                       (D)  $e' = 1/e$

MEL013

14. Suppose  $x$  and  $y$  are real numbers such that  $x^2 + 9y^2 - 4x + 6y + 4 = 0$  then maximum value of  $(4x - 9y)$  is

- (A) 10                      (B) 16                      (C) 32                      (D) 22

MEL014

15. An ellipse has foci at  $F_1(9, 20)$  and  $F_2(49, 55)$  in the  $xy$ -plane and is tangent to the  $x$ -axis, then the length of its major axis is

- (A) 85                      (B) 170                      (C) 70                      (D) 140

MEL015

MULTIPLE CORRECT TYPE QUESTIONS

16. The equation of the standard ellipse with respect to coordinate axes whose minor axis is equal to the distance between its foci and whose  $LR = 10$ , will be-  
 (A)  $2x^2 + y^2 = 100$  (B)  $x^2 + 2y^2 = 100$   
 (C)  $2x^2 + 3y^2 = 80$  (D)  $3x^2 + 2y^2 = 80$   
**MEL037**
17. Consider the ellipse  $\frac{x^2}{4} + \frac{y^2}{b^2} = 1$  ( $b^2 < 4$ ) and whose eccentricity is 'e'. If the normal at the end of latus-rectum passes through one extremity of minor axis, then which of the following statement(s) is/are true ?  
 (A) Equation of director circle of ellipse is  $x^2 + y^2 = 10 - 2\sqrt{5}$   
 (B) Length of latus rectum of the ellipse is equal to  $6 - 2\sqrt{5}$   
 (C) The value of  $e^2 + e$  is 1  
 (D) Area of region between director and auxiliary circle of the ellipse is  $2\pi(3 - \sqrt{5})$   
**MEL038**
18. Let  $A(\alpha)$  and  $B(\beta)$  be the extremities of a chord of an ellipse. If the slope of  $AB$  is equal to the slope of the tangent at a point  $C(\theta)$  on the ellipse, then the value of  $\theta$ , is  
 (A)  $\frac{\alpha + \beta}{2}$  (B)  $\frac{\alpha - \beta}{2}$  (C)  $\frac{\alpha + \beta}{2} + \pi$  (D)  $\frac{\alpha - \beta}{2} - \pi$   
**MEL039**
19. Let  $F_1, F_2$  be two foci of the ellipse and  $PT$  and  $PN$  be the tangent and the normal respectively to the ellipse at point  $P$  then  
 (A)  $PN$  bisects  $\angle F_1 P F_2$  (B)  $PT$  bisects  $\angle F_1 P F_2$   
 (C)  $PT$  bisects angle  $(180^\circ - \angle F_1 P F_2)$  (D) None of these  
**MEL040**
20. If  $\ell_1$  be the equation of the common tangent in 1<sup>st</sup> quadrant to the circle  $x^2 + y^2 = 16$  and ellipse  $\frac{x^2}{25} + \frac{y^2}{4} = 1$  and  $\lambda_1$  be the length of the intercept of the common tangent between the coordinate axes then  
 (A)  $\lambda_1 = \frac{14}{\sqrt{3}}$  (B) Equation of  $\ell_1$  is  $2x + \sqrt{3}y = 4\sqrt{7}$   
 (C)  $\lambda_1 = \frac{4}{\sqrt{3}}$  (D) Equation of  $\ell_1$  is  $x + \sqrt{3}y = 4\sqrt{7}$   
**MEL041**
21. If latus rectum of an ellipse  $\frac{x^2}{16} + \frac{y^2}{b^2} = 1$  ( $0 < b < 4$ ), subtend angle  $2\theta$  at farthest vertex such that  $\operatorname{cosec}\theta = \sqrt{5}$ , then -  
 (A)  $e = \frac{1}{2}$   
 (B) no such ellipse exist  
 (C)  $b = 2\sqrt{3}$   
 (D) area of  $\Delta$  formed by  $LR$  and nearest vertex is 6 sq. units  
**MEL042**

22. If  $x - 2y + k = 0$  is a common tangent to  $y^2 = 4x$  &  $\frac{x^2}{a^2} + \frac{y^2}{3} = 1 (a > \sqrt{3})$ , then the value of  $a, k$  and other common tangent are given by -

- (A)  $a = 2$  (B)  $a = 3$   
 (C)  $x + 2y + 4 = 0$  (D)  $k = 4$

MEL043

23. Equation of the ellipse whose axes are the axes of coordinates and which passes through the point  $(-3, 1)$  and has eccentricity  $\sqrt{2/5}$  is :-

- (A)  $3x^2 + 5y^2 - 15 = 0$  (B)  $5x^2 + 3y^2 - 32 = 0$   
 (C)  $3x^2 + 5y^2 - 32 = 0$  (D)  $5x^2 + 3y^2 - 48 = 0$

MEL044

24. If  $a$  and  $c$  are positive real number and the ellipse  $\frac{x^2}{4c^2} + \frac{y^2}{c^2} = 1$  has four distinct points in common with the circle  $x^2 + y^2 = 9a^2$ , then

- (A)  $6ac + 9a^2 - 2c^2 > 0$  (B)  $6ac + 9a^2 - 2c^2 < 0$   
 (C)  $9ac - 9a^2 - 2c^2 < 0$  (D)  $9ac - 9a^2 - 2c^2 > 0$

MEL045

25. Let the equations of two ellipses be  $E_1: \frac{x^2}{3} + \frac{y^2}{2} = 1$  and  $E_2: \frac{x^2}{16} + \frac{y^2}{b^2} = 1$ . If the product of their eccentricities is  $\frac{1}{2}$ , then the length of the minor axis of ellipse  $E_2$  can be :-

- (A) 9 (B) 16  
 (C) 2 (D) 4

MEL046

26. The equation of the common tangents of the parabola  $y^2 = 4x$  and an ellipse  $\frac{x^2}{4} + \frac{y^2}{3} = 1$  are -

- (A)  $x - 2y + 4 = 0$  (B)  $x + 2y + 4 = 0$   
 (C)  $2x - y + 1 = 0$  (D)  $2x + y + 1 = 0$

MEL047

27. If length of perpendicular drawn from origin to any normal of the ellipse  $\frac{x^2}{16} + \frac{y^2}{25} = 1$  is  $\ell$ , then  $\ell$  cannot be -

- (A) 4 (B)  $\frac{5}{2}$   
 (C)  $\frac{1}{2}$  (D)  $\frac{2}{3}$

MEL048

COMPREHENSION TYPE QUESTIONS

Paragraph for Question No. 28 to 30

Tangents are drawn from the point  $P(3,4)$  to the ellipse  $\frac{x^2}{9} + \frac{y^2}{4} = 1$  touching the ellipse at points  $A$  and  $B$ .

28. The coordinates of  $A$  and  $B$  are

- (A)  $(3,0)$  and  $(0,2)$  (B)  $\left(-\frac{8}{5}, \frac{2\sqrt{261}}{15}\right)$  and  $\left(-\frac{9}{5}, \frac{8}{5}\right)$   
 (C)  $\left(-\frac{8}{5}, \frac{2\sqrt{161}}{15}\right)$  and  $(0,2)$  (D)  $(3,0)$  and  $\left(-\frac{9}{5}, \frac{8}{5}\right)$

MEL049

29. The orthocenter of the triangle  $PAB$  is

- (A)  $\left(5, \frac{8}{7}\right)$  (B)  $\left(\frac{7}{5}, \frac{25}{8}\right)$   
 (C)  $\left(\frac{11}{5}, \frac{8}{5}\right)$  (D)  $\left(\frac{8}{25}, \frac{7}{5}\right)$

MEL050

30. The equation of the locus of the point whose distances from the point  $P$  and the line  $AB$  are equal, is -

- (A)  $9x^2 + y^2 - 6xy - 54x - 62y + 241 = 0$   
 (B)  $x^2 + 9y^2 + 6xy - 54x + 62y - 241 = 0$   
 (C)  $9x^2 + 9y^2 - 6xy - 54x - 62y - 241 = 0$   
 (D)  $x^2 + y^2 - 2xy + 27x + 31y - 120 = 0$

MEL051

Paragraph for Question No. 31 to 32

Let the two foci of an ellipse be  $(-1, 0)$  and  $(3, 4)$  and the foot of perpendicular from the focus  $(3, 4)$  upon a tangent to the ellipse be  $(4, 6)$ .

31. The foot of perpendicular from the focus  $(-1, 0)$  upon the same tangent to the ellipse is  $(\alpha, \beta)$  then  $5(\alpha + \beta)$  equal to

- (A) 46 (B) 47  
 (C) 48 (D) 49

MEL052

32. The length of semi-minor axis of the ellipse is  $\sqrt{\lambda}$  then  $\frac{\lambda}{2}$  equal to

- (A) 5.50 (B) 6.50  
 (C) 7.50 (D) 8.50

MEL053

MATRIX MATCH TYPE QUESTION

33.	Column-I		Column-II
(A)	The eccentricity of the ellipse which meets the straight line $2x - 3y = 6$ on the X-axis and the straight line $4x + 5y = 20$ on the Y-axis and whose principal axes lie along the coordinate axes, is	(P)	$\frac{1}{2}$
(B)	A bar of length 20 units moves with its ends on two fixed straight lines at right angles. A point $P$ marked on the bar at a distance of 8 units from one end describes a conic whose eccentricity is	(Q)	$\frac{1}{\sqrt{2}}$
(C)	If one extremity of the minor axis of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ and the foci form an equilateral triangle, then its eccentricity, is	(R)	$\frac{\sqrt{5}}{3}$
(D)	There are exactly two points on the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ whose distance from the centre of the ellipse are greatest and equal to $\sqrt{\frac{a^2 + 2b^2}{2}}$ . Eccentricity of this ellipse is equal to	(S)	$\frac{\sqrt{7}}{4}$

MEL054

EXERCISE - S

1. If  $a(x^2 + y^2 + 2y + 1) = (x - 2y + 3)^2$  is an ellipse and  $a \in (b, \infty)$ , then the value of  $b$  is **MEL065**
2. An ellipse passes through the points  $(-3, 1)$  &  $(2, -2)$  and its principal axes are along the coordinate axes in order. The value of  $10 \times (\text{length of semi-minor axis})^2$  is equal to **MEL066**
3. Eccentricity of an ellipse in which distance between their foci is 10 and that of focus and corresponding directrix is 15 is  $e$ , then  $4e$  is equal to **MEL019**
4. If  $x, y \in R$ , satisfies the equation  $\frac{(x-4)^2}{4} + \frac{y^2}{9} = 1$ , then the difference between the largest and the smallest value of the expression  $\frac{x^2}{4} + \frac{y^2}{9}$  is ... **MEL067**
5. Rectangle  $ABCD$  has area 200. An ellipse with area  $200\pi$  passes through  $A$  and  $C$  and has foci at  $B$  and  $D$ . Find the perimeter of the rectangle. **MEL018**
6. Equations of the line with equal intercepts on the axes & which touch the ellipse  $\frac{x^2}{16} + \frac{y^2}{9} = 1$  is  $lx + my + c = 0$  then value of  $25\left(\frac{l^2 + m^2}{c^2}\right)$  is **MEL016**
7. The tangent and normal to the ellipse  $x^2 + 4y^2 = 4$  at a point  $P(\theta)$  on it meet the major axis in  $Q$  and  $R$  respectively. If  $QR = 2$  and the eccentric angle  $\theta$  of  $P$  is given by  $\cos\theta = \pm\left(\frac{a}{b}\right)$ , where  $a$  &  $b$  are relative prime, then value of  $\frac{2b}{a}$  is equal to **MEL020**
8. A circle intersects an ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  precisely at three points  $A, B, C$  as shown in the figure.  $AB$  is a diameter of the circle and is perpendicular to the major axis of the ellipse. If the eccentricity of the ellipse is  $4/5$ , length of the diameter  $AB$  is  $\lambda a$ , then find  $\lambda$ . **MEL068**
9. Let  $P_i$  and  $P_i'$  be the feet of the perpendiculars drawn from foci  $S, S'$  on a tangent  $T_i$  to an ellipse whose length of semi-major axis is 20. If  $\sum_{i=1}^{10} (SP_i)(S'P_i') = 2560$ , then the value of  $100e$  is (where  $e$  eccentricity) **MEL017**
10.  $S_1$  and  $S_2$  are the foci of an ellipse of major axis of length 10 units, and  $P$  is any point on the ellipse such that the perimeter of triangle  $PS_1S_2$  is 15. Then the eccentricity of the ellipse is **MEL069**

**EXERCISE - JEE (Main) PYQ**

1. The area (in sq. units) of the quadrilateral formed by the tangents at the end points of the latera recta to the ellipse  $\frac{x^2}{9} + \frac{y^2}{5} = 1$  is : **[JEE (Main) 2015]**  
 (1)  $\frac{27}{2}$                       (2) 27                      (3)  $\frac{27}{4}$                       (4) 18  
**MEL021**
  
2. The eccentricity of an ellipse whose centre is at the origin is  $\frac{1}{2}$ . If one of its directrices is  $x = -4$ , then the equation of the normal to it at  $\left(1, \frac{3}{2}\right)$  is :- **[JEE (Main) 2017]**  
 (1)  $x + 2y = 4$               (2)  $2y - x = 2$               (3)  $4x - 2y = 1$               (4)  $4x + 2y = 7$   
**MEL022**
  
3. If tangents are drawn to the ellipse  $x^2 + 2y^2 = 2$  at all points on the ellipse other than its four vertices then the mid points of the tangents intercepted between the coordinate axes lie on the curve : **[JEE (Main) 2019]**  
 (1)  $\frac{x^2}{2} + \frac{y^2}{4} = 1$               (2)  $\frac{x^2}{4} + \frac{y^2}{2} = 1$               (3)  $\frac{1}{2x^2} + \frac{1}{4y^2} = 1$               (4)  $\frac{1}{4x^2} + \frac{1}{2y^2} = 1$   
**MEL023**
  
4. Let  $S$  and  $S'$  be the foci of the ellipse and  $B$  be any one of the extremities of its minor axis. If  $\Delta S'BS$  is a right angled triangle with right angle at  $B$  and area  $(\Delta S'BS) = 8$  sq. units, then the length of a latus rectum of the ellipse is : **[JEE (Main) 2019]**  
 (1)  $2\sqrt{2}$                       (2) 2                      (3) 4                      (4)  $4\sqrt{2}$   
**MEL024**
  
5. If the line  $x - 2y = 12$  is tangent to the ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  at the point  $\left(3, \frac{-9}{2}\right)$ , then the length of the latus rectum of the ellipse is : **[JEE (Main) 2019]**  
 (1) 9                      (2)  $8\sqrt{3}$                       (3)  $12\sqrt{2}$                       (4) 5  
**MEL025**
  
6. If the normal to the ellipse  $3x^2 + 4y^2 = 12$  at a point  $P$  on it is parallel to the line,  $2x + y = 4$  and the tangent to the ellipse at  $P$  passes through  $Q(4, 4)$  then  $PQ$  is equal to: **[JEE (Main) 2019]**  
 (1)  $\frac{\sqrt{221}}{2}$                       (2)  $\frac{\sqrt{157}}{2}$                       (3)  $\frac{\sqrt{61}}{2}$                       (4)  $\frac{5\sqrt{5}}{2}$   
**MEL026**
  
7. If  $3x + 4y = 12\sqrt{2}$  is a tangent to the ellipse  $\frac{x^2}{a^2} + \frac{y^2}{9} = 1$  for some  $a \in R$ , then the distance between the foci of the ellipse is : **[JEE (Main) 2020]**  
 (1) 4                      (2)  $2\sqrt{7}$                       (3)  $2\sqrt{5}$                       (4)  $2\sqrt{2}$   
**MEL027**

8. If the distance between the foci of an ellipse is 6 and the distance between its directrices is 12, then the length of its latus rectum is : **[JEE (Main) 2020]**

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

**MEL028**

9. Let the line  $y = mx$  and the ellipse  $2x^2 + y^2 = 1$  intersect at a point  $P$  in the first quadrant. If the normal to this ellipse at  $P$  meets the co-ordinate axes at  $\left(-\frac{1}{3\sqrt{2}}, 0\right)$  and  $(0, \beta)$ , then  $\beta$  is equal to

**[JEE (Main) 2020]**

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

**MEL029**

10. The length of the minor axis (along y-axis) of an ellipse in the standard form is  $\frac{4}{\sqrt{3}}$ . If this ellipse touches the line,  $x + 6y = 8$ ; then its eccentricity is : **[JEE (Main) 2020]**

- (1)  $\sqrt{\frac{5}{6}}$                       (2)  $\frac{1}{2}\sqrt{\frac{11}{3}}$                       (3)  $\frac{1}{3}\sqrt{\frac{11}{3}}$                       (4)  $\frac{1}{2}\sqrt{\frac{5}{3}}$

**MEL030**

11. If the point of intersections of the ellipse  $\frac{x^2}{16} + \frac{y^2}{b^2} = 1$  and the circle  $x^2 + y^2 = 4b, b > 4$  lie on the curve  $y^2 = 3x^2$ , then  $b$  is equal to: **[JEE (Main) 2021]**

- (1) 12                      (2) 5                      (3) 6                      (4) 10

**MEL031**

12. Let  $L$  be a tangent line to the parabola  $y^2 = 4x - 20$  at  $(6, 2)$ . If  $L$  is also a tangent to the ellipse  $\frac{x^2}{2} + \frac{y^2}{b} = 1$ , then the value of  $b$  is equal to : **[JEE (Main) 2021]**

- (1) 11                      (2) 14                      (3) 16                      (4) 20

**MEL032**

13. If  $m$  is the slope of a common tangent to the curves  $\frac{x^2}{16} + \frac{y^2}{9} = 1$  and  $x^2 + y^2 = 12$ , then  $12m^2$  is equal to : **[JEE (Main) 2022]**

- (1) 6                      (2) 9                      (3) 10                      (4) 12

**MEL033**

14. The locus of the mid point of the line segment joining the point  $(4, 3)$  and the points on the ellipse  $x^2 + 2y^2 = 4$  is an ellipse with eccentricity: **[JEE (Main) 2022]**

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

**MEL034**

## Ellipse

15. Let the ellipse  $E: x^2 + 9y^2 = 9$  intersect the positive  $x$ - and  $y$ -axes at the points  $A$  and  $B$  respectively. Let the major axis of  $E$  be a diameter of the circle  $C$ . Let the line passing through  $A$  and  $B$  meet the circle  $C$  at the point  $P$ . If the area of the triangle which vertices  $A, P$  and the origin  $O$  is  $\frac{m}{n}$ , where  $m$  and  $n$  are coprime, then  $m - n$  is equal to [JEE (Main) 2023]

(1) 18                      (2) 16                      (3) 17                      (4) 15

MEL035

16. Consider ellipses  $E_k: kx^2 + ky^2 = 1, k = 1, 2, \dots, 20$ . Let  $C_k$  be the circle which touches the four chords joining the end points (one on minor axis and another on major axis) of the ellipse  $E_k$ . If  $r_k$  is the radius of the circle  $C_k$ , then the value of  $\sum_{k=1}^{20} \frac{1}{r_k^2}$  is [JEE (Main) 2023]

(1) 3080                      (2) 3210                      (3) 3320                      (4) 2870

MEL036

EXERCISE - JEE (Advanced) PYQ

1. Suppose that the foci of the ellipse  $\frac{x^2}{9} + \frac{y^2}{5} = 1$  are  $(f_1, 0)$  and  $(f_2, 0)$  where  $f_1 > 0$  and  $f_2 < 0$ . Let  $P_1$  and  $P_2$  be two parabolas with a common vertex at  $(0,0)$  and with foci at  $(f_1, 0)$  and  $(2f_2, 0)$ , respectively. Let  $T_1$  be a tangent to  $P_1$  which passes through  $(2f_2, 0)$  and  $T_2$  be a tangent to  $P_2$  which passes through  $(f_1, 0)$ . If  $m_1$  is the slope of  $T_1$  and  $m_2$  is the slope of  $T_2$ , then the value of  $\left(\frac{1}{m_1^2} + m_2^2\right)$

is

[JEE (Advanced) 2015]

MEL055

2. Let  $E_1$  and  $E_2$  be two ellipses whose centers are at the origin. The major axes of  $E_1$  and  $E_2$  lie along the  $x$ -axis and the  $y$ -axis, respectively. Let  $S$  be the circle  $x^2 + (y - 1)^2 = 2$ . The straight line  $x + y = 3$  touches the curves  $S, E_1$  and  $E_2$  at  $P, Q$  and  $R$ , respectively. Suppose that  $PQ = PR = \frac{2\sqrt{2}}{3}$ . If  $e_1$  and  $e_2$  are the eccentricities of  $E_1$  and  $E_2$ , respectively, then the correct expression(s) is(are)

[JEE (Advanced) 2015]

(A)  $e_1^2 + e_2^2 = \frac{43}{40}$

(B)  $e_1 e_2 = \frac{\sqrt{7}}{2\sqrt{10}}$

(C)  $|e_1^2 - e_2^2| = \frac{5}{8}$

(D)  $e_1 e_2 = \frac{\sqrt{3}}{4}$

MEL056

PARAGRAPH :

Let  $F_1(x_1, 0)$  and  $F_2(x_2, 0)$  for  $x_1 < 0$  and  $x_2 > 0$ , be the foci of the ellipse  $\frac{x^2}{9} + \frac{y^2}{8} = 1$ . Suppose a parabola having vertex at the origin and focus at  $F_2$  intersects the ellipse at point  $M$  in the first quadrant and at point  $N$  in the fourth quadrant.

3. The orthocentre of the triangle  $F_1MN$  is-

[JEE (Advanced) 2016]

(A)  $\left(-\frac{9}{10}, 0\right)$

(B)  $\left(\frac{2}{3}, 0\right)$

(C)  $\left(\frac{9}{10}, 0\right)$

(D)  $\left(\frac{2}{3}, \sqrt{6}\right)$

MEL057

4. If the tangents to the ellipse at  $M$  and  $N$  meet at  $R$  and the normal to the parabola at  $M$  meets the  $x$ -axis at  $Q$ , then the ratio of area of the triangle  $MQR$  to area of the quadrilateral  $MF_1NF_2$  is -

[JEE (Advanced) 2016]

(A) 3 : 4

(B) 4 : 5

(C) 5 : 8

(D) 2 : 3

MEL058

5. Consider two straight lines, each of which is tangent to both the circle  $x^2 + y^2 = \frac{1}{2}$  and the parabola  $y^2 = 4x$ . Let these lines intersect at the point  $Q$ . Consider the ellipse whose center is at the origin  $O(0, 0)$  and whose semi-major axis is  $OQ$ . If the length of the minor axis of this ellipse is  $\sqrt{2}$ , then the which of the following statement(s) is (are) TRUE ? **[JEE (Advanced) 2018]**

(A) For the ellipse, the eccentricity is  $\frac{1}{\sqrt{2}}$  and the length of the latus rectum is 1

(B) For the ellipse, the eccentricity is  $\frac{1}{2}$  and the length of the latus rectum is  $\frac{1}{2}$

(C) The area of the region bounded by the ellipse between the lines  $x = \frac{1}{\sqrt{2}}$  and  $x = 1$  is  $\frac{1}{4\sqrt{2}}(\pi - 2)$

(D) The area of the region bounded by the ellipse between the lines  $x = \frac{1}{\sqrt{2}}$  and  $x = 1$  is  $\frac{1}{16}(\pi - 2)$

**MEL059**

6. Define the collections  $\{E_1, E_2, E_3, \dots\}$  of ellipses and  $\{R_1, R_2, R_3, \dots\}$  of rectangles as follows :

$$E_1 : \frac{x^2}{9} + \frac{y^2}{4} = 1;$$

$R_1$  : rectangle of largest area, with sides parallel to the axes, inscribed in  $E_1$  ;

$E_n$  : ellipse  $\frac{x^2}{a_n^2} + \frac{y^2}{b_n^2} = 1$  of largest area inscribed in  $R_{n-1}, n > 1$  ;

$R_n$  : rectangle of largest area, with sides parallel to the axes, inscribed in  $E_n, n > 1$ .

Then which of the following options is/are correct ? **[JEE (Advanced) 2019]**

(A) The eccentricities of  $E_{18}$  and  $E_{19}$  are NOT equal

(B) The distance of a focus from the centre in  $E_9$  is  $\frac{\sqrt{5}}{32}$

(C) The length of latus rectum of  $E_9$  is  $\frac{1}{6}$

(D)  $\sum_{n=1}^N (\text{area of } R_n) < 24$ , for each positive integer  $N$

**MEL060**

7. Let  $a, b$  and  $\lambda$  be positive real numbers. Suppose  $P$  is an end point of the latus rectum of the parabola  $y^2 = 4\lambda x$ , and suppose the ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  passes through the point  $P$ . If the tangents to the parabola and the ellipse at the point  $P$  are perpendicular to each other, then the eccentricity of the ellipse is **[JEE (Advanced) 2020]**

(A)  $\frac{1}{\sqrt{2}}$

(B)  $\frac{1}{2}$

(C)  $\frac{1}{3}$

(D)  $\frac{2}{5}$

**MEL061**

8. Let  $E$  be the ellipse  $\frac{x^2}{16} + \frac{y^2}{9} = 1$ . For any three distinct points  $P, Q$  and  $Q'$  on  $E$ , let  $M(P, Q)$  be the mid-point of the line segment joining  $P$  and  $Q$ , and  $M(P, Q')$  be the mid-point of the line segment joining  $P$  and  $Q'$ . Then the maximum possible value of the distance between  $M(P, Q)$  and  $M(P, Q')$ , as  $P, Q$  and  $Q'$  vary on  $E$ , is \_\_\_\_ **[JEE (Advanced) 2021]**

**MEL062**

9. Consider the ellipse  $\frac{x^2}{4} + \frac{y^2}{3} = 1$ . Let  $H(\alpha, 0)$ ,  $0 < \alpha < 2$ , be a point. A straight line drawn through  $H$  parallel to the  $y$ -axis crosses the ellipse and its auxiliary circle at points  $E$  and  $F$  respectively, in the first quadrant. The tangent to the ellipse at the point  $E$  intersects the positive  $x$ -axis at a point  $G$ . Suppose the straight line joining  $F$  and the origin makes an angle  $\phi$  with the positive  $x$ -axis.

**List-I**

- (I) If  $\phi = \frac{\pi}{4}$ , then the area of the triangle  $FGH$  is
- (II) If  $\phi = \frac{\pi}{3}$ , then the area of the triangle  $FGH$  is
- (III) If  $\phi = \frac{\pi}{6}$ , then the area of the triangle  $FGH$  is
- (IV) If  $\phi = \frac{\pi}{12}$ , then the area of the triangle  $FGH$  is

**List-II**

- (P)  $\frac{(\sqrt{3}-1)^4}{8}$
- (Q) 1
- (R)  $\frac{3}{4}$
- (S)  $\frac{1}{2\sqrt{3}}$
- (T)  $\frac{3\sqrt{3}}{2}$

The correct option is :

- (A) (I) → (R); (II) → (S); (III) → (Q); (IV) → (P)
- (B) (I) → (R); (II) → (T); (III) → (S); (IV) → (P)
- (C) (I) → (Q); (II) → (T); (III) → (S); (IV) → (P)
- (D) (I) → (Q); (II) → (S); (III) → (Q); (IV) → (P)

**[JEE (Advanced) 2022]**

**MEL063**

10. Let  $T_1$  and  $T_2$  be two distinct common tangents to the ellipse  $E : \frac{x^2}{6} + \frac{y^2}{3} = 1$  and the parabola  $P: y^2 = 12x$ . Suppose that the tangent  $T_1$  touches  $P$  and  $E$  at the point  $A_1$  and  $A_2$ , respectively and the tangent  $T_2$  touches  $P$  and  $E$  at the points  $A_4$  and  $A_3$ , respectively. Then which of the following statements is(are) true?

**[JEE (Advanced) 2023]**

- (A) The area of the quadrilateral  $A_1A_2A_3A_4$  is 35 square units
- (B) The area of the quadrilateral  $A_1A_2A_3A_4$  is 36 square units
- (C) The tangents  $T_1$  and  $T_2$  meet the  $x$ -axis at the point  $(-3, 0)$
- (D) The tangents  $T_1$  and  $T_2$  meet the  $x$ -axis at the point  $(-6, 0)$

**MEL064**

**JEE (Main) Practice Paper**

This paper is for yourself practice and assessment the discussion of this paper is optional though you can see PDF solutions or video solutions or solutions in hardcopy whichever is provided.

**SECTION-A**

- This section contains **TWENTY** questions.
- Each question has **FOUR** options (1), (2), (3) and (4). **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories:  
*Full Marks* : +4, if only the bubble corresponding to the correct option is darkened.  
*Zero Marks* : 0, if none of the bubbles is darkened.  
*Negative Marks* : -1 in all other cases.

1. A line of fixed length  $(a + b)$  moves so that its ends are always on two fixed perpendicular straight lines. The locus of the point which divided this line into portions of lengths  $a$  &  $b$ , is:  
 (1) an ellipse (2) an hyperbola (3) a circle (4) a straight line

MEL070

2. Coordinates of the vertices  $B$  and  $C$  of a triangle  $ABC$  are  $(2, 0)$  and  $(8, 0)$  respectively. The vertex  $A$  is varying in such a way that  $4 \tan \frac{B}{2} \cdot \tan \frac{C}{2} = 1$ . Then locus of  $A$  is

- (1)  $\frac{(x-5)^2}{25} + \frac{y^2}{16} = 1$  (2)  $\frac{(x-5)^2}{16} + \frac{y^2}{25} = 1$   
 (3)  $\frac{(x-5)^2}{25} + \frac{y^2}{9} = 1$  (4)  $\frac{(x-5)^2}{9} + \frac{y^2}{25} = 1$

MEL071

3. The locus of point of intersection of tangents to an ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  at the points, the sum of whose eccentric angles is constant, is :

- (1) a hyperbola (2) an ellipse  
 (3) a circle (4) a straight line

MEL072

4. An ellipse with major axis 4 and minor axis 2 touches both the coordinate axis, then Locus of its centre is (Major and minor axes parallel to coordinate axes)

- (1)  $x^2 - y^2 = 5$  (2)  $x^2 \cdot y^2 = 5$   
 (3)  $\frac{x^2}{4} + y^2 = 5$  (4)  $x^2 + y^2 = 5$

MEL073

5. An ellipse with major axis 4 and minor axis 2 touches both the coordinate axes, then locus of its focus is

- (1)  $(x^2 - y^2)(1 + x^2y^2) = 16x^2y^2$  (2)  $(x^2 - y^2)(1 - x^2y^2) = 16x^2y^2$   
 (3)  $(x^2 + y^2)(1 + x^2y^2) = 16x^2y^2$  (4)  $(x^2 + y^2)(1 - x^2y^2) = 16x^2y^2$

MEL074

6. A series of concentric ellipses  $E_1, E_2, \dots, E_n$  are drawn such that  $E_n$  touches the extremities of the major axis of  $E_{n-1}$  and the foci of  $E_n$  coincide with the extremities of minor axis of  $E_{n-1}$ . If the eccentricity of the ellipses is independent of  $n$ , then the value of the eccentricity is

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

MEL075

7. Let two variable ellipse  $E_1$  and  $E_2$  touches each other externally at  $(0, 0)$ . Their common tangent at  $(0, 0)$  is  $y = x$ . If one of the focus at  $E_1$  & one of the focus of  $E_2$  always lies on line  $y = 2x$  then find locus of other focus of  $E_1$  &  $E_2$ .

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

MEL076

8. If common tangent of  $x^2 + y^2 = r^2$  and  $\frac{x^2}{16} + \frac{y^2}{9} = 1$  forms square then find its area.

- (1) 50                      (2) 100                      (3) 25/2                      (4) 25

MEL077

9. An ellipse is inscribed in a circle and a point within the circle is chosen at random. If the probability that this point lies outside the ellipse is  $2/3$  then the eccentricity of the ellipse is :

- (1)  $\frac{2\sqrt{2}}{3}$                       (2)  $\frac{\sqrt{5}}{3}$                       (3)  $\frac{8}{9}$                       (4)  $\frac{2}{3}$

MEL078

10. If  $\alpha$  &  $\beta$  are the eccentric angles of the extremities of a focal chord of an standard ellipse, then the eccentricity of the ellipse is :

- (1)  $\frac{\cos \alpha + \cos \beta}{\cos(\alpha + \beta)}$                       (2)  $\frac{\sin \alpha - \sin \beta}{\sin(\alpha - \beta)}$   
 (3)  $\frac{\cos \alpha - \cos \beta}{\cos(\alpha - \beta)}$                       (4)  $\frac{\sin \alpha + \sin \beta}{\sin(\alpha + \beta)}$

MEL079

11. If  $P$  is any point on ellipse with foci  $S_1$  &  $S_2$  and eccentricity is  $\frac{1}{2}$  such that

$\angle PS_1S_2 = \alpha$ ,  $\angle PS_2S_1 = \beta$ ,  $\angle S_1PS_2 = \gamma$ , then  $\cot \frac{\alpha}{2}$ ,  $\cot \frac{\gamma}{2}$ ,  $\cot \frac{\beta}{2}$  are in

- (1) A.P.                      (2) G.P.  
 (3) H.P.                      (4) NOT A.P., G.P. or H.P.

MEL080

12. The area of the rectangle formed by the tangent and normal of the standard ellipse at its point whose eccentric angle is  $\pi/4$  and the perpendiculars from the centre of to the tangent and normal is :

- (1)  $\frac{(a^2 - b^2) ab}{a^2 + b^2}$                       (2)  $\frac{(a^2 + b^2) ab}{(a^2 - b^2)}$                       (3)  $\frac{(a^2 - b^2)}{ab(a^2 + b^2)}$                       (4)  $\frac{a^2 + b^2}{(a^2 - b^2) ab}$

MEL081



19. Consider the ellipse  $\frac{x^2}{\tan^2 \alpha} + \frac{y^2}{\sec^2 \alpha} = 1$  where  $\alpha \in (0, \pi/2)$ .

Which of the following quantities does not vary as  $\alpha$  varies ?

- (1) degree of flatness (2) ordinate of the vertex  
 (3) coordinates of the foci (4) length of the latus rectum

MEL088

20. Consider an ellipse  $\frac{x^2}{a} + \frac{y^2}{b} = 1$ . If  $A_1$  and  $A_2$  denotes area of ellipse and its director circle respectively, then -

- (1)  $A_2 \geq 2A_1$  (2)  $A_2 < 2A_1$   
 (3) if  $a = 4b$ , then  $A_1 = \frac{2}{5}A_2$  (4) if  $a = 4b$ , then  $A_2 = \frac{2}{5}A_1$

MEL089

**SECTION-B**

- This section will have **TEN** questions. Candidate can choose to attempt any 5 question out of these 10 questions. In case if candidate attempts more than 5 questions, first 5 attempted questions will be considered for marking.
- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value (Answer should be rounded off to the nearest integer).
- Answer to each question will be evaluated according to the following marking scheme:  
 Full Marks : +4, if only correct answer is given.  
 Zero Marks : 0, if no answer is given.  
 Negative Marks : -1 for incorrect answer

1.  $P$  &  $Q$  are the points with eccentric angles  $\theta$  &  $\theta + \pi/6$  on the ellipse  $\frac{x^2}{16} + \frac{y^2}{4} = 1$ , then the area of the triangle  $OPQ$  is :

MEL090

2. If  $P$  is a variable point on the ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  whose foci are  $S$  and  $S'$  and  $e_1$  is the eccentricity and the locus of the incentre of  $\Delta PSS'$  is an ellipse whose eccentricity is  $e_2$ , then the value of  $\left(1 + \frac{1}{e_1}\right)e_2^2$  is:

MEL091

3. If  $(0, 3 + \sqrt{5})$  is a point on the ellipse whose foci are  $(2, 3)$ ,  $(-2, 3)$  then the length of semi-major axis is :

MEL092

4. If  $OB$  is the semi-minor axis of an ellipse,  $F_1$  and  $F_2$  are its foci and the angle between  $F_1B$  and  $F_2B$  is a right angle, then twice the square of the eccentricity of the ellipse is :

MEL093

## Ellipse

5. Point 'O' is the centre of the ellipse with major axis  $AB$  & minor axis  $CD$ . Point  $F$  is one focus of the ellipse. If  $OF = 6$  & the diameter of the inscribed circle of triangle  $OCF$  is 2, then the product  $(AB)(CD)$  is **MEL094**
6. If 'r' be the radius of largest circle with centre  $(3, 0)$  that can be inscribed in the ellipse  $9x^2 + 25y^2 = 225$ , then  $4\sqrt{7}r$  is equal to **MEL095**
7. Minimum length of the intercept made by the axes on the tangent to the ellipse  $\frac{x^2}{81} + \frac{y^2}{36} = 1$  is equal to **MEL096**
8. If the distance of the centre of the ellipse  $4(x - 2y + 1)^2 + 9(2x + y + 2)^2 = 25$  from the origin is  $\lambda$  times its eccentricity, then  $5\lambda^2$  is : **MEL097**
9. The radius of the largest circle with centre  $(1, 0)$  that can be inscribed in the ellipse  $x^2 + 4y^2 = 16$  is  $\sqrt{\frac{\alpha}{\beta}}$  where  $\alpha$  and  $\beta$  are prime number, then  $\alpha + \beta$  is **MEL098**
10. Common tangents are drawn to the parabola  $y^2 = 4x$  & the ellipse  $3x^2 + 8y^2 = 48$  touching the parabola at  $A$  &  $B$  and the ellipse at  $C$  &  $D$ , then the area of the quadrilateral  $ABCD$  is  $\lambda\sqrt{2}$ , the  $\lambda$  is equal to **MEL099**



4. Let  $F_1, F_2$  be two foci of the ellipse and  $PT$  and  $PN$  be the tangent and the normal respectively to the ellipse at point  $P$  then  
 (A)  $PN$  bisects  $\angle F_1PF_2$  (B)  $PT$  bisects  $\angle F_1PF_2$   
 (C)  $PT$  bisects angle  $(180^\circ - \angle F_1PF_2)$  (D) None of these

MEL103

5. If  $\ell_1$  be the equation of the common tangent in 1<sup>st</sup> quadrant to the circle  $x^2 + y^2 = 16$  and ellipse  $\frac{x^2}{25} + \frac{y^2}{4} = 1$  and  $\lambda_1$  be the length of the intercept of the common tangent between the coordinate axes then

- (A)  $\lambda_1 = \frac{14}{\sqrt{3}}$  (B) Equation of  $\ell_1$  is  $2x + \sqrt{3}y = 4\sqrt{7}$   
 (C)  $\lambda_1 = \frac{4}{\sqrt{3}}$  (D) Equation of  $\ell_1$  is  $x + \sqrt{3}y = 4\sqrt{7}$

MEL104

6. Let  $E_1$  and  $E_2$  be two ellipses  $\frac{x^2}{a^2} + y^2 = 1$  and  $x^2 + \frac{y^2}{a^2} = 1$  (where  $a$  is parameter) the locus of points of intersection of the ellipses  $E_1$  and  $E_2$  is a set of curves  
 (A)  $y = x, y = -x, x^2 + y^2 = 1$  (B)  $y = 2x, y = -2x, x^2 + y^2 = 4$   
 (C)  $(4x^2 - y^2)(x^2 + y^2 - 4) = 0$  (D)  $(x^2 - y^2)(x^2 + y^2 - 1) = 0$

MEL105

SECTION-II

- This section contains **TWO** paragraphs.
- Based on each paragraph, there are **THREE** questions.
- Each question has **FOUR** options (A), (B), (C) and (D) **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories :  

Full Marks	:	+3	if only the bubble corresponding to the correct answer is darkened.
Zero Marks	:	0	in all other cases.

Comprehension # 1 (Q. No. 7 - 9)

Two tangents  $PA$  and  $PB$  are drawn from a point  $P(h, k)$  to the ellipse  $E: \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  ( $a > b$ ). Angle of the tangents with the positive  $x$  - axis are  $\theta_1$  and  $\theta_2$ . Normals at  $A$  and  $B$  are intersecting at  $Q$  point. On the basis of above information answer the following questions.

7. Locus of  $P$ , if  $\tan \theta_1 \cdot \tan \theta_2 = 4$ , is  
 (A)  $\frac{y-b}{x-a} = 2(x+a)$  (B)  $y^2 - b^2 = 2(x^2 + a^2)$   
 (C)  $\frac{y+b}{x+a} = \frac{4(x-a)}{y-b}$  (D)  $\frac{y+b}{x-b} = \frac{x+a}{y-b}$

MEL106

8. Circumcentre of  $\Delta QAB$  is  
 (A) mid point of  $AB$  (B) mid point of  $PQ$  (C) orthocentre of  $\Delta PAB$  (D) can't say

MEL107

9. Locus of  $P$ , if  $\cot \theta_1 + \cot \theta_2 = \lambda$ , is  
 (A)  $2xy = \lambda(y^2 - b^2)$  (B)  $2xy - \lambda(b^2 - y^2) = 0$   
 (C)  $xy = \lambda$  (D)  $x^2 + xy = \lambda$

MEL108

**Comprehension # 2 (Q. No. 10 - 12)**

Consider the ellipse  $\frac{x^2}{9} + \frac{y^2}{4} = 1$  and the parabola  $y^2 = 2x$ . They intersect at  $P$  and  $Q$  in the first and fourth quadrants respectively. Tangents to the ellipse at  $P$  and  $Q$  intersect the  $x$ -axis at  $R$  and tangents to the parabola at  $P$  and  $Q$  intersect the  $x$ -axis at  $S$ .

10. The ratio of the areas of the triangles  $PQS$  and  $PQR$ , is  
 (A) 1 : 3 (B) 1 : 2 (C) 2 : 3 (D) 3 : 4

MEL109

11. The area of quadrilateral  $PRQS$ , is  
 (A)  $\frac{3\sqrt{15}}{2}$  (B)  $\frac{15\sqrt{3}}{2}$  (C)  $\frac{5\sqrt{3}}{2}$  (D)  $\frac{5\sqrt{15}}{2}$

MEL110

12. The equation of circle touching the parabola at upper end of its latus rectum and passing through its vertex, is  
 (A)  $2x^2 + 2y^2 - x - 2y = 0$  (B)  $2x^2 + 2y^2 + 4x - \frac{9}{2}y = 0$   
 (C)  $2x^2 + 2y^2 + x - 3y = 0$  (D)  $2x^2 + 2y^2 - 7x + y = 0$

MEL111

**SECTION-III**

- This section contains **SIX** questions.
- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value of the answer using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer. If the numerical value has more than two decimal places, truncate/round-off the value to TWO decimal places.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +3 **ONLY** if the correct numerical value is entered;  
 Zero Marks : 0 In all other cases.

13. A circle of radius  $r$  is concentric with the ellipse  $\frac{x^2}{4^2} + \frac{y^2}{3^2} = 1$  and the common tangent is inclined to the major axis at an angle of  $\tan^{-1} \sqrt{\left(\frac{r^2 - \beta^2}{\alpha^2 - r^2}\right)}$ ;  $r \in (b, a)$  then the value of  $|\alpha| + |\beta|$  is

MEL112

14. The eccentricity of an ellipse whose foci are  $(2, 4)$  &  $(14, 9)$  and touches  $x$ -axis is  $\frac{\lambda}{\sqrt{313}}$  then the value of  $\lambda$  is

MEL113

## Ellipse

15. If  $CF$  is perpendicular from the centre of the ellipse  $\frac{x^2}{4^2} + \frac{y^2}{3^2} = 1$  to the tangent at  $P$ , and  $G$  is the point where the normal at  $P$  meets the major axis, then the product  $CF \cdot PG$  is **MEL114**
16. Least integral value of  $r$  for which equation  $\frac{x^2}{r^2 - r - 6} + \frac{y^2}{r^2 - 6r + 5} = 1$  will represent the ellipse. **MEL115**
17. If the centre of the ellipse  $\frac{(x+y-1)^2}{2} + \frac{(x-y+2)^2}{3} = 1$  is  $(a, b)$ , then the value of  $a + b$  is **MEL116**
18. An ellipse is drawn by taking a diameter of the circle  $(x - 1)^2 + y^2 = 1$  as its semi-minor axis and a diameter of the circle  $x^2 + (y - 2)^2 = 4$  as semi-major axis. If the centre of the ellipse is at the origin and its axes are the coordinate axes, then the value of  $4e^2$  is **MEL117**

**ANSWER KEY**

**EXERCISE - 0**

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	D	C	C	C	A	B	A	C	C	A
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	A	B	C	B	A	A,B	A,B,D	A,C	A,C	A,B
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	A,C,D	A,C,D	C,D	A,D	B,D	A,B	A,B	D	C	A
Que.	31	32	33							
Ans.	A	D	A→S;B→R;C→P;D→Q							

**EXERCISE - S**

1. 5.00      2. 64.00      3. 2      4. 8.00      5. 80  
 6. 2      7. 3      8. 1.05 or 1.06      9. 60      10. 0.50

**EXERCISE - JEE (Main) PYQ**

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	2	3	3	3	1	4	2	3	4	2
Que.	11	12	13	14	15	16				
Ans.	1	2	2	3	3	1				

**EXERCISE - JEE (Advanced) PYQ**

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	4	A,B	A	C	A,C	C,D	A	4	C	A,C

**JEE (Main) Practice Paper**

Section-A	Q.	1	2	3	4	5	6	7	8	9	10
	A.	1	1	4	4	3	3	3	1	1	4
	Q.	11	12	13	14	15	16	17	18	19	20
	A.	1	1	3	1	3	4	2	3	3	4
Section-B	Q.	1	2	3	4	5	6	7	8	9	10
	A.	2	2	3	1	65	21	15	9	14	55

**JEE (Advanced) Practice Paper**

Section-I	Q.	1	2	3	4	5	6
	A.	A,B,C,D	A,B,C	A,C	A,C	A,B	A,D
Section-II	Q.	7	8	9	10	11	12
	A.	C	B	A	C	B	D
Section-III	Q.	13	14	15	16	17	18
	A.	7	13	9	6	1	3