HYPERBOLA

SELECT THE CORRECT ALTERNATIVE (ONLY ONE CORRECT ANSWER)

1. The eccentricity of the hyperbola $4x^2 - 9y^2 - 8x = 32$ is -

(A) $\frac{\sqrt{5}}{3}$ (B) $\frac{\sqrt{13}}{3}$ (C) $\frac{4}{3}$ (D) $\frac{3}{2}$

2. 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 values of k is -

(A) ellipse (B) parabola (C) circle (D) hyperbola

3. If the latus rectum of an hyperbola be 8 and eccentricity be $\frac{3}{\sqrt{5}}$ then the equation of the hyperbola can be -

(A) $4x^2 - 5y^2 = 100$ (B) $5x^2 - 4y^2 = 100$ (C) $4x^2 + 5y^2 = 100$ (D) $5x^2 + 4y^2 = 100$

4. 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) $5x^2 - 4y^2 = 8$

5. The equation of the hyperbola whose foci are (6,5), (–4, 5) and eccentricity 5/4 is–

(A) $\frac{(x-1)^2}{16} - \frac{(y-5)^2}{9} = 1$ (B) $\frac{x^2}{16} - \frac{y^2}{9} = 1$ (C) $\frac{(x-1)^2}{16} - \frac{(y-5)^2}{9} = -1$ (D) $\frac{(x-1)^2}{4} - \frac{(y-5)^2}{9} = 1$

6. The vertices of a hyperbola are at (0, 0) and (10,0) and one of its foci is at (18,0). The possible 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) $\frac{(x-5)^2}{25} - \frac{(y-5)^2}{144} = 1$

7. 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

8. AB is a double ordinate of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ such that ΔAOB (where 'O' is the origin) is an equilateral triangle, then the eccentricity e of the hyperbola satisfies -

(A) $e > \sqrt{3}$ (B) $1 < e < \frac{2}{\sqrt{3}}$ (C) $e = \frac{2}{\sqrt{3}}$ (D) $e > \frac{2}{\sqrt{3}}$

9. The equation of the tangent lines to the hyperbola $x^2 - 2y^2 = 18$ which are perpendicular to the line $y = x$ are -

(A) $y = x \pm 3$ (B) $y = -x \pm 3$ (C) $2x + 3y + 4 = 0$ (D) none of these

10. The equations to the common tangents to the two hyperbolas $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ and $\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1$ are -

(A) $y = \pm x \pm \sqrt{b^2 - a^2}$ (B) $y = \pm x \pm (a^2 - b^2)$ (C) $y = \pm x \pm \sqrt{a^2 - b^2}$ (D) $y = \pm x \pm \sqrt{a^2 + b^2}$

11. Locus of the feet of the perpendiculars drawn from either foci on a variable tangent to the hyperbola $16y^2 - 9x^2 = 1$ is -

(A) $x^2 + y^2 = 9$ (B) $x^2 + y^2 = 1/9$ (C) $x^2 + y^2 = 7/144$ (D) $x^2 + y^2 = 1/16$

12. The ellipse $4x^2 + 9y^2 = 36$ and the hyperbola $4x^2 - y^2 = 4$ have the same foci and they intersect at right angles then the equation of the circle through the points of intersection of two conics is -

(A) $x^2 + y^2 = 5$ (B) $\sqrt{5}(x^2 + y^2) - 3x - 4y = 0$

(C) $\sqrt{5}(x^2 + y^2) + 3x + 4y = 0$ (D) $x^2 + y^2 = 25$

13. The equation of the common tangent to the parabola $y^2 = 8x$ and the hyperbola $3x^2 - y^2 = 3$ is -

(A) $2x \pm y + 1 = 0$ (B) $x \pm y + 1 = 0$ (C) $x \pm 2y + 1 = 0$ (D) $x \pm y + 2 = 0$

14. Equation of the chord of the hyperbola $25x^2 - 16y^2 = 400$ which is bisected at the point (6, 2) is -

(A) 16x–75y=418 (B) 75x–16y=418 (C) 25x–4y = 400 (D) none of these

15. The asymptotes of the hyperbola $xy - 3x - 2y = 0$ are-

(A) $x - 2 = 0$ and $y - 3 = 0$ (B) $x - 3 = 0$ and $y - 2 = 0$

(C) $x + 2 = 0$ and $y + 3 = 0$ (D) $x + 3 = 0$ and $y + 2 = 0$

16. If the product of the perpendicular distances from any point on the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ of eccentricity $e = \sqrt{3}$ on its asymptotes is equal to 6, then the length of the transverse axis of the hyperbola is -

(A) 3 (B) 6 (C) 8 (D) 12

17. If the normal to the rectangular hyperbola $xy = c^2$ at the point 't' meets the curve again at 't_1' then t^3t_1 has the value equal to -

(A) 1 (B) –1 (C) 0 (D) none

18. Area of triangle formed by tangent to the hyperbola $xy = 16$ at (16, 1) and co-ordinate axes equals -

(A) 8 (B) 16 (C) 32 (D) 64

19. Locus of the middle points of the parallel chords with gradient m of the rectangular hyperbola $xy = c^2$ is -

(A) $y + mx = 0$ (B) $y - mx = 0$ (C) $my - x = 0$ (D) $my + x = 0$

20. Let P (asecθ, btanθ) and Q (asecϕ, btanϕ), 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 & Q, then k is equal to - **[JEE 99]**

(A) $\frac{a^2 + b^2}{a}$ (B) $-\left(\frac{a^2 + b^2}{a}\right)$ (C) $\frac{a^2 + b^2}{b}$ (D) $-\left(\frac{a^2 + b^2}{b}\right)$

21. 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 - **[JEE 99]**

(A) $9x^2–8y^2 + 18x –9 = 0$ (B) $9x^2–8y^2 –18x +9 = 0$ (C) $9x^2–8y^2 –18x –9 = 0$ (C) $9x^2–8y^2 + 18x +9 = 0$

SELECT THE CORRECT ALTERNATIVES (ONE OR MORE THAN ONE CORRECT ANSWERS)

22. Consider the hyperbola $3x^2 - y^2 - 24x + 4y - 4 = 0$ -

(A) its centre is (4, 2) (B) its centre is (2, 4)

(C) length of latus rectum = 24 (D) length of latus rectum = 12

23. Let an incident ray $L_1 = 0$ gets reflected at point A(–2, 3) on hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ & passes through focus S(2, 0), then -

(A) equation of incident ray is $x + 2 = 0$ (B) equation of reflected ray is $3x + 4y = 6$

(C) eccentricity, $e = 2$ (D) length of latus rectum = 6

24. For the curve $5(x - 1)^2 + 5(y - 2)^2 = 3(2x + y - 1)^2$ which of the following is true -

(A) a hyperbola with eccentricity $\sqrt{3}$ (B) a hyperbola with directrix $2x + y - 1 = 0$

(C) a hyperbola with focus (1, 2) (D) a hyperbola with focus (2, 1)

25. The equation of common tangent of hyperbola $9x^2 - 9y^2 = 8$ and the parabola $y^2 = 32x$ is/are -

(A) $9x + 3y - 8 = 0$ (B) $9x - 3y + 8 = 0$ (C) $9x + 3y + 8 = 0$ (D) $9x - 3y - 8 = 0$

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	B	D	A	C	A	B	C	D	B	C
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	D	A	A	B	A	B	B	C	A	D
Que.	21	22	23	24	25					
Ans.	B	A,C	A,B,C,D	A,B,C	B,C					

EXTRA PRACTICE QUESTIONS ON HYPERBOLA

SELECT THE CORRECT ALTERNATIVES (ONE OR MORE THAN ONE CORRECT ANSWERS)

1. Variable circles are drawn touching two fixed circles externally, then locus of centre of variable circle is -

(A) parabola (B) ellipse (C) hyperbola (D) circle

2. The locus of the mid points of the chords passing through a fixed point (α, β) of the hyperbola, $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ is -

(A) a circle with centre $\left(\frac{\alpha}{2},\frac{\beta}{2}\right)$ (B) an ellipse with centre $\left(\frac{\alpha}{2},\frac{\beta}{2}\right)$

(C) a hyperbola with centre $\left(\frac{\alpha}{2},\frac{\beta}{2}\right)$ (D) straight line through $\left(\frac{\alpha}{2},\frac{\beta}{2}\right)$

3. The locus of the foot of the perpendicular from the centre of the hyperbola $xy = c^2$ on a variable tangent is :

(A) $(x^2 - y^2)^2 = 4c^2 xy$ (B)$(x^2 + y^2)^2 = 2c^2 xy$ (C) $(x^2 - y^2) = 4c^2xy$ (D) $(x^2 + y^2)^2 = 4c^2 xy$

4. The equation to the chord joining two points (x_1, y_1) and (x_2, y_2) on the rectangular hyperbola $xy = c^2$ is -

(A) $\frac{x}{x_1+x_2}+\frac{y}{y_1+y_2}=1$ (B) $\frac{x}{x_1-x_2}+\frac{y}{y_1-y_2}=1$

(C) $\frac{x}{y_1-y_2}+\frac{y}{x_1-x_2}=1$ (D) $\frac{x}{y_1-y_2}+\frac{y}{x_1-x_2}=1$

5. The equation $9x^2 - 16y^2 - 18x + 32y - 151 = 0$ represent a hyperbola -

(A) The length of the transverse axes is 4 (B) Length of latus rectum is 9

(C) Equation of directrix is $x = \frac{21}{5}$ and $x = -\frac{11}{5}$ (D) none of these

6. From the points of the circle $x^2 + y^2 = a^2$, tangents are drawn to the hyperbola $x^2 - y^2 = a^2$; then the locus of the middle points of the chords of contact is -

(A) $(x^2 - y^2)^2 = a^2 (x^2 + y^2)$ (B) $(x^2 - y^2)^2 = 2a^2 (x^2 + y^2)$

(C) $(x^2 + y^2)^2 = a^2 (x^2 - y^2)$ (D) $2(x^2 - y^2)^2 = 3a^2 (x^2 + y^2)$

7. The tangent to the hyperbola $xy = c^2$ at the point P intersects the x-axis at T and the y-axis at T'. The normal to the hyperbola at P intersects the x-axis at N and the y-axis at N'. The areas of the triangles PNT and PN ' T ' are Δ and Δ' respectively, then $\frac{1}{\Delta}+\frac{1}{\Delta'}$ is -

(A) equal to 1 (B) depends on t (C) depends on c (D) equal to 2

8. The tangent to the hyperbola, $x^2 - 3y^2 = 3$ at the point $(\sqrt{3}, 0)$ when associated with two asymptotes constitutes -

(A) isosceles triangle (B) an equilateral triangle

(C) a triangles whose area is $\sqrt{3}$ sq. units (D) a right isosceles triangle.

9. The asymptote of the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ form with any tangent to the hyperbola a triangle whose area is $a^2 \tan\lambda$ in magnitude then its eccentricity is -

(A) $\sec\lambda$ (B) $\operatorname{cosec}\lambda$ (C) $\sec^2\lambda$ (D) $\operatorname{cosec}^2\lambda$

10. From any point on the hyperbola H_1 : $(x^2/a^2) - (y^2/b^2) = 1$ tangents are drawn to the hyperbola H_2 : $(x^2/a^2) - (y^2/b^2) = 2$. The area cut-off by the chord of contact on the asymptotes of H_2 is equal to -

(A) ab/2 (B) ab (C) 2 ab (D) 4 ab

11. The tangent at P on the hyperbola $(x^2/a^2) - (y^2/b^2) = 1$ meets the asymptote $\frac{x}{a} - \frac{y}{b} = 0$ at Q. If the locus of the mid point of PQ has the equation $(x^2/a^2) - (y^2/b^2) = k$, then k has the value equal to -

(A) 1/2 (B) 2 (C) 3/4 (D) 4/3

12. If θ is the angle between the asymptotes of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ with eccentricity e, then $\sec\frac{\theta}{2}$ can be -

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

13. If (5, 12) and (24, 7) are the focii of a conic passing through the origin, then the eccentricity of conic is -

(A) $\sqrt{386}/12$ (B) $\sqrt{386}/13$ (C) $\sqrt{386}/25$ (D) $\sqrt{386}/38$

14. The point of contact of line $5x + 12y = 9$ and hyperbola $x^2 - 9y^2 = 9$ will lie on

(A) $4x + 15y = 0$ (B) $7x + 12y = 19$ (C) $4x + 15y + 1 = 0$ (D) $7x - 12y = 19$

15. Equation $(2 + \lambda)x^2 - 2\lambda xy + (\lambda - 1)y^2 - 4x - 2 = 0$ represents a hyperbola if -

(A) $\lambda = 4$ (B) $\lambda = 1$ (C) $\lambda = 4/3$ (D) $\lambda = -1$

16. If a real circle will pass through the points of intersection of hyperbola $x^2 - y^2 = a^2$ & parabola $y = x^2$, then -

(A) $a \in (-1, 1)$ (B) $a \in \left[-\frac{1}{2}, \frac{1}{2}\right] - \{0\}$

(C) area of circle $= \pi - \pi a^2$; $a \in \left(-\frac{1}{2}, \frac{1}{2}\right) - \{0\}$ (D) area of circle $= \pi - 4\pi a^2$

17. If least numerical value of slope of line which is tangent to hyperbola $\frac{x^2}{a^2} - \frac{y^2}{(a^3+a^2+a)^2} = 1$ is $\frac{3}{4}$, $a \in R_0$ is obtained at a = k. For this value of 'a', which of the following is/are true -

(A) $a = -\frac{1}{2}$ (B) $a = \frac{1}{2}$ (C) LR $= \frac{9}{16}$ (D) $e = \frac{5}{4}$

18. If the normal at point P to the rectangular hyperbola $x^2 - y^2 = 4$ meets the transverse and conjugate axes at A and B respectively and C is the centre of the hyperbola, then -

(A) PA = PC (B) PA = PB (C) PB = PC (D) AB = 2PC

19. If the circle $x^2 + y^2 = a^2$ intersects the hyperbola $xy = c^2$ in four points P (x_1, y_1), Q(x_2, y_2), R(x_3, y_3), S$(x_4, y4)$, then - **[JEE 98]**

(A) $x_1 + x_2 + x_3 + x_4 = 0$ (B) $y_1 + y_2 + y_3 + y_4 = 0$ (C) $x_1 x_2 x_3 x_4 = c^4$ (D) $y_1 y_2 y_3 y_4 = c^4$

20. The curve described parametrically by, $x = t^2 + t + 1$, $y = t^2 - t + 1$ represents - **[JEE 99]**

(A) a pair of straight lines (B) an ellipse (C) a parabola (D) a hyperbola

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	C	C	D	A	C	A	C	A,B,C	A	D
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	C	A,D	A,D	A,B	B,D	B,C	A,C,D	A,B,C,D	A,B,C,D	C