CHAPTER-9
Conic Sections

Section-A [JEE Advanced/IIT-JEE]

A : Fill in the Blanks

1. The point of intersection of the tangents at the ends of the latus rectum of the parabola $y^2 = 4x$ is..............(1994)

2. An ellipse has eccentricityand one focus at the point $P\left[\frac{1}{2}, 1\right]$. Its one directrix is the common tangent, nearer to the point P, to the circle $x^2 + y^2 = 1$ and the hyperbola $x^2 - y^2 = 1$. The equation of the ellipse, in the standard form is......(1996)

C : MCQ'S with One Correct Answer

1. The equation $\frac{x^2}{1-r} - \frac{y^2}{1+r} = 1, r > 1$ represents (1981)

   (a) an ellipse

   (b) a hyperbola

   (c) a circle

   (d) none of these

2. Each of the four inequalties given below defines a region in the xy plane. One of these four regions does not have the following property. For any two points (x_1, y_1) and (x_2, y_2) in the region, the point $\left[\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right]$ is also in the region. The inequality defining this region is (1981)

   (a) $x^2 + y^2 \leq 1$

   (b) Max$\{| x |, | y |\} \leq 1$

   (c) $x^2 - y^2 \leq 1$

   (d) $y^2 - x$
   $eq 0$

3. The equation $x^2 + y^2 + 2x + 3y - 8x - 18y + 35 = k$ represents (1994)

(a) no locus if $k > 0$

(b) no ellipse if $k < 0$

(c) no point if $k = 0$

(d) no hyperbola if $k > 0$

4. Let E be the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$ and C be the circle $x^2 + y^2 = 9$. Let P and Q be the points (1,2) and (2,1) respectively. Then (1994)

   (a) Q lies inside C but outside E

   (b) Q lies outside both C and E

   (c) P lies inside both C and E

   (d) P lies inside C but outside E

5. Consider a circle with its centre lying on the focus of the parabola $y^2 = 2Px$ such that it touches the directrix of the parabola. Then a point of intersection of the circle and parabola is (1995)

   (a) $\left[\frac{P}{2}, P\right]$ or $\left[\frac{P}{2}, -P\right]$

   (b) $\left[\frac{P}{2}, -\frac{P}{2}\right]$

   (c) $\left[-\frac{P}{2}, P\right]$

   (d) $\left[-\frac{P}{2}, -\frac{P}{2}\right]$

6. The radius of the circle passing through the foei of the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ and having its centre at (0,3) is (1995)

   (a) 4

   (b) 3

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

   (d) $\frac{7}{2}$

7. Let $P(a\sec\theta, b\tan\theta)$ and $Q(a\sec\theta, b\tan\theta)$, where $\theta + \phi = \frac{\pi}{2}$ be two points on the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$. If(h,k) is the point of intersection of the normals at P and Q then k is equal to (1999)

   (a) $\frac{a^2+b^2}{a}$

(b) $-\frac{a^2+b^2}{a}$

(c) $\frac{a^2+b^2}{b}$

(d) $-\frac{a^2+b^2}{b}$

8. If x=9 is the chord of contact of the hyperbola $x^2 - y^2 = 9$, then the equation of the corresponding pair of tangents is (1999)

   (a) $9x^2 + 8y^2 + 18x - 9 = 0$

   (b) $9x^2 + 8y^2 + 18x + 9 = 0$

   (c) $9x^2 + 8y^2 - 18x - 9 = 0$

   (d) $9x^2 + 8y^2 - 18x + 9 = 0$

9. The curve described parametrically by $x = t^2 + t + 1, y = t^2 - t + 1$ represents (1999)

   (a) a pair of straight lines

   (b) an ellippse

   (c) a parabola

   (d) a hyperbola

10. If $x + y = k$ is normal to $y^2 = 12x$, then k is (2000)

    (a) 3

    (b) 9

    (c) -9

    (d) -3

11. If the line $x - 1 = 0$ is the directrix of the parabola $y^2 - kx + 8 = 0$, then one of the values of k is (2000)

    (a) $\frac{1}{8}$

    (b) 8

    (c) 4

    (d) $\frac{1}{4}$

12. The equation of the common tangent touching the circle $(x-3)^2+y^2 = 9$ and the parabola $y^2 = 4x$ above the x-axis is (2001)

   (a) $\sqrt{3}y = 3x + 1$
   (b) $\sqrt{3}y = -(x + 3)$
   (c) $\sqrt{3}y = (x + 3)$
   (d) $\sqrt{3}y = -(3x + 1)$

13. The equation of the directrix of the parabola $y^2 + 4y + 4x + 2 = 0$ is (2001)

   (a) $x = -1$
   (b) $x = 1$
   (c) $x = -\frac{3}{2}$
   (d) $x = \frac{3}{2}$

14. If $a > 2b > 0$ then the positive value of m for which $y = mx-b\sqrt{1 + m^2}$ is a common tangent to $x^2 + y^2 = b^2$ and $(x - a)^2 + y^2 = b^2$ is (2002)

   (a) $\frac{2b}{\sqrt{a^2-4b^2}}$
   (b) $\frac{\sqrt{a^2-4b^2}}{2b}$
   (c) $\frac{2b}{a-2b}$
   (d) $\frac{b}{a-2b}$

15. The locus of the mid-point of the line segment joining the focus to a moving point on the parabola $y = 4ax$ is another parabola with directrix (2002)

   (a) $x = -a$
   (b) $-\frac{a}{2}$
   (c) $x = 0$
   (d) $\frac{a}{2}$

16. The equation of the common tangent to the curves $y^2 = 8x$ and $xy = -1$ is (2002)

(a) $3y = 9x + 2$

(b) $y = 2x + 1$

(c) $2y = x + 8$

(d) $y = x + 2$

17. The area of the quadrilateral formed by the tangents at the end points of latus rectum to the ellipse $\frac{x^2}{9} + \frac{y^2}{5} = 1$ is (2003)

(a) $\frac{27}{4} sq.units$

(b) 9 sq.units

(c) $\frac{27}{2} sq.units$

(d) 27 sq.units

18. The focal chord to $y^2 = 16x$ is tangent to $(x - 6)^2 + y^2 = 2$, then the possible values of the slope of this chord, are (2003)

(a) $\{-1, 1\}$

(b) $\{-2, 2\}$

(c) $\{-2, -\frac{1}{2}\}$

(d) $\{2, -\frac{1}{2}\}$

19. For hyperbola $\frac{x^2}{\sin^2\alpha} - \frac{y^2}{cos^2\alpha} = 1$ which of the following remains constant with change in $'\alpha'$ (2003)

(a) abscissae of vertices

(b) abscissae of foci

(c) eccentricity

(d) directrix

20. Iftangents are drawn to the ellipse $x^2 + 2y^2 = 2$, then the locus of the mid-point ofthe intercept made by the tangents between the coordinate axes is (2004)

(a) $\frac{1}{2x^2} + \frac{1}{4y^2} = 1$

(b) $\frac{1}{4x^2} + \frac{1}{2y^2} = 1$

(c) $\frac{x^2}{2} + \frac{y^2}{4} = 1$

(d) $\frac{x^2}{4} + \frac{y^2}{2} = 1$

21. The angle between the tangents drawn from the point (1,4) to the parabola $y^2 = 4x$ is (2004)

    (a) $\frac{\pi}{6}$
    (b) $\frac{\pi}{4}$
    (c) $\frac{\pi}{3}$
    (d) $\frac{\pi}{2}$

22. Ifthe line $2x + \sqrt{6}y = 2$ touches the hyperbola $x^2 - y^2 = 4$ then the point of contact is (2004)

    (a) $(-2\sqrt{6})$
    (b) $(-5, \sqrt[2]{6})$
    (c) $(\frac{1}{2}, \frac{1}{\sqrt{6}})$
    (d) $(4, -\sqrt{6})$

23. The minimum area of triangle formed by the tangent to the $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$& coordinate axes is (2005)

    (a) ab sq.units
    (b) $\frac{a^2+b^2}{2}$sq.units
    (c) $\frac{(a+b)^2}{2}$sq.units
    (d) $\frac{a^2+ab+b^2}{3}$sq.units

24. Tangent to the curve $y = x^2 + 6$ at a point (1,7) touches the circle $x^2 + y^2 + 16x + 12y + c = 0$ at a point Q. Then the coordinates of Q are (2005)

    (a) (-6,-11)
    (b) (-9,-13)
    (c) (-10,-15)
    (d) (-7,-5)

25. The axis ofa parabola is along the line $y = x$ and the distances of its vertex and focus from origin are $\sqrt{2}$ and $\sqrt[2]{2}$ respectively. If vertex and focus both lie in the first quadrant, then the equation of the parabola is (2006)

    (a) $(x + y)^2 = (x - y - 2)$
    (b) $(x - y)^2 = (x + y - 2)$
    (c) $(x - y)^2 = 4(x + y - 2)$
    (d) $(x - y)^2 = 8(x + y - 2)$

26. A hyperbola, having the transverse axis of length $2\sin\theta$,is confocal with the ellipse $3x^2 + 4y^2 = 12$. Then its equation is (2007)

    (a) $x^2 \text{cosec}^2\theta - y^2 \sec^2\theta = 1$
    (b) $x^2 \sec^2\theta - y^2 \text{cosec}^2\theta = 1$
    (c) $x^2 \sin^2\theta - y^2 \cos^2\theta = 1$
    (d) $x^2 \cos^2\theta - y^2 \sin^2\theta = 1$

27. Leta and b be non-zero real numbers. Then, the equation $(ax^2 + by^2 + c)(-5xy + 6y) = 0$ represents (2008)

    (a) four straight lines, when c=0 and a, b are ofthe same sign.
    (b) two straight lines and a circle, when a=b, and cis of sign opposite to that of a
    (c) two straight lines and a hyperbola, when a and b are of the same sign and c is of sign opposite to that of a
    (d) a circle and an ellipse, when a and b are of the same sign and c is of sign opposite to that of a

28. Consider a branch of the hyperbola$x^2 - y^2 - \sqrt[2]{2}x - \sqrt[4]{2}y - 6 = 0$. with vertex at the point A. Let B be one of the end point so its latus rectum. IfC is the focus of the hyperbola nearest to the point A, then the area of the triangle ABC is (2008)

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

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

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

29. The line passing through the extremity A of the major axis and extremity B of the minor axis of the ellipse $X^2+9y^2=9$ meets its auxiliary circle at the point M. Then the area of the triangle with vertices at A, M and the origin O is (2008)

    (a) $\frac{31}{10}$
    (b) $\frac{29}{10}$
    (c) $\frac{21}{10}$
    (d) $\frac{27}{10}$

30. The normal at a point P on the elipse $x^2+4y^2=16$ mets the x-axis at Q. If M is the mid point of the line segment PQ, then the locus of M intersects the latus rectums of the given ellipse at the points (2009)

    (a) $\left[\pm\frac{\sqrt[3]{5}}{2},\pm\frac{2}{7}\right]$
    (b) $\left[\pm\frac{\sqrt[3]{5}}{2},\pm\sqrt{\frac{19}{4}}\right]$
    (c) $\left[\pm\sqrt[2]{3},\pm\frac{1}{7}\right]$
    (d) $\left[\pm\sqrt[2]{3},\pm\frac{\sqrt[4]{3}}{7}\right]$

31. The locus of the orthocentre of the triangle formed by the lines $(1+p)x-PY+p(1+p)=0$, $(1+q)x-qy+q(1+q)=0$, and $y=0$, where $p\neq q$, is (2009)

    (a) a hyperbola
    (b) a parabola
    (c) an ellipse
    (d) a straight line

32. Let P(6, 3) be a point on the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$.If the normal at the point P intersects the x-axis at (9,0), then the eccentricity of the hyperbola is (2011)

(a) $\sqrt{\frac{5}{2}}$

(b) $\sqrt{\frac{3}{2}}$

(c) $\sqrt{2}$

(d) $\sqrt{3}$

33. Let (x, y) be any point on the parabola $y^2 = 4x$. Let P be thepoint that divides the line segment from (0,0) to (x,y) in the ratio 1 : 3. Then the locus of P is (2011)

    (a) $x^2 = y$

    (b) $y^2 = 2x$

    (c) $y^2 = x$

    (d) $x^2 = 2y$

34. The ellipse E: $\frac{x^2}{9} + \frac{y^2}{4} = 1$ is inscribed in a rectangle R whose sides are parallel to the coordinate axes. Another ellipse E, passing through the point (0,4) circumscribes the rectangleR. The eccentricity of the ellipse E, is (2012)

    (a) $\frac{\sqrt{2}}{2}$

    (b) $\frac{\sqrt{3}}{2}$

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

    (d) $\frac{3}{2}$

35. The common tangents to the circle $x^2+y^2 = 2$ and the parabola $y = 8x$ touch the circle at the points P, Q and the parabola at the points R, S. Then the area of the quadrilateral PQRS is (2014)

    (a) 3

    (b) 6

    (c) 9

    (d) 15

D : MCQ'S with One or More Than One Correct Answer

1. The number of values of c such that the straight line $y = 4x + c$ touches the curve $(x^2/4) + y2 = 1$ is (1998)
   (a) 0
   (b) 1
   (c) 2
   (d) infinity

2. If P=(x,y), $F_1 = (3,0), F_2 = (-3,0)$ and $16x^2 + 25y^2 = 400$,then $PF_1 + PF_2$ equals (1998)
   (a) 8
   (b) 6
   (c) 10
   (d) 12

3. On the ellipse $4x^2 + 9y^2 = 1$, the points at which the tangents are parallel to the line $8x = 9y$ are (1999)
   (a) $\frac{2}{5}, \frac{1}{5}$
   (b) $-\frac{2}{5}, \frac{1}{5}$
   (c) $-\frac{2}{5}, -\frac{1}{5}$
   (d) $\frac{2}{5}, -\frac{1}{5}$

4. he equations of the common tangents to the parabola $y = x^2$ and $y = -(x-2)^2$ is/are (2006)
   (a) $y = 4(x-1)$
   (b) $y = 0$
   (c) $y = -4(x-1)$
   (d) $y = -30x - 50$

5. Let a hyperbola passes through the focus of the ellipse $\frac{x^2}{25}+\frac{y^2}{16}=1$. The transverse and conjugate axes of this hyperbola coincide with the major and minor axes of the given ellipse, also the product of eccentricities of given ellipse and hyperbola is 1, then (2006)

   (a) the equation of hyperbola is $\frac{x^2}{9}-\frac{y^2}{16}=1$
   (b) the equation of hyperbola is $\frac{x^2}{9}-\frac{y^2}{25}=1$
   (c) focus of hyperbola is (5,0)
   (d) vertex of hyperbola is $(\sqrt[5]{3},0)$

6. Let $P(x_1,y_1)$ and $Q(x_2,y_2), y_1<0, y_2<0$, be the end points of the latus rectum of the ellipse $x^2+4y^2=4$. The equations of parabolas with latus rectum PQ are (2008)

   (a) $x^2+\sqrt[2]{3}y=3+\sqrt{3}$
   (b) $x^2-\sqrt[2]{3}y=3+\sqrt{3}$
   (c) $x^2+\sqrt[2]{3}y=3-\sqrt{3}$
   (d) $x^2-\sqrt[2]{3}y=3-\sqrt{3}$

7. In a triangle ABC with fixed base BC, the vertex A moves such that $\cos B+\cos C=4\sin^2\frac{A}{2}$. If a, b and c denote the lengths of the sides of the triangle opposite to the angles A, B and C, respectively, then (2009)

   (a) $b+c=4a$
   (b) $b+c=2a$
   (c) locus of point A is an ellipse
   (d) locus of point A is a pair of straight lines

8. The tangent PTand the normal PN to the parabola $y^2=4ax$ at a point P on it meet its axis at points T and N, respectively The locus of the centroid of the triangle PTN is a parabola whose (2009)

   (a) Vertex is $\left[\frac{2a}{3},0\right]$
   (b) directrix is $x=0$
   (c) latus rectum is $\frac{2a}{3}$

(d) focus is $(a, 0)$

9. An ellipse intersects the hyperbola $2x^2 - 2y^2 = 1$ orthogonally. The eccentricity of the ellipse is reciprocal of that of the hyperbola. If the axes of the ellipse are along the coordinate axes, then (2009)

   (a) equation of ellipse is $2x^2 + 2y^2 = 2$
   (b) the foci of ellipse are $(\pm 1, 0)$
   (c) equation of ellipse is $2x^2 + 2y^2 = 4$
   (d) the foci of ellipse are $(\pm\sqrt{2}, 0)$

10. Let A and B be two distinct points on the parabola $y = 4x$. If the axis of the parabola touchesa circle of radius r having AB as its diameter, then the slope of the line joining A and B can be (2010)

    (a) $-\frac{1}{r}$
    (b) $\frac{1}{r}$
    (c) $-\frac{2}{r}$
    (d) $\frac{2}{r}$

11. Let the eccentricity of the hyperbola $\frac{2}{a^2} - \frac{y^2}{b^2} = 1$ be reciprocal to that of the ellipse $x^2 + 4y^2 = 4$. If the hyperbola passes through a focus of the ellipse, then (2011)

    (a) the equation of the hyperbola is $\frac{2}{3} - \frac{y^2}{2} = 1$
    (b) a focus ofthe hyperbola is (2, 0)
    (c) the eccentricity of the hyperbola is $\frac{\sqrt{5}}{2}$
    (d) the equation of the hyperbola is $x^2 - 3y^2 = 3$

12. Let L be a normal to the parabola $y = 4x$. If L passes throughthe point (9,6) then L is given by (2011)

    (a) $y - x + 3 = 0$
    (b) $y + 3x - 33 = 0$
    (c) $y + x - 15 = 0$
    (d) $y - 2x + 12 = 0$

13. Tangents are drawn to the hyperbola $\frac{x^2}{9} - \frac{y^2}{4=1}$, parallel to the straight line $2x - y = 1$. The points of contact of thetangents on the hyperbola are (2012)

   (a) $\left[\frac{9}{\sqrt[2]{2}}, \frac{1}{\sqrt{2}}\right]$
   (b) $\left[-\frac{9}{\sqrt[2]{2}}, -\frac{1}{\sqrt{2}}\right]$
   (c) $\sqrt[3]{3}, -\sqrt[2]{2}$
   (d) $-\sqrt[3]{3}, \sqrt[2]{2}$

14. Let Pand Qbe distinct points on the parabola $y^2 = 2x$ such that a circle with PQ as diameter passes through the vertex O of the parabola. If P lies in the first quadrant and the ares ofthe triangle $\triangle OPQ$ is $\sqrt[3]{2}$,then which of the following is (are) the coordinates of P? (2015)

   (a) $(4, \sqrt[2]{2})$
   (b) $(9, \sqrt[3]{2})$
   (c) $\left[\frac{1}{4}, \frac{1}{\sqrt{2}}\right]$
   (d) $(1\sqrt{2})$

15. 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 E_1 and E_2 be the circle $x^2 + (y-1)^2 = 2$.The straight line $x + y = 3$ touches the curves.S at P,Q and R respectively. Suppose that PO = PR $=\frac{\sqrt[2]{2}}{3}$. If e_1, and e_2 are the eccentricities of E_1 and E_2 respectively, then the correct expression(s) is (are) (2015)

   (a) $e_1^2 + e_2 = \frac{43}{40}$
   (b) $e_1 e_2 = \frac{\sqrt{7}}{\sqrt[2]{7}}$
   (c) $\mid e_1^2 - e_2^2 \mid = \frac{5}{8}$
   (d) $e_1 e_2 = \frac{\sqrt{3}}{4}$

16. Consider the hyperbola $H : x^2 - y^2 = 1$ and a circle S with center $N(x_2, 0)$. Suppose that H and S touch each other at a point $P(x_1, y_1)$ with $x > 1$ and $y > 0$. The common tangent to H and S at P intersects the x-axis at point M. If(l, m) is the centroid of the triangle PMN, then the correct expressions is(are) (2015)

(a) $\frac{dl}{dx_1} = 1 - \frac{1}{3x_1^2} for x_1 > 1$

(b) $\frac{dm}{dx_1} = \frac{x_1}{3\left[\sqrt{x_1^2-1}\right]} for x_1 > 1$

(c) $\frac{dl}{dx_1} = 1 + \frac{1}{3x_1^2} for x_1 > 1$

(d) $\frac{dm}{dy_1} = 1 - \frac{1}{3} for y_1 > 1$

17. he circle $C_1 : x^2 + y^2 = 3$, with centre at O, intersects theparabola $x^2 = 2y$ at the point P in the first quadrant. Let the tangent to the circle C_1, at P touches other two circles C_2 and C_3 at R_2 and R_3, respectively. Suppose C_2 and C_3 have equal radii $\sqrt[2]{3}$ and centres Q_2 and Q_3, respectively. If Q_2 and Q_3 lies on the y-axis, then (2016)

(a) $Q_2Q_3 = 12$

(b) $R_2R_3 = \sqrt[4]{6}$

(c) area of the triangle $OR_2R_3 = \sqrt[6]{2}$

(d) area of the triangle $OQ_2Q_3 = \sqrt[4]{2}$

18. Let P be the point on the parabola $y^2 = 4x$ which is at the shortest distance from the center S of the circle $x^2 + y^2 - 4x - 16y + 64 = 0$. Let Q be the point on the circle dividing the line segment SP internally. Then (2016)

(a) $SP = \sqrt[2]{5}$

(b) $SQ : QP = (\sqrt{5+1}) : 4$

(c) the x-intercept of the normal to the parabola at P is 6

(d) the slope of the tangent to the circle at Q is $\frac{1}{2}$

19. If $2x - y + 1 = 0$ is a tangent to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{16} = 1$,then which of the following cannot be sides ofa right angled triangle? (2017)

(a) a,4,1

(b) a,4,2

(c) 2a,8,1

(d) 2a,4,1

20. Ifa chord, which is not a tangent, of the parabola $y^2 = 16x$ has the equation $2x + y = p$, and midpoint (h,k), then which of the following is(are) possible value(s) of p,h and k? (2017)

   (a) p=-2, h=2, k=4
   (b) p=-1, h=1, k=-3
   (c) p= 2, h=3, k=4
   (d) p=-5, h=4, k=-3

21. 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 which of the following statement(s) is (are) TRUE? (2018)

   (a) For the ellipse, the eccentricity is $\frac{1}{\sqrt{2}}$ and the length ofthe 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 $x = l$ 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 $\frac{1}{16}(\pi - 2)$

E : Subjective Problems

1. Suppose that the normals drawn at three different points on the parabola $y^2 = 4x$ pass through the point (h,k). Show that $h > 2$. (1981)

2. A is a point on the parabola $y^2 = 4ax$. The normal at A cuts the parabola again at point B. If AB subtends aright angle at the vertex of the parabola. find the slope of AB (1982)

3. Three normals are drawn from the point (c,0) to the curve $y = x$. Show that c must be greater than $\frac{1}{2}$. One normal is always the x-axis. Find c for which the other two normals are perpendicular to each other.(1991)

4. Through the vertex O of parabola $y = 4x$, chords OP and OQ are drawn at right angles to one another. Show that for all positions of P, PQ cuts the axis ofthe parabola at a fixed point. Also find the locus of the middle point of PQ.(1994)

5. Show that the locus of a point that divides a chord of slope 2 of the parabola $y^2 = 4x$ internally in the ratio 1 : 2 is a parabola. Find the vertex of this parabola.(1995)

6. Let 'd' be the perpendicular distance from the centre of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2} = 1$ to the tangent drawn at a point P on the ellipse. If F_1 and F_2 are the two foci of the ellipse, then $(PF_1 - PF_2) = 4a^2\left[1 - \frac{b^2}{d^2}\right]$.(1995)

7. Point A,B and C lie on the parabola $y^2 = 4ax$. The tangents to the parabola A,B and C taken in pairs, intersects with points P,Q and R. Determine the ratio of the areas of the triangle ABC and PQR (1996)

8. From a point A common tangents are drawn to the circle $x^2 + y^2 = a^2$ and parabola $y^2 = 4ax$. Find the area of thequadrilateral formed by the common tangents, the chord of contact of the circle and the chord of contact of the parabola (1996)

9. A tangent to the ellipse $x^2 + 4y^2 = 4$ meets the ellipse $x^2 + 2y^2 = 6$ at P and Q. Prove that the tangents at P and Q of the ellipse $x^2 + 2y^2 = 6$ are at right angles. (1997)

10. The angle between a pair of tangents drawn from a point P to the parabola $y^2 = 4ax$ is 45$\circ$. Show that the locus of the point P is a hyperbola.(1998)

11. Consider the family of circles $x^2 + y^2 = r^2, 2 < r < 5$. If in the first quadrant, the common tangent to a circle of this family and the ellipse $4x^2 + 25y^2 = 100$ meets the co-ordinate axes at A and B, then find the equation of the locus of the mid-point of AB.(1999)

12. Find the co-ordinates of all the points P on the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, or which the area of the triangle PON is a maximum, where O denotes the origin and N, the foot of the perpendicular from O to the tangent at P.(1999)

13. Let ABC be an equilateral triangle inscribed in the circle $x^2 + y^2 = a^2$. Suppose perpendiculars from A, B, C to the major axis of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1, (a > b)$ meets the ellipse respecti vely, at P, O, R. so that P,Q,R lie on the same side of the major axis as A, B, C respectively. Prove that the normals to the ellipse drawn at the points P, Q and R are concurrent. (2000)

14. Let C, and C, be respectively, the parabolas x =y- 1 and y=x- 1. Let P be any point on C_1 and Q be any point on C_2. Let P_1 and Q_1, be the reflections of P and Q,respectively with respect to the line $y = x$. Prove that P_1, lies on C_2, Q_1 lies on C_1, and $PQ > min\{PP_1, QQ_1$. Hence or otherwise determine points P_0 and Q_0, on the parabolas C_1 and C_2 respectively such that $P_0Q_0 \geq PQ$ for all pairs of points (P,Q) with P on C_1, and Q on C_2. (2000)

15. Let Pbe a point on the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1, 0 < b < a$. Let the line parallel to y-axis passing through P meet the circle $x^2 + y^2 = a^2$ at the point Q such that P and Q are on the same side of x-axis. For two positive real numbers r and s, find the locus of the point R on PQ such that $PR : RQ = r : s$ as P varies over the ellipse.(2000)

16. Prove that,in an ellipse, the perpendicular from a focus upon any tangent and the line joining the centre of the ellipse to the point of contact meet on the corresponding directrix. (2002)

17. Normals are drawn from the point P with slopes m_1m_2, m_3 to the parabola $y = 4x$. If locus of P with $m_1m_2 = \alpha$ is a part of the parabola itself then find α. (2003)

18. Tangent is drawn to parabola $y^2 - 2y - 4x + 5 = 0$ at a point P which cuts the directrix at the point Q. A point R is such that it divides QP externally in the ratio $\frac{1}{2} : 1$. Find the locus of point R. (2004)

19. Tangents are drawn from any point on the hyperbola $\frac{x^2}{9} + \frac{y^2}{4} = 1$ to the circle $x2 + y^2 = 9$. Find the locus of mid-point of the chord of contact. (2005)

20. Find the equation of the common tangent in 1^st quadrant to he circle $x^2 + y^2 = 16$ and the ellipse $\frac{x^2}{25} + \frac{y^2}{9} = 1$. Also find the length of the intercept of the tangent between the coordinate axes (2005)

F : Match The Following

DIRECTIONS (Q.1): Each question contains statements given in two columns, which have to be matched. The statements in Column-I are labelled 1, 2, 3 and 4. while the statements in Columa-II are labelled as a,b,c, d and e. Any given statement in Column-I can have correct matching with ONE OR MORE statement(s) in Column-II. The appropriate bubbles corresponding to the answer to these questions have to be darkened as illustrated in the following example: If the correct matches are 1-a. s and e: 2-b and c: 3-1 and 2: and 4-d

1. Match the following : (3,0) is the pt. from which three normals are drawn to the parabola $y^2 = 4x$ which meet the parabola in the points P, Q and R. Then (2006)

column-I	column-II
1. Area of triange $\triangle PQR$	a) 2
2. radius of circumcircle $\triangle PQR$	b) $\frac{5}{2}$
3. centroide of $\triangle PQR$	c) $(\frac{5}{2}, 0)$
4. circumcenter of $\triangle PQR$	d) $(\frac{2}{3}, 0)$

2. Match the statements in Column I with the properties in Column II and indicate your answer by darkening the appropriate bubbles in the 4×4 matrix givén in the ORS. (2007)

column-I	column-II
1. Two intersecting circles	a) have a common tangent
2. Twomutually external circles	b) have a common normal
3. Two circles, one strictly inside the other	c) do not have a common tangent
4. Two branches of a hyperbola	d) do not have a common normal

3. Match the conics in Column I with the statements/expressions in Column II. . (2009)

column-I	column-II
1. circle	a) The locus of the point (h,k) for which the line $hx+ky=1$ touches the circle $x^2+y^2=4$
2. parabola	b) Points z in the complex plane satisfying $\mid z+2 \mid - \mid z-2 \mid = \pm 3$
3. ellipse	c) Points of the conic have parametric representation $x=\sqrt{3}\left[\frac{1-t^2}{1+t^2}\right], y=\left[\frac{2t}{1-t^2}\right]$
4. hyperbola	d) The accentricity of the conic lies in the interval $1 < x < \infty$
5.	e) Points z in the complex plane satisfying $Re(z+1)^2 = \mid z \mid^2 = 1$

DIRECTIONS (Q-4): Following question has matching lists. The codes for the list have choices (a), (b), (c) and (d) out of which ONLY ONE is correct.

4. A line L:$y=mx+3$ meets y-axis at E(0, 3) and the arc of the parabola $y^2=16x, 0 \leq 6 \leq 0$ at the point F(x_0, Y_0). The tangent to the parabola at $F(x_0, Y_0)$ intersects the y-axis at $G(0, y_1)$. The slope m of the line L is chosen such that the arca of the triangle EFG has a local maximum. (2013)

Match List I with List II and select the correct answer using the code given below the lists:

List-I	List-II
1. m=	a) $\frac{1}{2}$
2. Maximum area of $\triangle EFG$ is	b) 4
3. $y_0 =$	c) 2
4. $y_1 =$	d) 1

Codes:

	1	2	3	4
(p)	d	b	c	a
(q)	b	c	a	d
(r)	c	d	a	b
(s)	a	d	c	b

Q(5-7) By appropriately matching the in formation given in the three columns of the following table. Column 1, 2, and 3 contain conics, equations of tangents to the conics and points of contact, respectively.

column-I	column-II	column-III
(I) $x^2 + y^2 = a^2$	(i) $my = m^2x + a$	(P) $\left[\frac{a}{m^2} \frac{2a}{m}\right]$
(II) $x^2 + a^2y^2 = a^2$	(ii) $y = mx + a\sqrt{m^2+1}$	(Q) $\left[\frac{-ma}{\sqrt{m^2+1}}, \frac{a}{\sqrt{m^2+1}}\right]$
(III) $y^2 = 4ax$	(iii) $y = mx + \sqrt{a^2m^2+1}$	(R) $\left[\frac{-a^2m}{\sqrt{a^2m^2+1}}, \frac{1}{\sqrt{a^2m^2+1}}\right]$
(IV) $x^2 - a^2y^2 = a^2$	(iv) $y = mx + \sqrt{a^2m^2-1}$	(S) $\left[\frac{-a^2m}{\sqrt{a^2m^2-1}}, \frac{1}{\sqrt{a^2m^2-1}}\right]$

5. For $a = \sqrt{2}$, if a tangent is drawn to a suitable conic (Column-I) at the point of contact (-1,1), then which of the following options is the only correct combination for obtaining its equation? (2017)

   (a) (I)(i)(P)

   (b) (I)(ii)(Q)

   (c) (II)(ii)(Q)

   (d) (III)(ii)(P)

6. Tangent to a suitable conic (column I) is found to be $y = x + 8$ and its point of contact is (8,16), then which of the following options is the only correct combination? (2018)

   (a) (I)(ii)(Q)

   (b) (II)(iv)(R)

   (c) (III)(i)(P)

   (d) (III)(ii)(Q)

7. The tangent to a suitable conic (Column I) at $\left[\sqrt{3}, \frac{1}{2}\right]$ is found to be $\sqrt{3}x + 2y = 4$, then which of the following options is the only correct combination? (2018)

   (a) (IV)(iii)(S)

   (b) (IV)(iv)(S)

   (c) (II)(iii)(R)

   (d) (II)(iv)(R)

8. Let $H : \frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$, where $a > b > 0$, be a hyperbola in the xy-plane whose conjugate axis LM subtends an angle of $60°$ at one of its vertices N. Let the area of the triangle LMN be $\frac{4}{\sqrt{3}}$ (2018)

List-I	List-II
1. The length of the conjugate axis of H is	a) 8
2. The eccentricity of H is	b) $\frac{4}{\sqrt{3}}$
3. The distance between the foci of H is	c) $\frac{2}{\sqrt{3}}$
4. The length of the latus rectum of H is	d) 4

   The correct option is:

   (a) $1 \to d; 2 \to b; 3 \to a; 4 \to c$

   (b) $1 \to d; 2 \to c; 3 \to a; 4 \to b$

   (c) $1 \to d; 2 \to a; 3 \to c; 4 \to b$

   (d) $1 \to c; 2 \to d; 3 \to b; 4 \to a$

G : Comprehension Based Questions

PASSAGE-1 Consider the circle $x^2 + y^2 = 9$ and the parabola $y^2 = 8x$. They intersect at P and Q in the first and the fourth quadrants,respectively Tangents to the curcle at Pand Q intersect the x-axis at R and tangents to the parabola at Pand Q intersect the x-axis at S.

1. The ratio of the areas of the triangles PQS and POR is (2007)

(a) $1 : \sqrt{2}$
(b) $1 : 2$
(c) $1 : 4$
(d) $1 : 8$

2. The radius of the circumcircle of the triangle PRS is (2007)

(a) 5
(b) $\sqrt[5]{3}$
(c) $\sqrt[3]{2}$
(d) $\sqrt[2]{3}$

3. The radius of the incircle of the triangle PQR is (2007)

(a) 4
(b) 3
(c) $\frac{8}{3}$
(d) 2

PASSAGE-2 The circle $x^2 + y^2 - 8x = 0$ and hyperbola $\frac{x^2}{9} - \frac{y^2}{4} = 1$ intersect at the point A and B (2010)

4. Equation of a common tangent with positive slope to the circle as well as to the hyperbola is

(a) $2x - \sqrt{5}y - 20x = 0$
(b) $2x - \sqrt{5}y + x = 0$
(c) $3x - 4y + 8 = 0$
(d) $4x - 3y + 4 = 0$

5. Equation of the circle with AB as its diameter is

(a) $x^2 + y^2 - 12x + 24 = 0$
(b) $x^2 + y^2 + 12x + 24 = 0$
(c) $x^2 + y^2 - 24x + 12 = 0$
(d) $x^2 + y^2 - 24x - 12 = 0$

PASSAGE-3 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. (2010)

6. The coordinates of A and B are
   (a) (3,0) and (0,2)
   (b) $\left[\frac{-8}{5}, \frac{\sqrt[2]{161}}{15}\right]$ and $\left[\frac{-9}{5}, \frac{8}{5}\right]$
   (c) $\left[\frac{-8}{5}, \frac{\sqrt[2]{161}}{15}\right]$ and (0,2)
   (d) $\left[\frac{-9}{5}, \frac{8}{5}\right]$ and (3,0)

7. 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) $\left[\frac{8}{25}, \frac{7}{5}\right]$

8. The equation of the locus of the point whose distances from the point P and the line AB are equal,is
   (a) $x^2 + y^2 - 6xy - 54x - 62y + 241 = 0$
   (b) $x^2 + 9y^2 + 6xy - 54x + 62y - 241 = 0$
   (c) $9x^2 + 9y^2 - 6xy - 54x - 62y - 241 = 0$
   (d) $x^2 + y^2 - 2xy + 27x + 31y - 120 = 0$

PASSAGE-4 Let PQ be a focal chord of the parabola $y^2 = 4ax$. The tangents to the parabola at P and Q meet at a point lying on the line $y = 2x + a, a > 0$.

9. Length of chord PQ is (2013)
   (a) 7
   (b) 5
   (c) 2
   (d) 3

10. If chord PQ subtends an angle θ at the vertex of $y^2 = 4ax$,then $\tan\theta$ (2013)

    (a) $\frac{2}{3}\sqrt{7}$
    (b) $-\frac{2}{3}\sqrt{7}$
    (c) $\frac{2}{3}\sqrt{5}$
    (d) $-\frac{2}{3}\sqrt{5}$

    PASSAGE-5 Let a, r, s, t be nonzero real numbers. Let $P(at^2, 2at)$, $R(ar^2, 2ar)$ and $S(as^2, 2as)$ be distinct points on the parabola $y^2 = 4ax$. Suppose that PQ is the focal chord and lines QR and PK are parallel, where K is the point (2a,0). (2014)

11. The value of r is

    (a) $-\frac{1}{t}$
    (b) $\frac{t^2+1}{t}$
    (c) $\frac{1}{t}$
    (d) $\frac{t^2-1}{t}$

12. If $st = 1$, then the tangent at P and the normal at S to the parabola meet at a point whose ordinate is

    (a) $\frac{(t^2+1)^2}{2t^3}$
    (b) $a\frac{(t^2+1)^2}{2t^3}$
    (c) $a\frac{(t^2+1)^2}{t^3}$
    (d) $a\frac{(t^2+2)^2}{t^3}$

    PASSAGE-6 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 Suppose $\frac{x^2}{9} + \frac{y^2}{4} = 1$ 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.

13. The orthocentre ofthe triangle F_1MN is (2016)

    (a) $\left[-\frac{9}{10}, 0\right]$

(b) $\left[\frac{2}{3}, 0\right]$

(c) $\left[\frac{9}{10}, 0\right]$

(d) $\left[\frac{2}{3}, \sqrt{6}\right]$

14. 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 MOR to area of the quadrilateral MF_1NF_2, is

    (a) 3 : 4

    (b) 4 : 5

    (c) 5 : 8

    (d) 2 : 3

H : Assertion And Reason Type Questions

1. STATEMENT-1: The curve $y = -\frac{x^2}{2} + x + 1$ is symmetric with respect to the line $x = 1$. because STATEMENT-2: A parabola is symmetric about its axis.(2007)

    (a) Statement-1 is True, Statement-2 is Tue; Statement-2 is a correct explanation for Statement-1

    (b) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement

    (c) Statement-1 is True, Statement-2 is False

    (d) Statement-1 is False, Statement-2 is True.

I : Integer Value Correct Type

1. The line $2x^2 + y^2 = 1$ is tangent to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ If this line passes through the point of intersection of the nearest directrix and the x-axis, then the eccentricity of the hyperbola is (2010)

2. Consider the parabola $y^2 = 8x$. Let A, be the area of the triangle formed by the end points of its latus rectum and the point $P\left[\frac{1}{2}, 2\right]$ on the parabola and $\triangle_2$, be the area of the triangle formed by drawing

tangents at P and at the end the points of the latus rectum. Then $\frac{\triangle_1}{\triangle_2}$ is (2011)

3. Let S be the focus of the parabola $y = 8x$ and let PQ be the common chord of the circle $x^2 + y^2 - 2x - 4y = 0$ and the given parabola. The area of the triangle PQS is (2012)

4. A vertical line passing through the point (h,0) intersects the ellipse $\frac{x^2}{4} + \frac{y^2}{3} = 1$ at the points P and Q. Let the tangents to the ellipse at P and Q meet at the point R. If $\triangle(h)$ = area of the triangle PQR,$\triangle_1$=$max_{\frac{1}{2}\leq h\leq 1}\triangle(h)$ and $\triangle_2$=$min_{\frac{1}{2}\leq h\leq 1}\triangle(h)$ then, $\frac{8}{\sqrt{5}}\triangle_1 - 8\triangle_2$ (2013)

   (a) g(x) is continuous but not differentiable at a
   (b) g(r) is differentiable on R
   (c) g(X) is continuous but not differentiable at b
   (d) g(x) is continuous and differentiable at either (a) or (b) but not both

5. If the normals of the parabola $y^2 = 4x$ drawn at the end points of its latus rectum are tangents to the circle $(x-3)^2 + (y+2)^2 = r^2$, then the value of r^2 is (2015)

6. Let the curve Cbe the mirror image of the parabola $y^2 = 4x$ with respect to the line $x+y+4 = 0$. If A and B are the pointsof intersection of C with the line $y = -5$, then the distance between A and B is (2015)

7. 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 G,0). If m_1, is the slope of T_1, and m_2 be slope of T_2, then the value of $\left[\frac{1}{m_1^2} + m_2^2\right]$ is (2015)

Section-B [JEE Mains /AIEEE]

1. Two common tangents to the circle $x^2+y^2 = 2a^2$ and parabola $y^2 = 8ax$ are (2002)

(a) $x = \pm(y + 2a)$

(b) $y = \pm(x + 2a)$

(c) $x = \pm(y + a)$

(d) $y = \pm(x + a)$

2. The normal at the point $(bt_1^2, 2bt_1)$ on a parabola meets the parabola again in the point $(bt_2^2, 2bt_2)$ then (2003)

   (a) $t_2 = t_1 + \frac{1}{t_1}$

   (b) $t_2 = -t_1 - \frac{1}{t_1}$

   (c) $t_2 = -t_1 + \frac{1}{t_1}$

   (d) $t_2 = t_1 - \frac{1}{t_1}$

3. The foci of the ellipse $\frac{x^2}{16} + \frac{y^2}{b^2} = 1$ and the hyperbola $\frac{x^2}{144} - \frac{y^2}{81} = \frac{1}{25}$ coincide. Then the value of b^2 is (2003)

   (a) 9

   (b) 1

   (c) 5

   (d) 7

4. If $a0$ and the line $2bx + 3cy + 4d = 0$ passes through the points of intersection of the parabolas $y^2 = 4ax$ and $x^2 = 4ay$, then (2004)

   (a) $d^2 + (3b - 2c)^2 = 0$

   (b) $d^2 + (3b + 2c)^2 = 0$

   (c) $d^2 + (2b + 3c)^2 = 0$

   (d) $d^2 + (2b - 3c)^2 = 0$

5. The eccentricity of an ellipse, with its centre at the origin, is $\frac{1}{2}$. If one of the directrices is $x^2 = 4$, then the equation of the ellipse: (2004)

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

   (b) $3x^2 + 4y^2 = 12$

   (c) $4x^2 + 3y^2 = 12$

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

6. Let Pbe the point (1,0) and Qa point on the locus $y^2 = 8x$ The locus of mid point of PQ is (2005)

   (a) $y^2 - 4x + 2 = 0$
   (b) $y^2 + 4x + 2 = 0$
   (c) $x^2 + 4y + 2 = 0$
   (d) $x^2 - 4y + 2 = 0$

7. The locus of a point $P(\alpha, \beta)$ moving under the condition that the line $y = \alpha x + \beta$ is a tangent to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ is (2005)

   (a) an ellipse
   (b) a circle
   (c) a parabola
   (d) a hyperbola

8. An ellipse has OB as semi minor axis, F and F' its focii and the angle FBF' is a right angle. Then the eccentricity of the ellipse is (2005)

   (a) $\frac{1}{\sqrt{2}}$
   (b) $\frac{1}{2}$
   (c) $\frac{1}{4}$
   (d) $\frac{1}{\sqrt{3}}$

9. The locus of the vertices of the family of parabolas $y = \frac{a^3x^2}{3} + \frac{a^2x}{2} - 2a$ is (2006)

   (a) $xy = \frac{105}{64}$
   (b) $xy = \frac{3}{4}$
   (c) $xy = \frac{35}{16}$
   (d) $xy = \frac{64}{105}$

10. In an ellipse, the distance between its foci is 6 and minoraxis is 8. Then its eccentricity is (2006)

(a) $\frac{3}{5}$

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

(c) $\frac{4}{5}$

(d) $\frac{1}{\sqrt{5}}$

11. Angle between the tangents to the curve $y = x^2 - 5x + 6$ at the points (2,0) and (3,0) is (2006)

    (a) π

    (b) $\frac{\pi}{2}$

    (c) $\frac{\pi}{6}$

    (d) $\frac{\pi}{4}$

12. For the Hyperbola $\frac{x^2}{\cos^2 \alpha} - \frac{y^2}{\sin^2 \alpha} = 1$, which of the following remains constant when α varies=? (2007)

    (a) abscissae of vertices

    (b) abscissae of foci

    (c) eccentricity

    (d) directrix.

13. The equation of a tangent to the parabola $y = 8x$ is $y = x + 2$. The point on this line from which the other tangent to the parabola is perpendicular to the given tangent is (2007)

    (a) (2,4)

    (b) (-2,0)

    (c) (1,1)

    (d) (0,2)

14. The normal to a curve at P(x,y) meets the x-axis at G. If the distance of G from the origin is twice the abscissa of P, then the curve is a (2007)

    (a) circle

    (b) hyperbola

(c) ellipse

(d) parabola

15. Afocus of an ellipse is at the origin. The directrix is the line $x = 4$ and the eccentricity is Then the length of the semi-major axis is (2007)

    (a) $\frac{8}{3}$

    (b) $\frac{2}{3}$

    (c) $\frac{4}{3}$

    (d) $\frac{5}{3}$

16. A parabola has the origin as its focus and the line $x = 2$ as the directrix. Then the vertex of the parabola is at (2008)

    (a) (0,2)

    (b) (1,0)

    (c) (2,0)

    (d) (0,1)

17. The ellipse $x^2 + 4y^2 = 4$ is inscribed in a rectangle aligned with the coordinate axes, which in turn is inscribed in another ellipse that passes through the point (4, 0). Then the equation of the ellipse is (2009)

    (a) $x^2 + 4y^2 = 4$

    (b) $x^2 + 12y^2 = 16$

    (c) $4x^2 + 48y^2 = 48$

    (d) $x^2 + 16y^2 = 16$

18. If two tangents drawn from a point P to the parabola $y^2 = 4x$ are at right angles, then the locus of P is (2010)

    (a) $2x + 1 = 0$

    (b) $x = -1$

    (c) $2x - 1 = 0$

    (d) $x = 1$

19. Equation of the ellipse whose axes are the axes of coordinates and which passes through the point (-3,1) and has eccentricity $\sqrt{\frac{2}{5}}$ is (2011)

    (a) $5x^2 + 3y^2 - 48 = 0$
    (b) $3x^2 + 5y^2 - 15 = 0$
    (c) $5x^2 + 3y^2 - 32 = 0$
    (d) $3x^2 + 5y^2 - 32 = 0$

20. Statement-1: An equation of a common tangent to the parabola $y = \sqrt[16]{3}x$ and the ellipse $2x^2 + y^2 = 4$ is $y = 2x + \sqrt[2]{3}$
    Statement-2:Iftheline $y = mx + \frac{\sqrt[4]{3}}{m}(m \neq 0)$ is a common tangent to the parabola $y = \sqrt[16]{3}x$ and the ellipse $2x^2 + y^2 = 4$, then m satisfies $m^4 + 2m^2 = 24$ (2012)

    (a) Statement-1 is false, Statement-2 is true.
    (b) Statement-1 is true, statement-2 is true; statement-2is a correct explanation for Statement-1.
    (c) Statement-1 is true, statement-2 is true; statement-2 is not a correct explanation for Statement-1.
    (d) Statement-1 is true, statement-2 is false.

21. An ellipse is drawn by takinga diameter of the circle $(x - 1)^2 + y^2 = 1$ as its semi-minor axis and a diameter of the circle $x^2 + (y - 2)^2 = 4$ is semi-major axis. If the centre of the ellipse is at the origin and its axes are the coordinate axes, then the equation of the ellipse is: (2012)

    (a) $4x^2 + y^2 = 4$
    (b) $x^2 + 4y^2 = 8$
    (c) $4x^2 + y^2 = 8$
    (d) $x^2 + 4y^2 = 16$

22. The equation of the circle passing through the foci of the elipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$, and having centreat (0,3) is (2013)

    (a) $x^2 + y^2 - 6y - 7 = 0$
    (b) $x^2 + y^2 - 6y + 7 = 0$

(c) $x^2 + y^2 - 6y - 5 = 0$

(d) $x^2 + y^2 - 6y + 5 = 0$

23. Given :A circle, $2x^2 + 2y^2 = 5$ and a parabola, $y^2 = \sqrt[4]{5}x$.
Statement-1 : An equation of a common tangent to these curves is $y = x + \sqrt{5}$
Statement-2 : If the line, $y = mx + \frac{\sqrt{5}}{m} (m \neq 0)$ is their common tangent, then m satisfies $m^4 - 3m^2 + 2 = 0$ (2013)

(a) Statement-1 is true; Statement-2 is true; Statement-2 is a correct explanation for Statement-1.

(b) Statement-1 is true; Statement-2 is true; Statement-2 is not a correct explanation for Statement-1.

(c) Statement-1 is true; Statement-2 is false.

(d) Statement-1 is false; Statement-2 is true.

24. The locus of the foot of perpendicular drawn from the centre ofthe ellipse $x^2 + 3y^2 = 6$ on any tangent to it is (2014)

(a) $(x^2 + y^2)^2 = 6x^2 + 2y^2$

(b) $(x^2 + y^2)^2 = 6x^2 - 2y^2$

(c) $(x^2 - y^2)^2 = 6x^2 + 2y^2$

(d) $(x^2 - y^2)^2 = 6x^2 - 2y^2$

25. The slope of the line touching both the parabolas $y^2 = 4x$ and $x^2 = -32y$ is (2014)

(a) $\frac{1}{8}$

(b) $\frac{2}{3}$

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

(d) $\frac{3}{2}$

26. Let O be the vertex and Q be any point on the parabola, $x^2 = 8y$. Ifthe point P divides the line segment OQ internally in the ratio 1 : 3, then locus of P is: (2015)

(a) $y^2 = 2x$

(b) $x^2 = 2y$

(c) $x^2 = y$

(d) $y^2 = x$

27. The normal to the curve, $x^2 + 2xy - 3y^2 = 0$, at (1,1) (2015)

    (a) meets the curve again in the third quadrant.

    (b) meets the curve again in the fourth quadrant.

    (c) does not meet the curve again.

    (d) mects the curve again in the second quadrant.

28. 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 : (2015)

    (a) $\frac{27}{2}$

    (b) 27

    (c) $\frac{27}{3}$

    (d) 18

29. Let P be the point on the parabola, $y^2 = 8x$ which is at a minimum distance from the eentre C of the circle, $x^2 + (y+6)^2 = 1$. Then the oquation of the circle, passing through C and having ts centre at P is: (2016)

    (a) $x^2 + y^2 - \frac{x}{4} + 2y - 24 = 0$

    (b) $x^2 + y^2 - 4x + 9y + 18 = 0$

    (c) $x^2 + y^2 - 4x + 8y + 18 = 0$

    (d) $x^2 + y^2 - x + 4y - 12 = 0$

30. The eccentricity of the hyperbola whose length of the latus rectum is cqual to 8 and the length of its conjugate axis is equal to half of the distance between its foci, is: (2016)

    (a) $\frac{2}{\sqrt{3}}$

    (b) $\sqrt{3}$

    (c) $\frac{4}{3}$

(d) $\frac{4}{\sqrt{3}}$

31. A hyperbola passes through the point $P(\sqrt{2}, \sqrt{3})$ and has foci at $(\pm 2, 0)$. Then the tangent to this hyperbola at P also passes through the point: (2017)

    (a) $(-\sqrt{2}, -\sqrt{3})$
    (b) $(\sqrt[3]{2}, \sqrt[2]{3})$
    (c) $(\sqrt[2]{2}, \sqrt[3]{3})$
    (d) $(\sqrt{3}, \sqrt{2})$

32. The radius ofa circle, having minimum area, which touches the curve $y = 4 - x^2$ and the lines, $y =| x |$ is (2018)

    (a) $4(\sqrt{2} + 1)$
    (b) $2(\sqrt{2} + 1)$
    (c) $2(\sqrt{2} - 1)$
    (d) $4(\sqrt{2} - 1)$

33. Tangents are drawn to the hyperbola $4x^2 - y^2 = 36$ at the points P and Q. If these tangents intersect at the point T(0,3) then the area(in sq. units) of $\triangle APTQ$ is: (2018)

    (a) $\sqrt[54]{3}$
    (b) $\sqrt[66]{3}$
    (c) $\sqrt[36]{5}$
    (d) $\sqrt[45]{5}$

34. Tangent and normal are drawn at P(16,16) on the parabola $y^2 = 16x$, which intersect the axis of the parabola at A and B respectively. If C is the centre of the circle through the points P,A and B and $\angle CPB = \theta$,then a value of $\tan\theta$ is (2018)

    (a) 2
    (b) 3
    (c) $\frac{4}{3}$

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

35. Two sets A and B are as under:
$A = \{(a,b) \in R \times R :| a - 5 |< 1 and \mid b - 5 |< 1\}$;
$B = \{(a,b) \in R \times R : 4(a-6)^2 + 9(b-5)^2 \leq 36\}$. Then: (2018)

   (a) $A \subset B$
   (b) $A \cap B = \phi(anemptyset)$
   (c) neither $A \subset B$ or $B \subset A$
   (d) $B \subset A$

36. If the tangent at (1,7) to the curve $x^2 = y - 6$ touches the circle $x^2 + y^2 + 16x + 12y + c = 0$ then the value of c is : (2018)

   (a) 185
   (b) 85
   (c) 195
   (d) 95

37. Axis of a parabola lies along x-axis. If its vertex and focus are at distance 2 and 4 respectively from the origin, on the positive x-axis then which of the following points does not lie on it? (2019)

   (a) $(5, \sqrt[2]{6})$
   (b) (8,6)
   (c) $(6, \sqrt[4]{2})$
   (d) (4,-4)

38. Let $0 < \theta, \frac{\pi}{2}$. If the eccentricity of the hyperbola $\frac{x^2}{\cos^2\theta} - \frac{y^2}{\sin^2\theta} = 1$ is greater than 2, then the length of its latus rectum lies in the interval: (2019)

   (a) $(3, \infty)$
   (b) $(\frac{3}{2}, 2)$
   (c) $(2, 3)$
   (d) $(1, \frac{3}{2})$

39. Equation of a common tangent to the circle ,$x^2 + y^2 - 6x = 0$ and the parabola $y^2 = 4x$, is: (2019)

   (a) $\sqrt[2]{3}y = 12x + 1$
   (b) $\sqrt{3}y = x + 3$
   (c) $\sqrt[2]{3}y = -x - 12$
   (d) $\sqrt{3}y = 3x + 1$

40. If the line $y = mx + \sqrt[7]{3}$ is normal to the hyperbola $\frac{x^2}{24} - \frac{y^2}{18} = 1$, then a value of m is :(2019)

   (a) $\frac{\sqrt{5}}{2}$
   (b) $\frac{\sqrt{15}}{2}$
   (c) $\frac{2}{\sqrt{5}}$
   (d) $\frac{3}{\sqrt{5}}$

41. If one end of a focal chord of the parabola, $y^2 = 8x$ is at (1,4), then the length of this focal chord is : (2019)

   (a) 25
   (b) 22
   (c) 24
   (d) 20