HYPERBOLA

EXERCISE

1. **If the latus rectum of an hyperbola be 8 and eccentricity be $3/\sqrt{5}$, then the equation of the hyperbola is**

(a) $4x^2 - 5y^2 = 100$ (b) $5x^2 - 4y^2 = 100$ (c) $4x^2 + 5y^2 = 100$ (d) $5x^2 + 4y^2 = 100$

2. **The length of the transverse axis of a hyperbola is 7 and it passes through the point (5, –2). The equation of the hyperbola is**

(a) $\frac{4}{49}x^2 - \frac{196}{51}y^2 = 1$ (b) $\frac{49}{4}x^2 - \frac{51}{196}y^2 = 1$ (c) $\frac{4}{49}x^2 - \frac{51}{196}y^2 = 1$ (d) None of these

3. **If $(0, \pm 4)$ and $(0, \pm 2)$ be the foci and vertices of a hyperbola, then its equation is**

(a) $\frac{x^2}{4} - \frac{y^2}{12} = 1$ (b) $\frac{x^2}{12} - \frac{y^2}{4} = 1$ (c) $\frac{y^2}{4} - \frac{x^2}{12} = 1$ (d) $\frac{y^2}{12} - \frac{x^2}{4} = 1$

4. **The equation of the hyperbola whose directrix is $x + 2y = 1$, focus (2, 1) and eccentricity 2 will be**

(a) $x^2 - 16xy - 11y^2 - 12x + 6y + 21 = 0$ (b) $3x^2 + 16xy + 15y^2 - 4x - 14y - 1 = 0$

(c) $x^2 + 16xy + 11y^2 - 12x - 6y + 21 = 0$ (d) None of these

5. **The equation of a hyperbola, whose foci are (5, 0) and (–5, 0) and the length of whose conjugate axis is 8, is**

(a) $9x^2 - 16y^2 = 144$ (b) $16x^2 - 9y^2 = 144$ (c) $9x^2 - 16y^2 = 12$ (d) $16x^2 - 9y^2 = 12$

6. **The equation of the hyperbola referred to its axes as axes of coordinate and whose distance between the foci is 16 and eccentricity is $\sqrt{2}$, is**

(a) $x^2 - y^2 = 16$ (b) $x^2 - y^2 = 32$ (c) $x^2 - 2y^2 = 16$ (d) $y^2 - x^2 = 16$

7. **The equation of the hyperbola referred to the axis as axes of co-ordinate and whose distance between the foci is 16 and eccentricity is $\sqrt{2}$, is**

(a) $x^2 - y^2 = 16$ (b) $x^2 - y^2 = 32$ (c) $x^2 - 2y^2 = 16$ (d) $y^2 - x^2 = 16$

8. **What will be equation of that chord of hyperbola $25x^2 - 16y^2 = 400$, whose mid point is (5, 3)**

(a) $115x - 117y = 17$ (b) $125x - 48y = 481$ (c) $127x + 33y = 341$ (d) $15x + 121y = 105$

9. **The straight line $x + y = \sqrt{2}p$ will touch the hyperbola $4x^2 - 9y^2 = 36$, if**

(a) $p^2 = 2$ (b) $p^2 = 5$ (c) $5p^2 = 2$ (d) $2p^2 = 5$

10. **The equation of the director circle of the hyperbola $\frac{x^2}{16} - \frac{y^2}{4} = 1$ is given by**

(a) $x^2 + y^2 = 16$ (b) $x^2 + y^2 = 4$ (c) $x^2 + y^2 = 20$ (d) $x^2 + y^2 = 12$

11. **The equation of the transverse and conjugate axis of the hyperbola $16x^2 - y^2 + 64x + 4y + 44 = 0$ are**

(a) $x = 2, y + 2 = 0$ (b) $x = 2, y = 2$ (c) $y = 2, x + 2 = 0$ (d) None of these

12. **The equation of the hyperbola whose conjugate axis is 5 and the distance between the foci is 13, is**

(a) $25x^2 - 144y^2 = 900$ (b) $144x^2 - 25y^2 = 900$ (c) $144x^2 + 25y^2 = 900$ (d) $25x^2 + 144y^2 = 900$

13. **The auxiliary equation of circle of hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$, is**

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

14. **The equation of the hyperbola whose foci are (6, 4) and (–4, 4) and eccentricity 2 is given by**

(a) $12x^2 - 4y^2 - 24x + 32y - 127 = 0$ (b) $12x^2 + 4y^2 + 24x - 32y - 127 = 0$

(c) $12x^2 - 4y^2 - 24x - 32y + 127 = 0$ (d) $12x^2 - 4y^2 + 24x + 32y + 127 = 0$

15. **The length of transverse axis of the parabola $3x^2 - 4y^2 = 32$ is**

(a) $\frac{8\sqrt{2}}{\sqrt{3}}$ (b) $\frac{16\sqrt{2}}{\sqrt{3}}$ (c) $\frac{3}{32}$ (d) $\frac{64}{3}$

16. **The latus-rectum of the hyperbola $16x^2 - 9y^2 = 144$, is**

(a) $\frac{16}{3}$ (b) $\frac{32}{3}$ (c) $\frac{8}{3}$ (d) $\frac{4}{3}$

17. **The eccentricity of the hyperbola $4x^2 - 9y^2 = 16$, is**

(a) $\frac{8}{3}$ (b) $\frac{5}{4}$ (c) $\frac{\sqrt{13}}{3}$ (d) $\frac{4}{3}$

18. **If the length of the transverse and conjugate axes of a hyperbola be 8 and 6 respectively, then the difference focal distances of any point of the hyperbola will be**

(a) 8 (b) 6 (c)14 (d)2

19. **The equation of the hyperbola whose directrix is $2x + y = 1$, focus (1, 1) and eccentricity $= \sqrt{3}$, is**

(a) $7x^2 + 12xy - 2y^2 - 2x + 4y - 7 = 0$ (b) $11x^2 + 12xy + 2y^2 - 10x - 4y + 1 = 0$

(c) $11x^2 + 12xy + 2y^2 - 14x - 14y + 1 = 0$ (d)None of these

20. **The difference of the focal distance of any point on the hyperbola $9x^2 - 16y^2 = 144$, is**

(a) 8 (b) 7 (c) 6 (d)4

21. **The locus of the point of intersection of the lines $\sqrt{3}x - y - 4\sqrt{3}k = 0$ and $\sqrt{3}kx + ky - 4\sqrt{3} = 0$ for different value of *k* is**

(a) Circle (b) Parabola (c)Hyperbola (d) Ellipse

22. **The equation of the tangent to the conic $x^2 - y^2 - 8x + 2y + 11 = 0$ at (2, 1) is**

(a) $x + 2 = 0$ (b) $2x + 1 = 0$ (c) $x - 2 = 0$ (d) $x + y + 1 = 0$

23. **The equation of the normal at the point (6, 4) on the hyperbola $\frac{x^2}{9} - \frac{y^2}{16} = 3$, is**

(a) $3x + 8y = 50$ (b) $3x - 8y = 50$ (c) $8x + 3y = 50$ (d) $8x - 3y = 50$

24. **The condition that the straight line $lx + my = n$ may be a normal to the hyperbola $b^2x^2 - a^2y^2 = a^2b^2$ is given by**

(a) $\frac{a^2}{l^2} - \frac{b^2}{m^2} = \frac{(a^2+b^2)^2}{n^2}$ (b) $\frac{l^2}{a^2} - \frac{m^2}{b^2} = \frac{(a^2+b^2)^2}{n^2}$

(c) $\frac{a^2}{l^2} + \frac{b^2}{m^2} = \frac{(a^2-b^2)^2}{n^2}$ (d) $\frac{l^2}{a^2} + \frac{m^2}{b^2} = \frac{(a^2-b^2)^2}{n^2}$

25. **If the eccentricities of the hyperbolas** $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ **and** $\frac{y^2}{b^2}-\frac{x^2}{a^2}=1$ **be** ***e*** **and** e_1**, then** $\frac{1}{e^2}+\frac{1}{e_1^2}=$

(a) 1 (b) 2 (c)3 (d)None of these

26. **If *e* and *e'* are eccentricities of hyperbola and its conjugate respectively, then**

(a) $\left(\frac{1}{e}\right)^2+\left(\frac{1}{e'}\right)^2=1$ (b) $\frac{1}{e}+\frac{1}{e'}=1$ (c) $\left(\frac{1}{e}\right)^2+\left(\frac{1}{e'}\right)^2=0$ (d) $\frac{1}{e}+\frac{1}{e'}=2$

27. **The eccentricity of curve** $x^2-y^2=1$ **is**

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

28. **The locus of the point of intersection of lines** $(x+y)t=a$ **and** $x-y=at$**, where *t* is the parameter, is**

(a) A circle (b) An ellipse (c)A rectangular hyperbola (d)None of these

29. **The eccentricity of the conjugate hyperbola of the hyperbola** $x^2-3y^2=1$**, is**

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

30. **If transverse and conjugate axes of a hyperbola are equal, then its eccentricity is**

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

31. **The eccentricity of the hyperbola conjugate to** $x^2-3y^2=2x+8$ **is**

(a) $\frac{2}{\sqrt{3}}$ (b) $\sqrt{3}$ (c) 2 (d)None of these

32. **A tangent to a hyperbola** $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ **intercepts a length of unity from each of the co-ordinate axes, then the point (*a*, *b*) lies on the rectangular hyperbola**

(a) $x^2-y^2=2$ (b) $x^2-y^2=1$ (c) $x^2-y^2=-1$ (d) None of these

33. **The radius of the director circle of the hyperbola** $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$**, is**

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

34. **The length of the chord of the parabola $y^2 = 4ax$ which passes through the vertex and makes an angle θ with the axis of the parabola, is**

(a) $4a\cos\theta\,\text{cosec}^2\theta$ (b) $4a\cos^2\theta\,\text{cosec}\,\theta$ (c) $a\cos\theta\,\text{cosec}^2\theta$ (d) $a\cos^2\theta\,\text{cosec}\,\theta$

35. **If (4, 0) and (–4, 0) be the vertices and (6, 0) and (–6, 0) be the foci of a hyperbola, then its eccentricity is**

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

36. **If the centre, vertex and focus of a hyperbola be (0, 0), (4, 0) and (6, 0) respectively, then the equation of the hyperbola is**

(a) $4x^2 - 5y^2 = 8$ (b) $4x^2 - 5y^2 = 80$ (c) $5x^2 - 4y^2 = 80$ (d) $5x^2 - 4y^2 = 8$

37. **The locus of a point which moves such that the difference of its distances from two fixed points is always a constant is**

(a) A straight line (b) A circle (c)An ellipse (d)A hyperbola

38. **The point of contact of the tangent $y = x + 2$ to the hyperbola $5x^2 - 9y^2 = 45$ is**

(a) (9/2, 5/2) (b) (5/2, 9/2) (c)(–9/2, –5/2) (d)none of these

39. **None of these The locus of the point of intersection of any two perpendicular tangents to the hyperbola is a circle which is called the director circle of the hyperbola, then the *eq*ⁿ of this circle is**

(a) $x^2 + y^2 = a^2 + b^2$ (b) $x^2 + y^2 = a^2 - b^2$ (c) $x^2 + y^2 = 2ab$ (d)None of these

40. **The vertices of a hyperbola are at (0, 0) and (10, 0) and one of its foci is at (18, 0). The equation of the hyperbola is**

(a) $\frac{x^2}{25} - \frac{y^2}{144} = 1$ (b) $\frac{(x-5)^2}{25} - \frac{y^2}{144} = 1$ (c) $\frac{x^2}{25} - \frac{(y-5)^2}{144} = 1$ (d) $\frac{(x-5)^2}{25} - \frac{(y-5)^2}{144} = 1$

41. **Centre of hyperbola $9x^2 - 16y^2 + 18x + 32y - 151 = 0$ is**

(a) (1, –1) (b) (–1, 1) (c)(–1, –1) (d)(1, 1)

42. **The equation of the tangent to the hyperbola $2x^2 - 3y^2 = 6$ which is parallel to the line $y = 3x + 4$, is**

(a) $y = 3x + 5$ (b) $y = 3x - 5$ (c) $y = 3x + 5$ and $y = 3x - 5$ (d) None of these

43. **A hyperbola passes through the points (3, 2) and (–17, 12) and has its centre at origin and transverse axis is along *x*-axis. The length of its transverse axis is**

(a) 2 (b) 4 (c) 6 (d) None of these

44. **The distance between the foci of a hyperbola is double the distance between its vertices and the length of its conjugate axis is 6. The equation of the hyperbola referred to its axes as axes of co-ordinates is**

(a) $3x^2 - y^2 = 3$ (b) $x^2 - 3y^2 = 3$ (c) $3x^2 - y^2 = 9$ (d) $x^2 - 3y^2 = 9$

45. **The equation of the tangents to the conic $3x^2 - y^2 = 3$ perpendicular to the line $x + 3y = 2$ is**

(a) $y = 3x \pm \sqrt{6}$ (b) $y = 6x \pm \sqrt{3}$ (c) $y = x \pm \sqrt{6}$ (d) $y = 3x \pm 6$

46. **Curve $xy = c^2$ is said to be**

(a) Parabola (b) Rectangular hyperbola (c) Hyperbola (d) Ellipse

47. **The distance between the directrices of a rectangular hyperbola is 10 units, then distance between its foci is**

(a) $10\sqrt{2}$ (b) 5 (c) $5\sqrt{2}$ (d) 20

48. **If m_1 and m_2 are the slopes of the tangents to the hyperbola $\frac{x^2}{25} - \frac{y^2}{16} = 1$ which pass through the point (6, 2), then**

(a) $m_1 + m_2 = \frac{24}{11}$ (b) $m_1 m_2 = \frac{20}{11}$ (c) $m_1 + m_2 = \frac{48}{11}$ (d) $m_1 m_2 = \frac{11}{20}$

49. **If the straight line $x\cos\alpha + y\sin\alpha = p$ be a tangent to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$, then**

(a) $a^2\cos^2\alpha + b^2\sin^2\alpha = p^2$ (b) $a^2\cos^2\alpha - b^2\sin^2\alpha = p^2$

(c) $a^2\sin^2\alpha + b^2\cos^2\alpha = p^2$ (d) $a^2\sin^2\alpha - b^2\cos^2\alpha = p^2$

50. **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**

(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

51. **The equation of the normal at the point $(a\sec\theta, b\tan\theta)$ of the curve $b^2x^2-a^2y^2=a^2b^2$ is**

(a) $\frac{ax}{\cos\theta}+\frac{by}{\sin\theta}=a^2+b^2$ (b) $\frac{ax}{\tan\theta}+\frac{by}{\sec\theta}=a^2+b^2$

(c) $\frac{ax}{\sec\theta}+\frac{by}{\tan\theta}=a^2+b^2$ (d) $\frac{ax}{\sec\theta}+\frac{by}{\tan\theta}=a^2-b^2$

52. **The value of m for which $y=mx+6$ is a tangent to the hyperbola $\frac{x^2}{100}-\frac{y^2}{49}=1$, is**

(a) $\sqrt{\frac{17}{20}}$ (b) $\sqrt{\frac{20}{17}}$ (c) $\sqrt{\frac{3}{20}}$ (d) $\sqrt{\frac{20}{3}}$

53. **The equation of the normal to the hyperbola $\frac{x^2}{16}-\frac{y^2}{9}=1$ at the point $(8, 3\sqrt{3})$ is**

(a) $\sqrt{3}x+2y=25$ (b) $x+y=25$ (c) $y+2x=25$ (d) $2x+\sqrt{3}y=25$

54. **The equation of the tangent to the conic $x^2-y^2-8x+2y+11=0$ at (2, 1) is**

(a) $x+2=0$ (b) $2x+1=0$ (c) $x-2=0$ (d) $x+y+1=0$

55. **If e and e' are eccentricities of hyperbola and its conjugate respectively, then**

(a) $\left(\frac{1}{e}\right)^2+\left(\frac{1}{e'}\right)^2=1$ (b) $\frac{1}{e}+\frac{1}{e'}=1$ (c) $\left(\frac{1}{e}\right)^2+\left(\frac{1}{e'}\right)^2=0$ (d) $\frac{1}{e}+\frac{1}{e'}=2$

56. **The coordinates of the foci of the rectangular hyperbola $xy=c^2$ are**

(a) $(\pm c, \pm c)$ (b) $(\pm c\sqrt{2}, \pm c\sqrt{2})$ (c) $\left(\pm\frac{c}{\sqrt{2}}, \pm\frac{c}{\sqrt{2}}\right)$ (d)None of these

57. **If 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**

(a) 1 (b) 5 (c)7 (d)9

58. **The product of the lengths of perpendiculars drawn from any point on the hyperbola $x^2 - 2y^2 - 2 = 0$ to its asymptotes is**

(a) 1/2 (b) 2/3 (c)3/2 (d)2

59. **The equation of the normal to the hyperbola $\frac{x^2}{16} - \frac{y^2}{9} = 1$ at $(-4, 0)$ is**

(a) $y = 0$ (b) $y = x$ (c) $x = 0$ (d) $x = -y$

60. **The equation to the hyperbola having its eccentricity 2 and the distance between its foci is 8**

(a) $\frac{x^2}{12} - \frac{y^2}{4} = 1$ (b) $\frac{x^2}{4} - \frac{y^2}{12} = 1$

(c) $\frac{x^2}{8} - \frac{y^2}{2} = 1$ (d) $\frac{x^2}{16} - \frac{y^2}{9} = 1$

61. **The equation of the hyperbola in the standard form (with transverse axis along the *x*-axis) having the length of the latus rectum = 9 units and eccentricity = 5/4 is**

(a) $\frac{x^2}{16} - \frac{y^2}{18} = 1$ (b) $\frac{x^2}{36} - \frac{y^2}{27} = 1$ (c) $\frac{x^2}{64} - \frac{y^2}{36} = 1$ (d) $\frac{x^2}{36} - \frac{y^2}{64} = 1$ (e) $\frac{x^2}{16} - \frac{y^2}{9} = 1$

62. 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

(a) A parabola (b) A hyperbola

(c) An ellipse (d) A circle

HYPERBOLA

HINTS AND SOLUTIONS

1. (a) $\frac{2b^2}{a}=8$ and $\frac{3}{\sqrt{5}}=\sqrt{1+\frac{b^2}{a^2}}$ or $\frac{4}{5}=\frac{b^2}{a^2}$

$\Rightarrow a=5,\ b=2\sqrt{5}$.

Hence the required equation of hyperbola is $\frac{x^2}{25}-\frac{y^2}{20}=1 \Rightarrow 4x^2-5y^2=100$.

2. (c) $2a=7$ or $a=\frac{7}{2}$

Also (5, –2) satisfies it, so $\frac{4}{49}(25)-\frac{51}{196}(4)=1$

and $a^2=\frac{49}{4} \Rightarrow a=\frac{7}{2}$.

3. (c) Foci $(0,\pm 4)\equiv(0,\pm be) \Rightarrow be=4$

Vertices $(0,\pm 2)\equiv(0,\pm b) \Rightarrow b=2 \Rightarrow a=2\sqrt{3}$

Hence equation is $\frac{-x^2}{(2\sqrt{3})^2}+\frac{y^2}{(2)^2}=1$ or $\frac{y^2}{4}-\frac{x^2}{12}=1$.

4. (a) $(x-2)^2+(y-1)^2=4\left[\frac{(x+2y-1)^2}{5}\right]$

$\Rightarrow 5[x^2+y^2-4x-2y+5]$

$=4[x^2+4y^2+1+4xy-2x-4y]$

$\Rightarrow x^2-11y^2-16xy-12x+6y+21=0$.

5. (b) $b=4 \Rightarrow 2ae=10 \Rightarrow 16=25-a^2 \Rightarrow a=3$

Hence the hyperbola is $16x^2-9y^2=144$.

6. (b) $2ae=16,\ e=\sqrt{2} \Rightarrow a=4\sqrt{2}$ and $b=4\sqrt{2}$

$\therefore$ Equation is $\frac{x^2}{(4\sqrt{2})^2}-\frac{y^2}{(4\sqrt{2})^2}=1 \quad \Rightarrow x^2-y^2=32$.

7. (b)According to question, Transverse axis = Conjugate axis

Given that, $e=\sqrt{2}, 2ae=16$; $\therefore a=4\sqrt{2}$

Therefore, equation of hyperbola is $x^2-y^2=32$.

8. (b)According to question, $S \equiv 25x^2 - 16y^2 - 400 = 0$

Equation of required chord is $S_1 = T$ .....(i)

Here, $S_1 = 25(5)^2 - 16(3)^2 - 400$

$= 625 - 144 - 400 = 81$

and $T \equiv 25xx_1 - 16yy_1 - 400$, where $x_1 = 5, y_1 = 3$

$= 25(x)(5) - 16(y)(3) - 400 = 125x - 48y - 400$

So from (i), required chord is

$125x - 48y - 400 = 81$ or $125x - 48y = 481$.

9. (d) The condition for the line $y = mx + c$ will touch the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ is $c^2 = a^2m^2 - b^2$

Here $m = -1$, $c = \sqrt{2}p$, $a^2 = 9, b^2 = 4$

$\therefore$ We get $2p^2 = 5$.

10. (d) Equation of 'director-circle' of hyperbola is $x^2 + y^2 = a^2 - b^2$. Here $a^2 = 16, b^2 = 4$

$\therefore$ $x^2 + y^2 = 12$ is the required 'director circle'.

11. (c) $(4x + 8)^2 - (y - 2)^2 = -44 + 64 - 4$

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

Transverse and conjugate axes are $y = 2$, $x = -2$.

12. (a) Conjugate axis is 5 and distance between foci = 13 $\Rightarrow$ $2b = 5$ and $2ae = 13$.

Now, also we know for hyperbola

$b^2 = a^2(e^2 - 1) \Rightarrow \frac{25}{4} = \frac{(13)^2}{4e^2}(e^2 - 1)$

$\Rightarrow \frac{25}{4} = \frac{169}{4} - \frac{169}{4e^2}$ or $e^2 = \frac{169}{144} \Rightarrow e = \frac{13}{12}$

Or $a = 6, b = \frac{5}{2}$ or hyperbola is $\frac{x^2}{36} - \frac{y^2}{25/4} = 1$

$\Rightarrow 25x^2 - 144y^2 = 900$.

13. (a) The equation is $(x - 0)^2 + (y - 0)^2 = a^2$.

14. (a) Foci are (6,4) and (–4,4), $e = 2$ and centre is $\left(\frac{6-4}{2}, 4\right) = (1,4)$

$\Rightarrow 6 = 1 + ae \Rightarrow ae = 5 \Rightarrow a = \frac{5}{2}$ and $b = \frac{5}{2}(\sqrt{3})$

Hence the required equation is $\frac{(x-1)^2}{(25/4)} - \frac{(y-4)^2}{(75/4)} = 1$ or $12x^2 - 4y^2 - 24x + 32y - 127 = 0$

15. (a) The given equation may be written as $\frac{x^2}{32/2}-\frac{y^2}{8}=1$ or $\frac{x^2}{(4\sqrt{2}/\sqrt{3})^2}-\frac{y^2}{(2\sqrt{2})^2}=1$.

Comparing the given equation with $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$, we get $a^2=\left(\frac{4\sqrt{2}}{\sqrt{3}}\right)^2$ or $a=\frac{4\sqrt{2}}{\sqrt{3}}$. Therefore length of transverse axis of a hyperbola $=2a=2\times\frac{4\sqrt{2}}{\sqrt{3}}=\frac{8\sqrt{2}}{\sqrt{3}}$.

16. (b) The given equation of hyperbola is

$16x^2-9y^2=144 \Rightarrow \frac{x^2}{9}-\frac{y^2}{16}=1$

$\therefore L.R. =\frac{2b^2}{a}=\frac{2.16}{3}=\frac{32}{3}$.

17. (c) Given equation of hyperbola, $\frac{x^2}{4}-\frac{y^2}{(16/9)}=1$,

$\therefore a=2,\ b=\frac{4}{3}$. As we know, $b^2=a^2(e^2-1)$

$\Rightarrow \frac{16}{9}=4(e^2-1) \Rightarrow e^2=\frac{13}{9}$, $\therefore e=\frac{\sqrt{13}}{3}$.

18. (a) $2a=8,\ 2b=6$

Difference of focal distances of any point of the hyperbola $=2a=8$.

19. (a) $S(1,1)$, directrix is $2x+y=1$ and $e=\sqrt{3}$. Now let the various point be (h,k), then accordingly

$$\frac{\sqrt{(h-1)^2+(k-1)^2}}{\frac{2h+k-1}{\sqrt{5}}}=\sqrt{3}$$

Squaring both the sides, we get

$5[(h-1)^2+(k-1)^2]=3(2h+k-1)^2$

On simplification, the required locus is $7x^2+12xy-2y^2-2x+4y-7=0$

20. (c) Here coefficient of x^2 is $+ve$ and that of y^2 is $-ve$ *i.e.*, a hyperbola.

21. (c) Multiplying both, we get $3x^2-y^2=48$

Or $\frac{x^2}{(48/3)}-\frac{y^2}{48}=1$, which is a hyperbola.

22. (c) Equation of the tangent to $x^2-y^2-8x+2y+11=0$ at (2, 1) is $2x-y-4(x+2)+(y+1)+11=0$ or $x=2$.

23. (a) Equation of normal at any point (x_1,y_1) on hyperbola is,

$$\frac{a^2(x-x_1)}{x_1}=\frac{b^2(y-y_1)}{-y_1}$$

Here, $a^2=267, b^2=48$ and $(x_1,y_1)=(6,4)$

$\therefore \frac{27(x-6)}{6}=-\frac{48(y-4)}{4} \Rightarrow 3(x-6)=-8(y-4)$

$\Rightarrow 3x+8y=50$.

24. (a)Any normal to the hyperbola is

$\frac{ax}{\sec\theta}+\frac{by}{\tan\theta}=a^2+b^2$ .....(i)

But it is given by $lx+my-n=0$ .....(ii)

Comparing (i) and (ii), we get

$\sec\theta=\frac{a}{l}\left(\frac{-n}{a^2+b^2}\right)$ and $\tan\theta=\frac{b}{m}\left(\frac{-n}{a^2+b^2}\right)$

Hence eliminating θ, we get $\frac{a^2}{l^2}-\frac{b^2}{m^2}=\frac{(a^2+b^2)^2}{n^2}$.

25. (a) $e=\sqrt{1+\frac{b^2}{a^2}} \Rightarrow e^2=\frac{a^2+b^2}{a^2}$

$e_1=\sqrt{1+\frac{a^2}{b^2}} \Rightarrow e_1^2=\frac{b^2+a^2}{b^2} \Rightarrow \frac{1}{e_1^2}+\frac{1}{e^2}=1$.

26. (a)Let hyperbola is $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ .....(i)

Then its conjugate will be, $\frac{x^2}{a^2}-\frac{y^2}{b^2}=-1$ .....(ii)

If e is eccentricity of hyperbola (i), then $b^2=a^2(e^2-1)$

or $\frac{1}{e^2}=\frac{a^2}{(a^2+b^2)}$ .....(iii)

Similarly if e' is eccentricity of conjugate (ii), then $a^2=b^2(e'^2-1)$ or $\frac{1}{e'^2}=\frac{b^2}{(a^2+b^2)}$ .....(iv)

Adding (iii) and (iv), $\frac{1}{(e')^2}+\frac{1}{e^2}=\frac{a^2}{a^2+b^2}+\frac{b^2}{a^2+b^2}=1$.

27. (d) Since it is a rectangular hyperbola, therefore eccentricity $e=\sqrt{2}$.

28. (c)Multiplying both, we get $x^2-y^2=a^2$. This is equation of rectangular hyperbola as $a=b$.

29. (a)Eccentricity of $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ is $e=\sqrt{\frac{a^2+b^2}{a^2}}$

Eccentricity of conjugate hyperbola, $e'=\sqrt{\frac{a^2+b^2}{b^2}}$

Write the given equation in standard form,

$\frac{x^2}{1}-\frac{y^2}{1/3}=1 \Rightarrow a^2=1,\ b^2=\frac{1}{3}$

$\therefore e'=\sqrt{\frac{1+1/3}{1/3}}=\sqrt{4}=2$.

30. (b) Hyperbola is $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$. Here, transverse and conjugate axis of a hyperbola is equal.

i.e., $a=b \therefore x^2-y^2=a^2$; which is a rectangular hyperbola. Hence, eccentricity $e=\sqrt{1+\frac{b^2}{a^2}}=\sqrt{2}$.

31. (c)Given, equation of hyperbola is $x^2-3y^2=2x+8$

$\Rightarrow x^2-2x-3y^2=8$

$\Rightarrow (x-1)^2-3y^2=9 \Rightarrow \frac{(x-1)^2}{9}-\frac{y^2}{3}=1$

Conjugate of this hyperbola is $-\frac{(x-1)^2}{9}+\frac{y^2}{3}=1$

and its eccentricity $(e)=\sqrt{\left(\frac{a^2+b^2}{b^2}\right)}$

Here, $a^2=9$, $b^2=3$; $\therefore\ e=\sqrt{\frac{9+3}{3}}=2$.

32. (b) Tangent at $(a\sec\theta, b\tan\theta)$ is,

$\frac{x}{(a/\sec\theta)}-\frac{y}{(b/\tan\theta)}=1$ or $\frac{a}{\sec\theta}=1,\ \frac{b}{\tan\theta}=1$

$\Rightarrow a=\sec\theta$, $b=\tan\theta$ or (a,b) lies on $x^2-y^2=1$.

33. (c) Equation of director-circle of the hyperbola

$\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ is $x^2+y^2=a^2-b^2$

So, radius $=\sqrt{a^2-b^2}$.

34. (a) $y=x\tan\theta$ will be equation of chord. The points of intersection of chord and parabola are

(0, 0), $\left(\frac{4a}{\tan^2\theta}, \frac{4a}{\tan\theta}\right)$

Hence length of chord $=4a\sqrt{\left(\frac{1}{\tan^2\theta}\right)^2+\frac{1}{\tan^2\theta}}$

$=\frac{4a}{\tan\theta}\sqrt{\frac{1+\tan^2\theta}{\tan^2\theta}}=4a\,\mathrm{cosec}^2\theta\cos\theta$.

35. (c) Vertices $(\pm 4,0)\equiv(\pm a,0) \Rightarrow a=4$

Foci $(\pm 6,0)\equiv(\pm ae,0) \Rightarrow e=\frac{6}{4}=\frac{3}{2}$.

36. (c) Centre (0, 0), vertex (4,0) $\Rightarrow a = 4$ and focus $(6,0)$

$\Rightarrow ae = 4 \Rightarrow e = \frac{3}{2}$. Therefore $b = 2\sqrt{5}$

Hence required equation is $\frac{x^2}{16} - \frac{y^2}{20} = 1$

i.e., $5x^2 - 4y^2 = 80$.

37. (d) It is obvious.

38. (c) Hyperbola is $\frac{x^2}{9} - \frac{y^2}{5} = 1$.

Hence point of contact is $\left[\frac{-9(1)}{\sqrt{9-5}}, \frac{-5}{\sqrt{9-5}}\right] \equiv \left[\frac{-9}{2}, \frac{-5}{2}\right]$.

39. (b) Equation of hyperbola is $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

Any tangent to hyperbola are $y = mx \pm \sqrt{a^2m^2 - b^2}$

Also tangent perpendicular to this is $y = \frac{-1}{m}x \pm \sqrt{\frac{a^2}{m^2} - b^2}$

Eliminating *m*, we get $x^2 + y^2 = a^2 - b^2$.

40. (b) $2a = 10$, $\therefore a = 5$

$ae - a = 8$ or $e = 1 + \frac{8}{5} = \frac{13}{5}$

$\therefore b = 5\sqrt{\frac{13^2}{5^2} - 1} = 5 \times \frac{12}{5} = 12$

and centre of hyperbola $\equiv (5, 0)$ $\therefore \frac{(x-5)^2}{5^2} - \frac{(y-0)^2}{12^2} = 1$.

41. (b) Centre is given by

$\left(\frac{hf - bg}{ab - h^2}, \frac{gh - af}{ab - h^2}\right) = \left(\frac{+16.9}{-9.16}, \frac{-9(16)}{-9(16)}\right) = (-1, 1)$.

42. (c) Let tangent be $y = 3x + c$

$c = \pm\sqrt{a^2m^2 - b^2} = \pm\sqrt{3.9 - 2} = \pm 5 \Rightarrow y = 3x \pm 5$.

43. (a) Let the equation of hyperbola is $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

But it passes through (3, 2) $\Rightarrow \frac{9}{a^2} - \frac{4}{b^2} = 1$ .....(i)

Also its passes through (–17, 12)

$\Rightarrow \frac{(-17)^2}{a^2} - \frac{(12)^2}{b^2} = 1$ .....(ii)

Solving these, we get $a = 1$ and $b = \sqrt{2}$

Hence length of transverse axis $= 2a = 2$.

44. (c) According to given conditions, $2ae = 2.2a$ or $e = 2$ and $2b = 6 \Rightarrow b = 3$. Hence, $a = \frac{3}{\sqrt{3}} = \sqrt{3}$

Therefore, equation is $\frac{x^2}{3} - \frac{y^2}{9} = 1$ *i.e.*, $3x^2 - y^2 = 9$.

45. (a) Tangent to $\frac{x^2}{1} - \frac{y^2}{3} = 1$ and perpendicular to $x + 3y - 2 = 0$ is given by $y = 3x \pm \sqrt{9-3} = 3x \pm \sqrt{6}$.

46. (b) $xy = c^2$. Rectangular hyperbola $a^2 = b^2$.

47. (d) $\because$ Distance between directrices $= \frac{2a}{e}$.

$\because$ Eccentricity of rectangular hyperbola $= \sqrt{2}$.

$\therefore$ Distance between directrics $= \frac{2a}{\sqrt{2}}$.

Given that , $\frac{2a}{\sqrt{2}} = 10 \Rightarrow 2a = 10\sqrt{2}$

Now, distance between foci $= 2ae = (10\sqrt{2})(\sqrt{2}) = 20$.

48. (a,b) The line through (6,2) is

$y - 2 = m(x-6) \Rightarrow y = mx + 2 - 6m$

Now from condition of tangency, $(2-6m)^2 = 25m^2 - 16$

$\Rightarrow 36m^2 + 4 - 24m - 25m^2 + 16 = 0$

$\Rightarrow 11m^2 - 24m + 20 = 0$

Obviously its roots are m_1 and m_2, therefore

$m_1 + m_2 = \frac{24}{11}$ and $m_1 m_2 = \frac{20}{11}$.

49. (b) $x\cos\alpha + y\sin\alpha = p \Rightarrow y = -\cot\alpha.\ x + p\operatorname{cosec}\alpha$

It is tangent to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

Therefore, $p^2\operatorname{cosec}^2\alpha = a^2\cot^2\alpha - b^2 \Rightarrow a^2\cos^2\alpha - b^2\sin^2\alpha = p^2$.

50. (d) The given ellipse is $\frac{x^2}{9} + \frac{y^2}{4} = 1$. The value of the expression $\frac{x^2}{9} + \frac{y^2}{4} - 1$ is positive for $x = 1, y = 2$ and negative for $x = 2, y = 1$. Therefore *P* lies outside *E* and *Q* lies inside *E*. The value of the expression $x^2 + y^2 - 9$ is negative for both the points *P* and *Q*. Therefore *P* and *Q* both lie inside *C*. Hence *P* lies inside *C* but outside *E*.

51. (c)Equation of normal to hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ at $(a\sec\theta, b\tan\theta)$ is $\frac{a^2x}{a\sec\theta} + \frac{b^2y}{b\tan\theta} = a^2 + b^2$.

52. (a) If $y = mx + c$ touches $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$,

then $c^2 = a^2m^2 - b^2$. Here $c = 6,\ a^2 = 100,\ b^2 = 49$

$\therefore 36 = 100m^2 - 49 \Rightarrow 100m^2 = 85 \Rightarrow m = \sqrt{\frac{17}{20}}$.

53. (d) Applying the formula, the required normal is

$\frac{16x}{8} + \frac{9y}{3\sqrt{3}} = 16 + 9$ *i.e.*, $2x + \sqrt{3}y = 25$

54. (c) Equation of the tangent to $x^2 - y^2 - 8x + 2y + 11 = 0$ at (2, 1) is $2x - y - 4(x + 2) + (y + 1) + 11 = 0$ or $x = 2$.

55. (a) $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1 \Rightarrow \frac{1}{e^2} = \frac{a^2}{(a^2 + b^2)}$ .....(i)

$\frac{x^2}{a^2} - \frac{y^2}{b^2} = -1 \Rightarrow \frac{1}{e'^2} = \frac{b^2}{(a^2 + b^2)}$ .....(ii)

$\frac{1}{(e')^2} + \frac{1}{e^2} = \frac{a^2}{a^2 + b^2} + \frac{b^2}{a^2 + b^2} = 1$. $xy = c^2$ as $c^2 = \frac{a^2}{2}$.

56. (b) focus = $(ae\cos 45°, ae\sin 45°) \equiv (c\sqrt{2}, c\sqrt{2})$, $\{\because e = \sqrt{2}\ , a = c\sqrt{2}\}$

Similarly other focus is $(-c\sqrt{2}, -c\sqrt{2})$

57. (c)Hyperbola is $\frac{x^2}{144} - \frac{y^2}{81} = \frac{1}{25}$

$a = \sqrt{\frac{144}{25}},\ b = \sqrt{\frac{81}{25}},\ e_1 = \sqrt{1 + \frac{81}{144}} = \sqrt{\frac{225}{144}} = \frac{15}{12} = \frac{5}{4}$

Therefore, foci $= (ae_1, 0) = \left(\frac{12}{5}.\frac{5}{4}, 0\right) = (3, 0)$

Therefore, focus of ellipse $= (4e, 0)$ *i.e.* $(3, 0)$

$\Rightarrow e = \frac{3}{4}$. Hence $b^2 = 16\left(1 - \frac{9}{16}\right) = 7$.

58. (b) Given equation is $\frac{x^2}{2} - \frac{y^2}{1} = 1$ .....(i)

Product of length of perpendiculars drawn from any point on the hyperbola (i) to the asymptotes is $\frac{a^2b^2}{a^2 + b^2} = \frac{2 \times 1}{2 + 1} = \frac{2}{3}$.

59. (a) $\frac{x^2}{16} - \frac{y^2}{9} = 1 \Rightarrow \frac{2x}{16} - \frac{2y}{9}\frac{dy}{dx} = 0$

$\Rightarrow \frac{dy}{dx} = \frac{2x \times 9}{16 \times 2y} = \frac{9}{16}\frac{x}{y} \Rightarrow \left(\frac{-dx}{dy}\right)_{(-4,0)} = \frac{-16}{9}\frac{y}{x} = 0$

Hence, equation of normal

$\Rightarrow (y-0) = 0(x+4) \Rightarrow y = 0.$

60. (b) Distance between foci = 8

$\therefore\ 2ae = 8$ also $e = 2$; $\therefore\ 2a = 4$

$\Rightarrow a = 2 \Rightarrow a^2 = 4$; $\therefore b^2 = 4(4-1) = 12$

$\therefore$ Equation of hyperbola is $\frac{x^2}{4} - \frac{y^2}{12} = 1$.

61. (c) $\because \frac{2b^2}{a^2} = 9 \Rightarrow 2b^2 = 9a$ .....(i)

Now $b^2 = a^2(e^2 - 1) = \frac{9}{16}a^2 \Rightarrow a = \frac{4}{3}b$ .....(ii), ($\because e = \frac{5}{4}$)

From (i) and (ii), $b = 6$, $a = 8$

Hence, equation of hyperbola $\frac{x^2}{64} - \frac{y^2}{36} = 1$.

62. (b) If $y = mx + c$ is tangent to the hyperbola then $c^2 = a^2m^2 - b^2$. Here $\beta^2 = a^2\alpha^2 - b^2$. Hence locus of $P(\alpha, \beta)$ is $a^2x^2 - y^2 = b^2$, which is a hyperbola.

HYPERBOLA

PRACTICE EXERCISE

1. **The foci of hyperbola $9x^2 - 16y^2 + 72x - 32y - 16 = 0$ are**

   1) (1, 1), (9,1) 2) (1, -1), (9, -1) 3) (1, -1), (-9, -1) 4) (-1, 1) (-9, 1)

2. **The eccentricity of the conic represented by x = a (t + 1/t) ; y = a(t-1/t) is**

   1) $\sqrt{2}$ 2) $\sqrt{3}$ 3) 2 4) 3

3. **The length of the latusrectum of the hyperbola $4x^2 - 9y^2 - 8x - 32 = 0$ is**

   1) 2/3 2) 4/3 3) 8/3 4) 10/3

4. **The centre of the hyperbola $\frac{(3x-4y-12)^2}{225} - \frac{(4x+3y+12)^2}{100} = 1$ is**

   1) (1, 1) 2) (2, 2) 3) (1, 2) 4) $\left(-\frac{12}{25}, -\frac{84}{25}\right)$

5. **The eccentricity of a hyperbola is 4/3. Then the eccentricity of its conjugate hyperbola is**

   1) $1/\sqrt{7}$ 2) $2/\sqrt{7}$ 3) $3/\sqrt{7}$ 4) $4/\sqrt{7}$

6. **If e_1 and e_2 are eccentricities of two hyperbolas $x^2 - y^2 = a^2$, $xy = c^2$, then $e_1^2 + e_2^2 =$**

   1) 1 2) 2 3) 3 4) 4

7. **The equation of the normal at $\theta = \pi/3$ to the hyperbola $3x^2 - 4y^2 = 12$ is**

   1) x+y=1 2) x+y=3 3) x+y=5 4) x+y=7

8. **The line x+2y+3=0 meets the hyperbola $x^2-y^2=4$ in A and B. The mid point of the chord AB is**

   1) (1, -2) 2) (-1, 2) 3) (-3, 0) 4) (1, 2)

9. **One asymptote of the hyperbola $2x^2+3xy-2y^2-7x+y+6=0$ is $x+2y-3=0$. Then the other asymptote is**

1) $2x-y+4=0$ 2) $2x-y+3=0$ 3) $2x-y+1=0$ 4) $2x-y-1=0$

10. **The line $x+y+1=0$ is an asymptote of $x^2-y^2+x-y-2=0$. The other asymptote is**

1) $x+y=0$ 2) $x-y=0$ 3) $x-y=1$ 4) $x-y+1=0$

11. **If (5, 12) and (24, 7) are the foci of the hyperbola passing through the origin, then the eccentricity is**

1) $\frac{\sqrt{368}}{38}$ 2) $\frac{\sqrt{386}}{13}$ 3) $\frac{\sqrt{386}}{25}$ 4) $\frac{\sqrt{386}}{12}$

12. **The locus of the point of intersection of the lines $x\sqrt{3}-y-4\sqrt{3}k=0$ and $kx\sqrt{3}+ky=4\sqrt{3}$ is a hyperbola of eccentricity**

1) 1 2) 2 3) 3 4) 4

13. **If a circle cuts the rectangular hyperbola $xy=1$ at the points $(x_r, y_r); r=1,2,3,4$, then** $x_1x_2x_3x_4+y_1y_2y_3y_4=$

1) zero 2) 1 3) 2 4) -1

14. **If the latusrectum through one focus subtends a right angle at the farther vertex of the hyperbola, then the eccentricity is**

1) 4 2) $\sqrt{3}$ 3) 2 4) $\sqrt{2}$

15. **If the latusrectum through one focus of a hyperbola subtends an angle $\frac{\pi}{3}$ at the other focus. then e =**

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

16. **If the latusrectum through one focus of a hyperbola subtends an angle $\frac{\pi}{2}$ at the centre, then e =**

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

17. **I : The product of the perpendiculars from any point on the hyperbola to its asymptotes is a constant.**

II: Equation to the tangent at $\theta = \pi/3$ are the hyperbola $3x^2 - 4y^2 = 12$ is x - y = 12.

Which of the statements is correct ?

1) Only I is true 2) Only II is true

3) Both I and II are true 4) Neither I nor II true

18. **Observe the following lists:**

List - I	**List - II**
A) The locus of the point $\left(\frac{e^t + e^{-t}}{2}, \frac{e^t - e^{-t}}{2}\right)$ is	1) $x^2 + y^2 = 36$
B) Equation to the auxiliary circle of $\frac{x^2}{36} - \frac{y^2}{76} = 1$ is	2) hyperbola
C) The locus of the points (a coshθ, b sinhθ) is	3) Rectangular hyperbola
D) Equation to the director circle of $\frac{x^2}{36} + \frac{y^2}{14} = 1$	4) $x^2 + y^2 = 76$
	5) $x^2 + y^2 = 50$

Correct match for List-1 from List-II is

	A	B	C	D
1)	2	3	4	1
2)	3	5	1	2
3)	1	2	5	3
4)	3	1	2	5

19. Assertion (A): PSP' is a focal chord of $\frac{x^2}{25}+\frac{y^2}{16}=1$. If SP = 8 then $S^1P = 2$

Reason (R): The semi latus-rectum of an ellipse is the harmonic mean between the segments of a focal chord.

1) Both A and R are true and R is correct explanation of A

2) Both A and R are true but R is not the correct explanation of A

3) A is true but R is false

4) A is false but R is true.

20. I : If $P(x_1, y_1)$ is a point on $b^2 x^2 + a^2 y^2 = a^2 b^2$, then area $\Delta SPS = ae\sqrt{a^2 - x_1^2}$.

II : A tangent to $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ meets the axes in P and Q. Then

$\frac{a^2}{CP^2}-\frac{b^2}{CQ^2}=1$, where C is the centre of the conic.

1) Only I is true
2) Only II is true
3) Both I and II are true
4) Neither I nor II true

21.The normal at any point on the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ cuts the axes in Q and R. The equation to the locus of the mid point of QR is

1) $a^2x^2 - b^2y^2 = (a^2 + b^2)^2$
2) $a^2x^2 - b^2y^2 = 4(a^2 + b^2)^2$
3) $4a^2x^2 - 4b^2y^2 = (a^2 + b^2)^2$
4) $\left(\frac{1}{a^2+b^2}\right)^2\left(\frac{x^2}{a^2}-\frac{y^2}{b^2}\right)^2\left(\frac{a^6}{x^2}-\frac{b^6}{y^2}\right)=1$

22. The locus of the middle points of all chords of the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ which are parallel to the line $y = m_1x$ is the straight line $y = m_2x$ such that

1) $m_1 - m_2 = \frac{2a^2}{b}$
2) $\frac{m_1}{m_2}=\frac{2b^2}{a}$
3) $m_1 + m_2 = \frac{2b^2}{a}$
4) $m_1m_2 = \frac{b^2}{a^2}$

23. **The asymptotes of a hyperbola are parallel to x+y+3=0, 2x-3y+6=0, its centre is (1,2). Then the equation of a hyperbola passing through origin is**

1) $2x^2-xy-3y^2-2x-5y=0$ 2) $2x^2+xy+3y^2-2x-5y=0$

3) $2x^2+xy+3y^2+2x+5y=0$ 4) $2x^2-xy-3y^2-2x+13y=0$

24. **The product of the perpendiculars from any point on $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ to its asymptotes is**

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

25. **The product of the distances from any point on the hyperbola $\frac{x^2}{16}-\frac{y^2}{9}=1$ to its two asymptotes is**

1) 144/25 2) 25/144 3) 140/25 4) None

26. **The points of intersection of the asymptotes of the hyperbola $\frac{x^2}{9}-\frac{y^2}{4}=1$ with its directricies lie on**

1) $x^2+y^2=5$ 2) $x^2+y^2=9$ 3) $3x-4=0$ 4) $x-3=0$

27. **If the latusrectum subtends a right angle at the centre of the hyperbola, then its eccentricity**

1) $e=\frac{(\sqrt{13})}{2}$ 2) $e=\frac{(\sqrt{5}-1)}{2}$ 3) $e=\frac{(\sqrt{5}+1)}{2}$ 4) $e=\frac{(\sqrt{3}+1)}{2}$

28. **If the latusrectum of a hyperbola forms an equilateral triangle with the vertex at the centre of the hyperbola, then its eccentricity e =**

1) $\frac{\sqrt{5}+1}{2}$ 2) $\frac{\sqrt{11}+1}{2}$ 3) $\frac{\sqrt{13}+1}{2\sqrt{3}}$ 4) $\frac{\sqrt{13}-1}{2\sqrt{3}}$

29. **If the latusrectum of a hyperbola through one focus subtends 60^0 at the other focus, then its eccentricity e =**

1) $\sqrt{2}$ 2) $\sqrt{3}$ 3) $\sqrt{5}$ 4) $\sqrt{6}$

30. **If PQ is a double ordinate of the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ such that OPQ is an equilateral triangle, O being the centre of the hyperbola. Then the eccentricity e of the hyperbola satisfies**

1) $1 < e < \frac{2}{\sqrt{3}}$ 2) $e=\frac{2}{\sqrt{3}}$ 3) $e=\frac{\sqrt{3}}{2}$ 4) $e>\frac{2}{\sqrt{3}}$

31. **The tangent at any point P on $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ meets the lines bx-ay =0 and bx +ay=0 in the points Q and R. Then CQ.CR =**

1) a^2b^2 2) $a^2 - b^2$ 3) $a^2 + b^2$ 4) None of these

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

1) 1 2) 5 3) 7 4) 9

PRACTICE EXERCISE KEY

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
3	**1**	**3**	**4**	**4**	**4**	**4**	**1**	**4**	**2**
11	12	13	14	15	16	17	18	19	20
4	**2**	**3**	**3**	**3**	**2**	**1**	**4**	**1**	**2**
21	22	23	24	25	26	27	28	29	30
3	**4**	**1**	**1**	**1**	**2**	**3**	**3**	**2**	**4**
31	32								
3	**3**								