MATHS

JEE (MAIN AND ADVANCED) MATHEMATICS

HYPERBOLA

Solved Examples

1. What is the equation to the hyperbola if its latusrectum is $\frac{9}{2}$ and eccentricity is $\frac{5}{4}$.

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2. What are the foci of the hyperbola $\frac{x^2}{36} - \frac{y^2}{16} = 1$

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3. Find the equation of the hyperbola whose foci are (6,4) and (-4,4) and eccentricity is 2.

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4. Find the equation of the hyperbola whose foci are (1,2), $e = \sqrt{3}$ and the directrix is 2x+y=1.

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5. Find the centre, foci, eccentricity equation of the directrices, length of the latus rectum of the hyperbola.

$x^2 - 4y^2 = 4$

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6. Find the eccentricity, co ordinates of foci-length of latus rectum and equation of directrices of the folloeing ellipses.

$9x^2 + 16y^2 - 36x + 32y - 92 = 0$

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7. (i) Show that the equation $\frac{x^2}{9-c} + \frac{y^2}{5-c} = 1$ represents (a) an ellipse if c is a real constant less than 5 (b) a hyperbola if c is any real constant between 5 and 9.

(ii) Show that each ellipse in (a) and each hyperbola in (b) has foci at the two points $(\pm 2, 0)$ independent of the value of c.

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8. The condition that the line $x\cos\alpha + y\sin\alpha = p$ to be a tangent to the hyperbola $x^2/a^2 - y^2/b^2 = 1$ is

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9. Find the equation of the tangents to the hyperbola $3x^2 - 4y^2 = 12$ which are (i) Parallel and (ii) perpendicular to the line $y = x - 7$

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10. Tangents are drawn from (-2,1) to the hyperola $2x^2 - 3y^2 = 6$. Find their equations.

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11. The product of the perpendicular from the foci on any tangent to the hyperbola $x^2/a^2 - y^2/b^2 = 1$ is

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12. The equation of the normal to the hyperbola $x^2 - 4y^2 = 5at(3, -1)$ is

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13. Find the equation of the normal at $\theta = \frac{\pi}{3}$ to the hyperbola $3x^2 - 4y^2 = 12$.

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14. Prove that the product of the perpendicular from any point on the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ to its asymptodes is constant.

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15. If the normal at θ on the hyperola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ meets the transverse axis at G, prove that $AG, A'G = a^2\left(e^4 \sec^2\theta - 1\right)$. Where A and A' are the vertices of the hyperbola.

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16. Find the eccentricity of the hyperbola with asymptotes 3x+4y=2 and 4x-3y=2

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17. A circle cuts the rectangular hyperbola $xy = 1$ in the points $(x_1, y_1), r = 1, 2, 3, 4.$

Prove that $x_1x_2x_3x_4 = y_1y_2y_3y_4 = 1$

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18. If four points be taken on a retangular hyperola such that the chords joining any two points is perpendicular to the chord joining the other two, and if α, β, γ and δ be the inclinations to either asymptote oof the straight lines joining these points to the centre prove that $\tan\alpha\tan\beta\tan\gamma\tan\delta = 1$

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19. What is the equation to the hyperbola if its latusrectum is $\frac{9}{2}$ and eccentricity is $\frac{5}{4}$.

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20. What are the foci of the hyperbola $\frac{x^2}{36} - \frac{y^2}{16} = 1$

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21. Find the equation of the hyperbola whose foci are (6,4) and (-4,4) and eccentricity is 2.

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22. Find the equation of the hyperbola whose foci are (1,2), $e = \sqrt{3}$ and the directrix is 2x+y=1.

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23. Find the eccentricity, foci, length of latusrectum and the equations to the directrices of the hyperbola $\frac{x^2}{16} - \frac{y^2}{9} = 1$

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24. The equation of the hyperbola whose focus is origin, eccentricity $\sqrt{2}$ and directrix $x + y + 1 = 0$ is

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25. Find the eccentricity and length of the latus rectum of the hyperbola

(i) $4x^2 - 9y^2 = 27$

(ii) $x^2 - 9y^2 = 27$

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26. Find the foci of the hyperbola $9x^2 - 16y^2 + 72x - 32y - 16 = 0$

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27. Find the eccentricity foci, equation of the directrices and length of the latusrectum of the hyperbola $x^3 - 4y^2 = 4$

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28. (i) Show that equation $\frac{x^2}{9-c} + \frac{y^2}{5-c} = 1$ represents

(a) an ellipse if c is a real constant less than 5

(b) a hyperbola if c is any real constant between 5 and 9

(ii) Show that each ellipse in

(a) and each hyperbola in

(b) has foci at the two points $(\pm 2, 0)$, independent of the value of c.

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29. The foci of a hyperola coincide with the foci of the ellipse $\frac{x^2}{25} + \frac{y^2}{9} = 1$. Find the equation of the hyperola, if its eccentricity is 2.

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30. Find the equations of the tangents to the hyperbola $x^2 - 4y^2 = 4$ which are

(i) parallel and , (ii) perpendicular to the line x + 2y = 0

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31. Tangents to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ make angles α and β with the transverse axis. Find the locus of the their point of intersection if $\tan\alpha + \tan\beta = k$

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32. The equations of the tangents to the hyperbola $3x^2 - 4y^2 = 12$ which make equal intercepts on the axes is

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33. Find the equation of the normal at (1, 0) on the hyperbola $x^2 - 4y^2 = 1$

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34. Tangents are drawn from (0, 2) to the hyperbola $5x^2 - y^2 = 5$. Find their equations.

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35. The chord of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$, whose equation is $x\cos\alpha + y\sin\alpha = p$, subtends a right angle at its centre. Prove that it

always touches a circle of radius $\frac{ab}{\sqrt{a^2-b^2}}$

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36. Find the condition for the line $x\cos\alpha + y\sin\alpha = p$ to be tangent to the hyperbole $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

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37. Prove that the product of the lengths of the perpendicular drawn from foci on any tangent to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1 is b^2$

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38. The point of intersection of the asymptotes with the directrices lie on

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39. Write down the equation of the normal at $\theta = \frac{\pi}{3}$ to the hyperbola $3x^2 - 4y^2 = 12$

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40. Prove that the product of the perpendicular from any point on the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ to its asymptodes is constant.

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41. If the normal at θ on the hyperola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ meets the transverse axis at G, prove that $AG, A'G = a^2\left(e^4 \sec^2\theta - 1\right)$. Where A and A' are the vertices of the hyperbola.

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42. If a circle cuts the rectangular hyperbola xy = 1 in the points $(x_r, y_r), r = 1, 2, 3, 4$ prove that $x_1, x_2, x_3, x_4 = y_1, y_2, y_3, y_4 = 1$

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43. Find the equation of the chord joining two points (x_1, y_1) and (x_2, y_2) on t he rectangular hyperbola $xy = c^2$

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44. The eccentricity of the hyperbola with asymptotes 3x+4y=2 and 4x-3y=2 is

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45. Find the centre, eccentricity, foci directrices and the length of the latus rectum of the following hyperbolas $(i) 4x^2 - 9y^2 - 8x - 32 = 0$

(ii) $4(y+3)^2 + 9(x-2)^2 = 1$

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46. Find the equations of the tangents to the hyperbola $3x^2 - 4y^2 = 12$ which are (i) parallel and (ii) perpendicular to the line y = x - 7

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47. Prove that the point of intersection of two perpendicular tangents tot he hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ lies on the circle $x^2 + y^2 = a^2 - b^2$

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Additional Solved Examples

1. The foci of a hyperola coincide with the foci of the ellipse $\frac{x^2}{25} + \frac{y^2}{9} = 1$. Find the equation of the hyperola, if its eccentricity is 2.

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2. The chord of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$, whose equation is $x\cos\alpha + y\sin\alpha = p$, subtends a right angle at its centre. Prove that it always touches a circle of radius $\frac{ab}{\sqrt{a^2 - b^2}}$

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3. If the chords of contact of tangents from two points (x_1, y_1) and (x_2, y_2) to the hyperola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ are at right angles, then find $\frac{x_1 x_2}{y_1 y_2}$

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4. The point of intersection of the asymptotes with the directrices lie on

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5. Find the asymptotes of the hyperola.

$2x^2 - xy - y^2 + 2x - 2y + 2 = 0$

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6. Show that the equation of the chord joining two points (x_1, y_1) and (x_2, y_2) on the rectangular hyperbola $xy = c^2 is \frac{x}{x_1 + x_2} + \frac{y}{y_1 + y_2} = 1$

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Example

1. Find the asymptotes of the hyperbola $4x^2 - 9y^2 = 36$

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2. Find the asymptotes of the hyperbola $xy - 3y - 2x = 0$

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3. The asympototes of a hyperola having centre at (1,2) are parallel to 2x+3y=0 and 3x+2y=0 and hyperbola passes through the point (5,3). Find the equatioin of the hypberbola.

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4. If the normal at the point t_1 to the rectangle hyperola $xy = c^2$ meets it again at the point t_2 prove that $t_1^3 t_2 = -1$

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5. A triangle has its vertices on a rectangular hyperola. Prove that the orthocentre of the triangle also on the same Hyperola.

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6. Find the equation of the auxiliarly circle of the hyperbola $\frac{x^2}{6} - \frac{y^2}{4} = 1$

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7. Find the equation of the pair of tangents drawn from (-1,2) to the hyperola $2x^2 - 3y^2 = 1$.

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8. If a,P are the eccentric angles of the extremeties of a focal chord of the ellipse

(i) $e\frac{\cos(\alpha+\beta)}{2} = \frac{\cos(\alpha-\beta)}{2}$

(ii) $\frac{\tan(\alpha)}{2}\frac{\tan(\beta)}{2} = \frac{e-1}{e+1}$

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9. The equation of the transverse and conjugate axes of a hyperbola are respectively 3x+4y-7=0, 4x-3y+7=0 and their respective lengths are 4 and 6. Find the equation of the hyperbola.

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Exercise 5 1 Very Short Answer Questions

1. Find the equation of Hyperbola with one focus at the origin and directrix x+3=0 and eccentricity $\sqrt{3}$

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2. Find the equation of the ellipse whose foci are (0 ± 3) and $e = \frac{3}{4}$

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3. The equation of the hyperbola with is transverse axis parallel to x-axis and its centre is $(3, -2)$ the length of axes, are 8,6 is

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4. If $\frac{5}{4}$ is the eccentricity of a hyperbola find the eccentricity of its conjugate hyperbola.

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Exercise 5 1 Short Answer Questions

1. The focus and the correspondin directrix of a hyperbola are (1-3) and y=2 and eccentricity is 3/2. Find the equation of the hyperbola.

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2. If the lines 3x-4y=12 and 3x+4y=12 meets on a hyperbola $\frac{x^2}{a^2} - \frac{y^2}{9} = 1$ then find its eccentricity.

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3. Find the equation to the hyperola of given length of transverse axis 5 and the join of centre and focus is bisected by vertex.

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Exercise 5 1 Long Answer Questions

1. The equations of the directrices of the ellipse $25x^2 + 9y^2 - 150x - 90y + 225 = 0$

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2. Find the eccentricity, length of latus rectum, centre, foci, vertices and the equatioin to the dircctriccs of the hyperola.

(i) $4x^2 - 5y^2 - 16x + 10y + 31 = 0$

(ii) $5x^2 - 4y^2 + 20x + 8y - 4 = 0$

(iii) $4(y+3)^2 - 9(x-2)^2 = 1$

(iv) $4x^2 - 9y^2 - 8x - 32 = 0$

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Exercise 5 2 Very Short Answer Questions

1. Find the value of k if the line 3x-4y=k is a tangent to $x^2 - 4y^2 = 5$

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2. Find the equation of the tangents to the hyperbola $3x^2 - 4y^2 = 12$ which are (i) Parallel and (ii) perpendicular to the line $y = x - 7$

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3. Find the equation of the tangent to the hyperbola $3x^2 - 4y^2 = 12$ which is perpendicular to the line x-y=7.

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4. The equations of the tangents to the hyperbola $3x^2 - 4y^2 = 12$ which make equal intercepts on the axes is

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Exercise 5 2 Short Answer Questions

1. Tangents are drawn from (-2,1) to the hyperola $2x^2 - 3y^2 = 6$. Find their equations.

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2. Tangents to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ make angle θ_1, θ_2 with transvrse axis of a hyperbola. Show that the points of intersection of these tangents lies on the curve $2xy = k\left(x^2 - a^2\right)$ when $\tan\theta_1 + \tan\theta_2 = k$

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3. The product of the perpendicular from the foci on any tangent to the hyperbola $x^2/a^2 - y^2/b^2 = 1$ is

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4. Find the equation of the normal to the hyperbola $x^2 - 3y^2 = 144$ at the positive end of the latus rectum.

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Exercise 5 3 Very Short Answer Questions

1. Find the equation of the tangent to the hyperbola $4x^2 - 9y^2 = 36$ at $\theta = \frac{\pi}{4}$

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2. Find the equation of the normal at $\theta = \frac{\pi}{3}$ to the hyperbola $3x^2 - 4y^2 = 12$.

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3. Find the equation of the hyperbola whose asymptotes are $3x = +5y$ and the vartices are $(\pm 5, 0)$.

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4. The angle between the asymptotes of the hyperbola $x^2 - 3y^2 = 3$ is

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5. Show that the angle between the asymptotes of the hyperola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ is $2\tan^{-1}\left(\frac{b}{a}\right)$ or $2\sec^{-1}(e)$.

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6. If the angle between the asymptotes is 30° then find its eccentricity.

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Exercise 5 3 Short Answer Questions

1. Show that product of lengths of the perpendicular from any point on the hyperbola $\frac{x^2}{16} - \frac{y^2}{9} = 1$ to its asymptotes is $\frac{144}{25}$.

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2. Find the equation of the hyperbola whose asymptotes are $x + 2y + 3 = 0$ and $3x + 4y + 5 = 0$ and which passes through (1,-1).

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Additional Exercise

1. The equation of the transverse and cojugate axes of a hyperbola are respectively $x + 2y - 3 = 0, 2x - y + 4 = 0$ and their respectively length are $\sqrt{2}$ and $2/\sqrt{3}$. The equation of the hyperbola is

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2. 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 center of the hyperola, then prove that the eccentricity e of the hyperbola satisfies $e > \frac{2}{\sqrt{3}}$.

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3. If x= 9 is a chord of contact of the hyperbola $x^2 - y^2 = 9$, then the equation of the tangents at one of the points of contact is

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4. Find the locus of the mid-point of the chord of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ which subtends a right angle at the origin.

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5. A hyperbola has axes along the coordinate axes. Its trasverse axis is 2a and it passes through (h.k). Find its eccentricity.

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6. Find the locus of the point of intersection of two tangents to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$. which makes an angle α with one another.

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7. Prove that the locus of the mid -points of the chords of the circle $x^2 + y^2 = 16$ which are tangents to the hyperbola $9x^2 - 16y^2 = 144$ is $\left(x^2 + y^2\right)^2 = 16x^2 - 9y^2$.

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8. Find the asymptodes of the hyperbola $2x^2 + 5xy + 2y^2 - 11x - 7y - 4 = 0$

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9. Find the equation of the hyperbola whose asymptotes are the straight lines 3x-4y+7=0 and 4x+3y+1=0 and which pass-through the origin.

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10. The equation of the line passing throught the centre of a rectangular hyperola is x-y-1=0. If one of its asymptotes is 3x-4y-6=0. Find the equation of the other.

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11. A normal to the hyperbola $x^2/a^2 - y^2/b^2 = 1$ cuts the axes at K and L. The perpendicular at K and L to axes meet in P. The locus of P is

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

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13. Prove that the locus of the point of intersection of tangents at the ends of normal chords of hyperbola $x^2-y^2=a^2$ is $a^2(y^2-x^2)=4x^2y^2$

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14. Prove that the portion of the tangent of the rectangular hyperbola intercepted between the asymptotes is bisected at the point of contact and the area of the triangle formed by the tangent and the two asymptotes is constant.

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15. If the hyperbola $xy = c^2$ intersects the circle $x^2 + y^2 = a^2$ is four points $P(x_1, y_1), Q(x_2, y_2), R(x_3, y_3)$ and $S(x_4, y_4)$ then show that

(i) $x_1 + x_2 + x_3 + x_4 = 0$

(ii) $y_1 + y_2 + y_3 + y_4 = 0$

(iii) $x_1 x_2 x_3 x_4 = c^4$

(iv) $y_1 y_2 y_3 y_4 = c^4$

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

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17. If x=9 is the chord of contact of tangents of $x^2 - y^2 = 9$, then show that the equation of corresponding tangents is

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

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18. Show that the equationi of the rectanglar hyperbola whose focus is (1,-1) and the corresponding, directrix x-y+1 is 2xy-4x+4y+1=0

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19. The hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ has its conjugate axis 5 and passes through the point (2,-1). Then find the length of the latus rectum.

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20. Tangents are drawn from points on the hyperbola $\frac{x^2}{9} - \frac{y^2}{4} = 1$ to the circle $x^2 + y^2 = 9$. Then show that the locus of the mid point of the chord of contact is $\left(x^2 + y^2\right)^2 = 81\left(\frac{x^2}{9} - \frac{y^2}{4}\right)$

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21. If a hyperbola passes through a focus of the ellipse and it transverse and conjugate axes coincides with major and minor axis of the ellipse and the product of their eccentricities is 1, then

(i) Show that the equation of the hyperbola is $\frac{x^2}{9} - \frac{y^2}{16} = 1$

(ii) Find the focus of the hyperbola.

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22. A hyperbola having the transverse axis of length 2 sin θ, is confocal with the ellipse $3x^2 + 4y^2 = 12$. Then show that the equation of this hyperbola is $\frac{x^2}{\sin^2\theta} - \frac{y^2}{\cos^2\theta} = 1$.

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23. An ellipse has eccentricity $\frac{1}{2}$ and the 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

hyperola $x^2 - y^2 = 1$ and the circle $x^2 + y^2 = 1$. Find the equation of the ellipse.

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24. The locus represented by $x = \frac{a}{2}\left(t + \frac{1}{t}\right), y = \frac{a}{2}\left(t - \frac{1}{t}\right)$ is

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25. If the normal at $(x_i y_i)$ i=1,2,3,4 on $xy = c^2$ meet at the point (α, β) show that $\sum x_i = \alpha, \sum y_i = \beta, \sum x_i^2 = \alpha^2, \sum y^2 = \beta^2, x_1 x_2 x_3 x_4 = y_1 y_2 y_3 y_4 =$

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26. Given the base BC of the triangle ABC and if $\angle C - \angle B = k$, a constant, show that the locus of the vertex A is a hyperbola.

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27. The ordinate of any point P on the hyperbola $25x^2 - 16y^2 = 400$ is produced to cut the asymptoles in the points Q and R. Find the value of QP. PR

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28. Given the base of the triangle and the sum of tangent of base angles as a negative constant $-k^2$, show that the locus of the vertex of the triangle is a parabola.

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29. From a fixed point $A(x_1, y_1)$ a variable straight line is drawn to cut the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ at B and C. A point P is choosen on the chord BC such that the locur of P is $\frac{x(x - x_1)}{a^2} = \frac{y(y - y_1)}{b^2}$

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Exercise I

1. Equation of the hyperbola with one focus at the origin and directrix x+3=0 and eccentricity $\sqrt{3}$ is

A. $x^2 - 2y^2 + 18x + 27 = 0$

B. $2x^2 - y^2 + 18x + 27 = 0$

C. $x^2 - 2y^2 - 18x - 27 = 0$

D. $2x^2 - y^2 - 18x + 27 = 0$

Answer: B

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2. The equation of the hyperbola whose foci are $(\pm 5, 0)$ and eccentricity 5/3 is

A. $\frac{x^2}{9} - \frac{y^2}{16} = 1$

B. $\frac{x^2}{4} - \frac{y^2}{16} = 1$

C. $\frac{x^2}{9} + \frac{y^2}{6} = 1$

D. $\frac{x^2}{4} - \frac{y^2}{16} = 1$

Answer: A

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3. The equation of the hyperola whose centre is (1,2) one focus is (6,2) and transverse axis 6 is

A. $16(x-1)^2 - 9(y-2)^2 = 144$

B. $9(x-1)^2 - 16(y-2)^2 = 144$

C. $16(x-1)^2 - 25(y-2)^2 = 200$

D. $25(x-1)^2 - 16(y-2)^2 = 200$

Answer: A

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4. $x^2 - y^2 + 5x + 8y - 4 = 0$ represents

A. rectangular hyperbola

B. ellipse

C. hyperbola

D. pair of lines

Answer: A

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5. If $(\lambda - 2)x^2 + 4y^2 = 4$ represents a rectangular hyperbola then $\lambda =$

A. 0

B. 1

C. -2

D. 3

Answer: C

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6. If m is a variable the locus of the point of intersection of the lines $\frac{x}{3} - \frac{y}{2} = m$ and $\frac{x}{3} + \frac{y}{2} = \frac{1}{m}$ is

A. a parabola

B. an ellipse

C. a hyperbola

D. Straight line

Answer: C

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7. The centre of the hyperbola $x^2 - y^2 - 4x - 2y - 8 = 0$ is

A. (2,2)

B. (2,-2)

C. (2,1)

D. (2,-1)

Answer: D

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8. The vertices of the hyperbola $x^2 - 3y^2 + 2x + 12y + 1 = 0$ are

A. $(\pm 3, 0)$

B. $(1 \pm 2, 2)$

C. $(-1, 2 \pm 2)$

D. $(1, -2 \pm 3)$

Answer: C

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9. The length of the transverse axis of $9x^2 - 16y^2 - 18x - 32y - 151 = 0$ is

A. 16

B. 8

C. 9

D. 6

Answer: B

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10. The length of the latus rectum of the hyperbola $x^2 - 4y^2 = 4$ is

A. 2

B. 1

C. 4

D. 3

Answer: B

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11. The equation of the conjugate axis of the hyperbola $\frac{(y-2)^2}{9} - \frac{(x+3)^2}{16} = 1$ is

A. y=2

B. y=6

C. y=8

D. y=3

Answer: A

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12. Equation of directrices of $4x^2 - 9y^2 = 36$ are

A. $\sqrt{13}x = \pm 3$

B. $\sqrt{13x} = \pm 9$

C. $\sqrt{13}x = \pm 2$

D. $\sqrt{13}x = \pm 4$

Answer: B

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13. The equation of the latusrectum of the hyperbola $3y^2 - 4x^2 = 12$ are

A. $y = \pm\sqrt{11}$

B. $y = \pm\sqrt{3}$

C. $y = \pm\sqrt{7}$

D. $y = \pm\sqrt{5}$

Answer: C

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14. The equation of the axes of the hyperbola $9x^2 - 16y^2 + 72x - 32y - 16 = 0$ are

A. y+1=0, x+4=0

B. y+2=0, x+3=0

C. y-1=0, x-4=0

D. y+3=0, x-4=0

Answer: A

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15. If a,b are eccentricities of a hyperbola and its conjugate hyperbola then $a^{-2}+b^{-2}=$

A. 4

B. 1

C. a^2b^2

D. $a^{-2}b^2$

Answer: C

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16. The eccentricity of the conjugate hyperbola of the hyperola $x^2-3y^2=1$ is

A. 2

B. $\frac{2}{\sqrt{3}}$

C. 4

D. $\frac{4}{3}$

Answer: A

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17. If e_1 and e_2 are eccentricities of the hyperbolas $xy = c^2$ and $x^2 - y^2 = a^2$ then $e_1^2 + e_2^2 = 0$

A. 4

B. 1

C. $e_1^2 - e_2^2$

D. $2e_1^2e_2^2$

Answer: A

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18. The locus of the point $\left(\frac{e^t + e^{-t}}{2}, \frac{e^t - e^{-t}}{2}\right)$ is a hyperbola of eccentricity

A. $\sqrt{3}$

B. 3

C. $\sqrt{2}$

D. 2

Answer: C

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19. The distance between the foci is $4\sqrt{13}$ and the length of conjugate axis is 8 then, the eccentricity of the hyperbola is

A. $\sqrt{13}/3$

B. $\sqrt{13}/5$

C. $\sqrt{13}/7$

D. none

Answer: A

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20. The latus rectum of a hyperbola $\frac{x^2}{16} - \frac{y^2}{p} = 1 is 4\frac{1}{2}$ .Its eccentricity e=

A. $4/5$

B. $5/4$

C. $3/4$

D. $4/3$

Answer: B

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21. If the latus rectum through one focum subtends a right angle at the farther vertex of the hyperbola then its eccentricity is

A. $\sqrt{2}$

B. 2

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

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

Answer: B

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22. If the lactus recturm of a hyperbola through one focus subtends 60° at the other focus then its eccentricity is

A. $\sqrt{2}$

B. $\sqrt{3}$

C. $\sqrt{5}$

D. $\sqrt{6}$

Answer: B

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23. If the latus rectum of a hyperola forms an equilateral triangle with the centre of the hyperbola, then its eccentricity is

A. $\frac{\sqrt{5}+1}{2}$

B. $\frac{\sqrt{11}+1}{2}$

C. $\frac{\sqrt{13}+1}{2\sqrt{3}}$

D. $\frac{\sqrt{13}\cdot 1}{2\sqrt{3}}$

Answer: C

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24. The line $y = mx + 2$ touches the hyperola $4x^2 - 9y^2 = 36$ then m=

A. $\pm \frac{2}{3}$

B. $\pm \frac{2\sqrt{2}}{3}$

C. $\pm \frac{8}{9}$

D. $\pm \frac{4\sqrt{2}}{3}$

Answer: B

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25. Equations of tangents to the hyperbola $4x^2 - 3y^2 = 24$ which makes an angle 30° with y-axis are

A. $\sqrt{3}x + y = \pm\sqrt{10}$

B. $\sqrt{3}x - y = \pm 10$

C. $\sqrt{3}x - y = \pm 5$

D. $\sqrt{3}x - y = \pm\sqrt{5}$

Answer: A

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26. The equation of the tangents to the hyperbola $3x^2 - 4y^2 = 12$ which are parallel to the line $2x + y + 7 = 0$ are

A. $2x + y \pm \sqrt{13} = 0$

B. $3x - y \pm \sqrt{16} = 0$

C. $3x - y \pm 2 = 0$

D. $3x - y \pm \sqrt{2} = 0$

Answer: A

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27. The point of contact of 9x+8y-11=0 to the hyperbola $3x^2 - 4y^2 = 11$ is

A. (3,-2)

B. (3,2)

C. (-3,-3)

D. (3,3)

Answer: A

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28. The nummber of tangents to $x^2/9 - y^2/4 = 1$ throught (6,2) is

A. 0

B. 1

C. 2

D. 3

Answer: A

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29. For all real values of m' the straight line $y = mx + \sqrt{9m^2 - 4}$ is a tangent to the curve

A. $9x^2 + 4y^2 = 36$

B. $4x^2 + 9y^2 = 36$

C. $9x^2 - 4y^2 = 36$

D. $4x^2 - 9y^2 = 36$

Answer: D

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30. The condition that the line x=my+c may be a tangent of $\frac{x^2}{a^2} - \frac{y^2}{b^2} = -1$ is

A. $c^2 = a^2m^2 - b^2$

B. $c^2 = a^2 - b^2m^2$

C. $c^2 = b^2 - a^2m^2$

D. $c^2 = b^2m^2 - a^2$

Answer: D

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31. Product of perpendiculars from the foci of $\frac{x^2}{4} - \frac{y^2}{9} = 1$ to $y = mx + \sqrt{4m^2 - 9}$ where $m > \frac{3}{2}$ is

A. 4

B. $\frac{36}{13}$

C. 3

D. 9

Answer: D

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32. If $m_1, m_2,$ are slopes of the tangens to the hyperbola $x^2/25 - y^2/16 = 1$ which pass through the point (6, 2) then

A. $m_1 + m_2 = 24/11$

B. $m_1 + m_2 = 48/11$

C. $m_1 m_2 = 28/11$

D. $m_1 m_2 = 11/20$

Answer: A

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33. Number of points from where perpendicular tangents can be drawn to the curve $\frac{x^2}{16} - \frac{y^2}{25} = 1$ is

A. 1

B. 2

C. 0

D. infinite

Answer: C

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34. The equation of the auxiliary circle of $\frac{x^2}{16} - \frac{y^2}{25} = 1$ is

A. $x^2 + y^2 = 16$

B. $x^2 + y^2 = 9$

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

D. $x^2 + y^2 = 25$

Answer: A

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35. Locus of feet of perpendicular from (5,0) to the tangents of $\frac{x^2}{16} - \frac{y^2}{9} = 1$ is

A. $x^2 + y^2 = 4$

B. $x^2 + y^2 = 16$

C. $x^2 + y^2 = 9$

D. $x^2 + y^2 = 25$

Answer: B

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36. Find the equation of the normal to the hyperbola $x^2 - 3y^2 = 144$ at the positive end of the latus rectum.

A. $\sqrt{3}x + 2y = 32$

B. $\sqrt{3}x - 3y = 48$

C. $3x + \sqrt{3}y = 48$

D. $3x - \sqrt{3}y = 48$

Answer: A

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37. If S and T are foci of $\frac{x^2}{16} - \frac{y^2}{9} = 1$. If P is a point on the hyperbola then |SP-PT|=

A. 8

B. 3

C. 6

D. 12

Answer: a

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38. Equation of the tangent to the hyperbola $4x^2 - 9y^2 = 1$ with eccentric angle $\pi/6$ is

A. $4x + 3y = \sqrt{3}$

B. $4x - 3y = \sqrt{3}$

C. $3x - 4y = \sqrt{3}$

D. $3x - 4y = \sqrt{5}$

Answer: B

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39. Equation of normal to $9x^2 - 25y^2 = 225$ at $\theta = \pi/4$ is

A. $5x + 3\sqrt{2}y = 34\sqrt{2}$

B. $5x + \sqrt{2}y = 34\sqrt{2}$

C. $5x + \sqrt{3}y = 34\sqrt{2}$

D. $5x - 3\sqrt{2}y = 34\sqrt{2}$

Answer: A

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40. The equation to the pair of asymptotes of the hyperbola $\frac{x^2}{9} - \frac{y^2}{5} = 1$ is

A. $\frac{x^2}{9} - \frac{y^2}{5} + 1 = 0$

B. $\frac{x^2}{9} - \frac{y^2}{5} = 2$

C. $5x^2 - 9y^2 = 0$

D. $9x^2 - 5y^2 = 0$

Answer: C

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41. The angle between the asymptotes of the hyperbola $x^2 - y^2 = 2$ is

A. $\frac{\pi}{4}$

B. $\frac{\pi}{3}$

C. $\frac{\pi}{6}$

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

Answer: D

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42. The angle between the asymptotes of the hyperbola $xy = a^2$ is

A. 30°

B. 60°

C. 45°

D. 90°

Answer: D

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43. The eccentricity of the hyperbola with asymptotes 3x+4y=2 and 4x-3y=2 is

A. 3

B. 2

C. $\sqrt{2}$

D. 4

Answer: C

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44. The angle between the asymptotes of the hyperbola $x^2/a^2 - y^2/b^2 = 1$ is

A. $2\sin^{-1}(e)$

B. $2\cos^{-1}(e)$

C. $2\tan^{-1}(e)$

D. $2\sec^{-1}(e)$

Answer: D

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45. Angle between the asymptotes of a hyperbola is 30° then e=

A. $\sqrt{6}$

B. $\sqrt{2}$

C. $\sqrt{6}-\sqrt{2}$

D. $\sqrt{6}-\sqrt{3}$

Answer: C

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46. Angle between the asymptotes of a hyperbola is $x^2 - 3y^2 = 1$ is

A. 15°

B. 45°

C. 60°

D. 30°

Answer: C

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47. The product of lengths of perpendicular from any point on the hyperola $x^2 - y^2 = 16$ to its asymptotes is

A. 2

B. 4

C. 8

D. 16

Answer: C

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Exercise Ii

1. The equation of the heyperbola with its transverse axis parallel to x-axis and its centre is (-2,1) the length of transverse axis is 10 and eccentricity 6/5 is

A. $x^2 - 2y^2 + 18x + 27 = 0$

B. $\frac{(x+2)^2}{25} - \frac{(y-1)^2}{9} = 1$

C. $\frac{(x-3)^2}{6} - \frac{(y-2)^2}{9} = 1$

D. $\frac{(x-2)^2}{16} - \frac{(y-3)^2}{19} = 1$

Answer: B

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2. The vertices of a hyperbola are $(2, 0), (-2, 0)$ and the foci are (3,0) , (-3,0) .The equation of the hyperbola is

A. $\frac{x^2}{5} - \frac{y^2}{4} = 1$

B. $\frac{x^2}{4} - \frac{y^2}{5} = 1$

C. $\frac{x^2}{5} - \frac{y^2}{2} = 1$

D. $\frac{x^2}{2} - \frac{y^2}{5} = 1$

Answer: B

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3. The transverse axis of a hyperbola is of length 2a and a verlex divides the segment of the axis between the centre and the corresponding focus in the ratio 2 : 1. The equation of the hyperbola is

A. $5x^2 - 4y^2 = 5a^2$

B. $5x^2 - 4y^2 = 4a^2$

C. $4x^2 - 5y^2 = 5a^2$

D. $4x^2 - 5y^2 = 4a^2$

Answer: A

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4. If e_1 is the eccentricity of the ellipse $\frac{x^2}{16} + \frac{y^2}{25} = 1$ and e_2 is the eccentricity of a hyperbola passing through the foci of the given ellipse and $e_1 e_2 = 1$, then the equation of such a hyperbola among the following is

A. $\frac{x^2}{16} + \frac{y^2}{25} = 1$

B. $\frac{x^2}{16} - \frac{y^2}{9} = -1$

C. $\frac{x^2}{9} - \frac{y^2}{25} = 1$

D. $\frac{x^2}{16} - \frac{y^2}{9} = 1$

Answer: B

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5. The equation $\frac{x^2}{7-K}+\frac{y^2}{5-K}=1$ represents a hyperbola if

A. $5<K<7$

B. $K<5$ or $K>7$

C. $K>5$

D. $K\neq 5, K\neq 7$

Answer: A

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6. If the foci of the ellips $\frac{x^2}{25}+\frac{y^2}{16}=1$and the hyperbola $\frac{x^2}{4}-\frac{y^2}{b^2}=1$ coincide ,then $b^2=$

A. 4

B. 5

C. 8

D. 9

Answer: B

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

A. 5

B. 7

C. 9

D. 1

Answer: B

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8. Statement-I : If P,Q,R,S are the ends of latus recta of the hyperbola $\frac{x^2}{16} - \frac{y^2}{9} = 1$ then the area of rectangle of PQRS is 45 square units.

Statement -II: The centre of the hyperbola $\frac{(x+y+1)^2}{3} - \frac{(x-y-3)^2}{6} = 1$ lies in second quadrant. Which of above statement is true

A. only I

B. only II

C. both I and II

D. neither I nor II

Answer: A

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9. The eccentricity of the hyperbola $4x^2 - 9y^2 = 2ax + b^2$ is

A. $\frac{a}{b}$

B. $\frac{\sqrt{b}}{a}$

C. $\frac{\sqrt{13}}{2}$

D. $\frac{\sqrt{13}}{3}$

Answer: D

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10. The eccentricity of $\frac{x^2}{9} - \frac{y^2}{16} = 1$ is

A. $\frac{17}{16}$

B. $\frac{5}{4}$

C. $\frac{5}{3}$

D. $\frac{\sqrt{7}}{4}$

Answer: C

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

A. $\frac{13}{5}$

B. $\frac{\sqrt{386}}{13}$

C. $\frac{\sqrt{386}}{25}$

D. $\frac{\sqrt{386}}{12}$

Answer: D

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12. If the ecentricity of a hyperbola is $\sqrt{3}$ then the ecentricity of its conjugate hyperbola is

A. $\sqrt{2}$

B. $\sqrt{3}$

C. $\sqrt{3/2}$

D. $2\sqrt{3}$

Answer: C

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13. If e and e^1 are the eccentricities of the ellipse $5x^2 + 9y^2 = 45$ and the hyperbola $5x^2 - 4y^2 = 45$ then $ee^1 =$

A. 9

B. 5

C. 4

D. 1

Answer: D

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14. If the equation $(10x-5)^2+(10y4)^2=\lambda^2(3x+4y-1)^2$ represents a hyperbola then

A. $-2<\lambda<2$

B. $\lambda>2$

C. $\lambda>-2, \lambda>2$

D. $0<\lambda<2$

Answer: C

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15. Statement-I: The number of integral values of K for which the equation $\frac{x^2}{3K-2}+\frac{y^2}{K-10}=1$ represents a hyperbola is 10.

Statement-II : The above equation represents a rectangular hyperbola for K =3.

Which of above statements is true

A. only I

B. only II

C. both I and II

D. neither I nor II

Answer: B

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16. The equation of the director circle of $x^2/12 - y^2/8 = 1$ is

A. $x^2 + y^2 = 9$

B. $x^2 + y^2 = 4$

C. $x^2 + y^2 = -9$

D. $x^2 - y^2 = 4$

Answer: B

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17. If the tangents drawn from a point on the hyperola $x^2 - y^2 = a^2 - b^2$ to the ellipse $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ makes angles α and β with transverse axis of the hyperbola, then

A. $\tan\alpha - \tan\beta = 1$

B. $\tan\alpha + \tan\beta = 1$

C. $\tan\alpha \tan\beta = 1$

D. $\tan\alpha \tan\beta = 1$

Answer: C

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18. Equation of one of the tangents passing through (2, 8) to the hyperbola $5x^2 - y^2 = 5$ is

A. 3x+y-14=0

B. 3x-y+2=0

C. x+y+3=0

D. x-y+6=0

Answer: B

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19. The locus of the point of Interection of two tangents to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ which a make an angle 60° with one another is

A. $\left(x^2 + y^2 - a^2 + b^2\right)^2 = 12\left(a^2y^2 - b^2x^2 + a^2b^2\right)$

B. $\left(x^2 + y^2 - a^2 + b^2\right)^2 = 4\left(a^2y^2 - b^2x^2 + a^2b^2\right)$

C. $3\left(x^2 + y^2 - a^2 + b^2\right)^2 = 4\left(a^2y^2 - b^2x^2 + a^2b^2\right)$

D. $x^2 + y^2 = a^2 - b^{2^2}$

Answer: C

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20. Locus of P such that the chord of contact of P with respect to $y^2 = 4ax$ touches the hyperbola $x^2 - y^2 = a^2$ as

A. $x^2 + 4y^2 = 4a^2$

B. $4x^2 + y^2 = 4a^2$

C. $x^2 + 2y^2 = 2a^2$

D. $2x^2 + y^2 = 2a^2$

Answer: B

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21. 3x+4y-7=0 is normal to $4x^2 - 3y^2 = 1$ at the point

A. (-3,4)

B. (1,1)

C. (2,1/4)

D. (5,-2)

Answer: B

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22. The mid point of the chord 4x-3y=5 of the hyperbola $2x^2 - 3y^2 = 12$ is

A. (2,1)

B. (5,5)

C. (1,-1/3)

D. (1/2,-1)

Answer: A

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23. If α and β are two points on the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ and the chord joining these two points passes through the focus (ae, 0) then $e\cos\frac{\alpha-\beta}{2} =$

A. $\cos\frac{\alpha+\beta}{2}$

B. $\cos\frac{\alpha-\beta}{2}$

C. $\cos\frac{2\alpha+2\beta}{4}$

D. $\cos\frac{\alpha+\beta}{4}$

Answer: A

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24. If the intercepts made by tangent, normal to a rectangular hyperbola $x^2 - y^2 = a^2$ with x-axis are a_1, a_2 and with y-axis are $b_1 b_2$ when $a_1 a_2 + b_1 b_2 =$

A. 0

B. 1

C. -1

D. a^2

Answer: A

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25. If the normal at θ on the hyperbola $x^2/a^2 - y^2/b^2 = 1$ meets the transverse axis at G, then AG. A'G=

A. $a^2\left(e^4\sec^2\theta - 1\right)$

B. $a^2\left(e^4\sec^2\theta + 1\right)$

C. $b^2\left(e^4\sec^2\theta - 1\right)$

D. none

Answer: A

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26. If the $lx + my = 1$ is a normal to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$, then shown that $\frac{a^2}{l^2} - \frac{b^2}{m^2} = \left(a^2 + b^2\right)^2$

A. $a^2 - b^2$

B. $a^2 + b^2$

C. $\left(a^2 - b^2\right)$

D. $\left(a^2 - b^2\right)^2$

Answer: C

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27. The locus of the point of intersection of the tangents at the ends of normal chord of the hyperbola $x^2 - y^2 = a^2$ is

A. $y^4 - x^4 = 4a^2x^2y^2$

B. $y^4 - x^2 = 4a^2x^2y^2$

C. $a^2\left(y^2-x^2\right)=4x^2y^2$

D. $y^2+x^2=4a^2x^2y^2$

Answer: C

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28. The locus of middle points of normal chords of the rectangular hyperbola $x^2-y^2=a^2$ is

A. $\left(x^2+y^2\right)+4a^2x^2y^2=0$

B. $\left(x^2-y^2\right)^3+4a^2x^2y^2=0$

C. $\left(x^2+y^2\right)-4a^2x^2y^2\right)=0$

D. $\left(x^2-y^2\right)^2-4a^2x^2y^2=0$

Answer: B

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29. The maximum number of normals to hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ from an external point is

A. 2

B. 4

C. 6

D. 5

Answer: B

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30. The product of lengths of the perpendiculars from the point of the hyperbola $x^2 - y^2 = 8$ to its asymptotes is

A. $\frac{a^2 + b^2}{a^2 b^2}$

B. $\frac{a^2 - b^2}{a^2 b^2}$

C. $\frac{a^2 b^2}{a^2 + b^2}$

D. $\frac{a^2+b^2}{a^2-b^2}$

Answer: C

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31. The product of lengths of the perpendiculars from the point of the hyperbola $x^2 - y^2 = 8$ to its asymptotes is

A. 2

B. 3

C. 4

D. 8

Answer: C

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32. The angle between the asymptotes of the hyperbola $x^2 - 3y^2 = 3$ is

A. $\frac{\pi}{6}$

B. $\frac{\pi}{4}$

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

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

Answer: C

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33. The asymptotes of the hyperbola $6x^2 + 13xy + 6y^2 - 7x - 8y - 26 = 0$ are

A. 2x+3y-1=0, 3x+2+2=0

B. 2x+3y=1, 3x+2y=2

C. 2x+3y=0, 3x+2=0

D. 2x+3y=3, 3x+2y=4

Answer: B

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34. The assymptotes of the hyperbola are parallel to 3x+2y=0, 2x+3y=0 whose centre is at (1,2) and it passes through the point (5,3) its equation is

A. $6x^2 + 13xy + 6y^2 - 37x - 38y - 56 = 0$

B. $6x^2 + 13xy + 6y^2 - 38x - 37y - 98 = 0$

C. $6x^2 + 13xy + 6y^2 - 38x + 37y - 98 = 0$

D. none

Answer: B

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35. If $2x^2 + 5xy + 2y^2 - 11x - 7y + K = 0$ is the pair of asymptotes of the hyperbola $2x^2 + 5xy + 2y^2 - 11x - 7y - 4 = 0$ then K=

A. 3

B. 4

C. 5

D. 6

Answer: C

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

A. x+y=0

B. x-y=0

C. x-y=1

D. x-y+1=0

Answer: B

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37. The equation of a line passing through the centre of a rectangular hyperbola is x- y-1 =0. If one of the asymptotes is 3x -4y -6= 0, the equation of the other asymptote is

A. 4x+3y+17=0

B. 4x-3y+17=0

C. $-4x+3y+17=0$

D. $-4x+3y+1=0$

Answer: A

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38. The area of the triangle formed by any tangent to the hyperbola $x^2/a^2 - y^2/b^2 = 1$ with its asymptotes is

A. ab

B. abc

C. 4 ab

D. a^2b^2

Answer: A

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39. Statement-I : The combined equatioin of the pair of asymptotes of the hyperola 2xy+6x+y+5=0 is 2xy+6x+y+3=0

Statement II: The angle between the asymptotes of the hyperola $xy - 2y + 3x + \sqrt{3} = 0$ is 60°.

Which of above statement is true.

A. A) only I

B. B) only II

C. C) both I and II

D. D) neither I nor II

Answer: A

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40. If x= 9 is a chord of contact of the hyperbola $x^2 - y^2 = 9$, then the equation of the tangents at one of the points of contact is

A. $x + \sqrt{3}y + 2 = 0$

B. $3x - 2\sqrt{2}y - 3 = 0$

C. $3x - \sqrt{2}y + 6 = 0$

D. $x - \sqrt{3}y + 2 = 0$

Answer: B

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41. If the circle $x^2 + y^2 = r^2$ intersects the hyperbola $xy = c^2$ in four points (x_i, y_i) for i=1,2,3 and 4 then $y_1 + y_2 + y_3 + y_4 =$

A. 0

B. c

C. a

D. c^4

Answer: A

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42. The area (in square units) of the equilateral triangle formed by the tangent at $\left(\sqrt{3}, 0\right)$ to the hyperbola $x^2 - 3y^2 = 3$with the pair of asymptotes of the heyperbola is

A. $\sqrt{2}$

B. $\sqrt{3}$

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

D. $2\sqrt{3}$

Answer: B

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Practice Exercise

1. Equation of the hyperbola with foci (+-2 ,0) and eccentricity 3/2 is

A. $\frac{x^2}{9} - \frac{y^2}{4} = -1$

B. $\frac{x^2}{20} - \frac{y^2}{16} = -1$

C. $\frac{x^2}{4} - \frac{y^2}{5} = \frac{4}{9}$

D. $\frac{9x^2}{20} - \frac{9y^2}{16} = -1$

Answer: C

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2. Equation of the hyperbola of eccentricity 3 and the distance between whose foci is 24 is

A. $x^2 - 8y^2 = 128$

B. $x^2 - 16y^2 = 128$

C. $16x^2 - y^2 = 128$

D. $8x^2 - y^2 = 128$

Answer: D

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3. The equation of the hyperola with its transverse axis is parallel el to x-axis and its centre (3,-2) the length of axes are 8,6 is

A. $\frac{(x-3)^2}{16} - \frac{(y+2)^2}{9} = 1$

B. $\frac{(x+2)^2}{25} - \frac{(y-1)^2}{11} = 1$

C. $\frac{(x-3)^2}{6} - \frac{(y-2)^2}{9} = -1$

D. $\frac{(x-2)^2}{16} - \frac{(y-3)^2}{19} = 1$

Answer: A

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4. The equation of the hyperola whose centre is (5,2) vertex is (9,2) and the length of conjugate axis is 6 is

A. $\frac{(x-5)^2}{16} + \frac{(y-2)^2}{9} = 1$

B. $\frac{(x-5)^2}{16} - \frac{(y-2)^2}{9} = 1$

C. $\frac{(x-5)^2}{16} - \frac{(y-2)^2}{9} = -1$

D. $\frac{(x+5)^2}{26} - \frac{(y+2)^2}{29} = 1$

Answer: B

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5. The equation of the hyperola whose vertices are (2,5), (2,-1) and eccentricity 4/3 is

A. $\frac{(x-2)^2}{7} - \frac{(y-2)^2}{9} = -1$

B. $\frac{(x-2)^2}{5} - \frac{(y-2)^2}{9} = -1$

C. $\frac{(x+2)^2}{7} - \frac{(y+2)^2}{9} = 1$

D. $\frac{(x-2)^2}{17} + \frac{(y-2)^2}{19} = 1$

Answer: A

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6. The equation to hyperola whose centre is (0,0) distance between the foci is 18 and distance between the directrices is 8 is

A. $x^2/45 - y^2/36 = 1$

B. $x^2/36 - y^2/45 = 1$

C. $x^2/36 - y^2/25 = 1$

D. $x^2/25 - y^2/36 = 1$

Answer: B

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7. Equation of the hyperbola with latus rectum $\frac{22}{5}$ and eccentricity 6/5 is

A. $\frac{x^2}{9} - \frac{y^2}{4} = 1$

B. $\frac{x^2}{16} - \frac{y^2}{20} = 1$

C. $\frac{x^2}{16} - \frac{y^2}{9} = 1$

D. $\frac{x^2}{25} - \frac{y^2}{11} = 1$

Answer: D

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8. The equation of the hyperola of given transverse axis 2a with its vertex mid-way between the centre and the corresponding focus is

A. $3x^2 - y^2 = a^2$

B. $3x^2 - y^2 = 3a^2$

C. $x^2 - 3y^2 = a^2$

D. $x^2 - 3y^2 = a^2$

Answer: B

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9. If e is the eccentricity, l is the semi latus-rectum and S. S^1 are foci of the hyperbola $9x^2 - 16y^2 + 72x - 32y = 16$ then ascending order of l, e SS^1 is

A. $1, e, SS^1$

B. $e, 1, SS^1$

C. e, SS^1, l

D. SS^1, l, e

Answer: B

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10. Match the numerical difference of the focal distance of any point on the hyperbolas

	List-I	List-II
A)	$\frac{x^2}{16}-\frac{y^2}{4}=1$	1) 24
B)	$\frac{-x^2}{36}+\frac{y^2}{8}=1$	2) 10
C)	$\frac{(x-2)^2}{25}-\frac{y^2}{16}=1$	3) 8
D)	$-\frac{(x-3)^2}{64}+\frac{(y+1)^2}{144}=1$	4) $4\sqrt{2}$

The correct Match is

A. A-4, B-3, C-2, D-1

B. A-3, B-2, C-4, D-1

C. A-3,B-4, C-1, D-2

D. A-3, B-4, C-2, D-1

Answer: D

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11. Assertion (A): The locus of the point $\left(\frac{e^{2t}+e^{-2t}}{2}, \frac{e^{2t}-e^{-2t}}{2}\right)$ when 't' is a parameter represents a rectangular hyperbola.

Reason (R) : The eccentricity of a rectangular hyperbola is 2.

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true and R is not the correct explanation of A

C. A is true, R is false

D. A is false, R is true

Answer: C

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12. If $\frac{x^2}{12-k} - \frac{y^2}{k-8} = 1$ represents a hyperbola then

A. $k < 8$

B. $k > 12$

C. $8 < k < 12$

D. $k = \pm 12, k = +8$

Answer: C

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13. The vertices of the hyperbola $\frac{(x-2)^2}{9} - \frac{(y-3)^2}{4} = 1$ are

A. (2,3), (-1,3)

B. (5,3), (-1,3)

C. (0,3), (4,3)

D. (1,3), (3,3)

Answer: A

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14. The equation of the latusrecta of the hyperola $\frac{(x-4)^2}{16} - \frac{(y-3)^2}{20} = 1$ are

A. $x = 1 \pm 5$

B. $x = 4 \pm 6$

C. $x = 2 \pm 6$

D. $x = 3 \pm 5$

Answer: B

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15. The length of the conjugate axis of the hyperbola $9x^2 - 16y^2 - 18x - 64y + 89 = 0$ is

A. 8

B. 6

C. 4

D. 5

Answer: A

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16. The length of the latus rectum of the hyperbola $25x^2 - 16y^2 = 400$ is

A. $8/3$

B. $9/2$

C. $11/3$

D. $25/2$

Answer: D

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17. The foci of the hyperbola $9x^2 - 16y^2 + 18x + 32y - 151 = 0$ are

A. (2,1), (-6,1)

B. (-2,5), (-2,3)

C. (4,1), (-6,1)

D. (-2,4), (-2,-2)

Answer: B

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18. The length of the latus rectum of the hyperbola $9x^2 - 16y^2 + 72x - 32y - 16 = 0$ is

A. $9/2$

B. $32/3$

C. $11/5$

D. $21/5$

Answer: D

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19. The equation of directrices of the hyperbola $5x^2 - 4y^2 - 30x - 8y - 39 = 0$ are

A. $x = \pm 9/5$

B. $x = 3 \pm 8/3$

C. $x = 2 \pm 8/5$

D. $x = 3 \pm 16/5$

Answer: B

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20. The equations of the latus recta of the hyperbola $9x^2 - 16y^2 - 18x - 32y - 151 = 0$ are

A. x=6, x+4=0

B. x=-6, x-14=0

C. x=3, x+4=0

D. x=2, x-11=0

Answer: A

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21. If sec θ is the eccentricity of a hyper bola then the eccentricity of the conjugate hyperbola is

A. $\tan\theta$

B. $\cot\theta$

C. $\cos\theta$

D. $\cos ec\theta$

Answer: D

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22. The eccentricity of the hyperbola $9x^2 - 16y^2 = 144$ is

A. $4/3$

B. $5/4$

C. $4/5$

D. $3/5$

Answer: B

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23. If the latusrectum subtends a right angle at the centre of the hyperbola then its eccentricity

A. $\sqrt{3}$

B. $\sqrt{3}+1$

C. $\frac{\sqrt{3}+1}{\sqrt{2}}$

D. $\frac{\sqrt{3}+1}{\sqrt{3}}$

Answer: B

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24. The eccentricity of the hyperola whose latus rectum subtends a right angle at centre is

A. $2\sin 18^\circ$

B. $2\cos 36^\circ$

C. $2\tan 18^\circ$

D. $2\cot 18^\circ$

Answer: B

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25. z=x+iy is a conplex number. If the imaginary part of z^2 is 32. then Locus of z is a hyperola of eccentricity.

A. $\sqrt{2}$

B. 2

C. $3/2$

D. $4/3$

Answer: A

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26. In the line $3x - y = k$ is a tangent to the hyperbola $3x^2 - y^2 = 3$,then k =

A. $\pm\sqrt{7}$

B. $\pm\sqrt{3}$

C. $\pm\sqrt{5}$

D. $\pm\sqrt{6}$

Answer: D

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27. If the line x $\cos\alpha + y\sin\alpha = p$ touches $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ then $a^2\cos^2\alpha - b^2\sin^2\alpha =$

A. $2p^2$

B. p^2

C. p

D. 2p

Answer: B

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28. The equations of the tangents to the hyperbola $2x^2 - 3y^2 = 6$which are perpendicular to the line $x - 2y + 5$ =0 are

A. $x - 2y \pm \sqrt{11} = 0$

B. $2x + y \pm \sqrt{10} = 0$

C. $x + 5y \pm \sqrt{21} = 0$

D. $x + 6y \pm \sqrt{31} = 0$

Answer: B

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29. The number of tangents to $x^2/25 - y^2/9 = 1$ through (5,0) is

A. 0

B. 1

C. 2

D. 3

Answer: B

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30. The sum and product of the slopes of the tangents to the hyperbola $\frac{x^2}{4} - \frac{y^2}{2} = 1$ drawn from the point (3,-2) are

A. $\frac{-12}{5}, \frac{6}{5}$

B. $\frac{12}{5}, \frac{6}{5}$

C. $\frac{11}{4}, \frac{7}{3}$

D. $\frac{-12}{5}, \frac{8}{5}$

Answer: A

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31. The slopes of the tangents drawn form (0,2) to the hyperbola $5x^2 - y^2 = 5$ is

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

B. $-3, \frac{1}{3}$

C. ± 2

D. ± 3

Answer: D

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32. The point of contact of 5x+6y+1=0 to the hyperbola $2x^2 - 3y^2 = 2$ is

A. (5,4)

B. (-5,4)

C. (-5,-4)

D. (5,-4)

Answer: B

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33. The condition that the line y=mx+c may be a tangent to $\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1$ is

A. $c^2 = a^2m^2 - b^2$

B. $c^2 = a^2 - b^2m^2$

C. $c^2 = b^2 - a^2m^2$

D. $c^2 = b^2m^2 - a^2$

Answer: B

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34. The locus of the point of intersection of two tangents to the hyperbola $x^2/a^2 - y^2/b^2 = 1$ which make an angle 90° with one another is

A. $x^2 + y^2 = a^2 + b^2$

B. $x^2 + y^2 = a^2 - b^2$

C. $x^2 - y^2 = a^2 - b^2$

D. $x^2 - y^2 = a^2 + b^2$

Answer: B

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35. The radius of the director circle of the hyperbola $x^2/25 - y^2/9 = 1$ is

A. 3

B. 4

C. 5

D. 8

Answer: B

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36. The radius of the auxiliary circle of the hyperbola $x^2/25 - y^2/9 = 1$ is

A. 3

B. 4

C. 5

D. 6

Answer: C

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37. The equation of the normal to the hyperbola $x^2 - 4y^2 = 5$ at (3,-1) is

A. 4x+3y-15=0

B. 4x-3y-15=0

C. 4x+3y+5=0

D. 4x+4y+15=0

Answer: B

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38. Tangents to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ makes angles θ_1, θ_2 with the transverse axis. If θ_1, θ_2 are complementary then the locus of the point of intersection of tangents is

A. $x^2 - y^2 = a^2 + b^2$

B. $x^2 + y^2 = a^2 - b^2$

C. $x^2 - y^2 = a^2 - b^2$

D. $x^2 + y^2 = a^2 + b^2$

Answer: A

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39. Tangents are drawn to $3x^2 - 2y^2 = 6$ from a point P. If the product of the slopes of the tangents is 2, then the locus of P is

A. $x^2 - y^2 = 7$

B. $x^2 - 2y = 7$

C. $2x^2 - y^2 = 7$

D. $x^2 - y^2 = 8$

Answer: C

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40. The chords of contact al P.w.r.t. $x^2 - y^2 = a^2$ and $x^2 + y^2 = a^2$ are at right angles. The locus of P is

A. $x^2 - y^2 = a^2$

B. $x^2 - y^2 = 2a^2$

C. $x^2 - y^2 = 0$

D. $x^2 - y^2 = 1$

Answer: C

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41. The equation to the common tangent to the hyperbolas $\frac{x^2}{25} - \frac{y^2}{9} = 1$ and $\frac{x^2}{9} - \frac{y^2}{25} + 1 = 0$ is

A. $y = \pm x \pm \sqrt{34}$

B. $y = \pm x \pm 5$

C. $y = \pm x + 3$

D. $y = \pm x \pm 4$

Answer: D

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42. The point of intersection of two tangents to hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ the product of whose slopes is c^2?, lies on the curve

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

B. $x^2 + a^2 = c^2(x^2 - b^2)$

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

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

Answer: D

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43. The locus of the midpoints of chords of the hyperbola $3x^2 - 2y^2 + 4x - 6 = 0$ which are parallel to y= 2x is

A. 3x-4y=4

B. 3x-4y=2

C. 2x-y=4

D. x+2y=3

Answer: A

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44. The mid point of the chord x+2y+3=0 of the hyperbola $x^2 - y^2 = 4$ is

A. (1,2)

B. (2,1)

C. (-3,0)

D. (1,-2)

Answer: D

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45. The equation of the tangent to the hyperola $\frac{x^2}{9} - \frac{y^2}{4} = 1$ at the point $\theta = \frac{\pi}{3}$ is

A. $4x + 3\sqrt{2}y = 6$

B. $4x - 3\sqrt{3}y = 6$

C. $4x - 2\sqrt{3}y = 6$

D. $4x - 5\sqrt{3}y = 4$

Answer: B

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46. Equation of normal to $x^2 - 4y^2 = 5$ at $\theta = 45^\circ$ is

A. $2\sqrt{2}x + 2y = 5\sqrt{5}$

B. $2\sqrt{2}x + y = 5\sqrt{5}$

C. $x + 2\sqrt{2}y = 5\sqrt{5}$

D. $x - 2\sqrt{2}y = 5\sqrt{5}$

Answer: A

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47. The equation of asymptotes of the hyperbola $4x^2 - 9y^2 = 36$ is

A. $3y \pm 2x = 0$

B. $2x \pm 5y = 0$

C. $2x \pm 6y = 0$

D. $2x \pm 8y = 0$

Answer: A

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48. The equation to the pair of asymptotes of the hyperola $2x^2 - y^2 = 1$ is

A. $2x^2 + y^2 = 0$

B. $2x^2 - y^2 = 0$

C. $x^2 + 2y^2 = 0$

D. $x^2 - 2y^2 = 0$

Answer: B

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49. Show that product of lengths of the perpendicular from any point on the hyperbola $\frac{x^2}{16} - \frac{y^2}{9} = 1$ to its asymptotes is $\frac{144}{25}$.

A. 144/9

B. 144/25

C. 144/16

D. 25/144

Answer: B

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50. The equation of one asymptote of the hyperbola $14x^2 + 38y + 20y^2 + x - 7y - 91 = 0$ is $7x + 5y - 3 = 0$. Then the other asymptote is

A. 2x+4y=1

B. 2x+4y+1=0

C. 2x+4y+3=0

D. 2x+4y+4=0

Answer: B

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51. The equation of the hyperbola is xy-4x+3y=0 and its asymptotes are xy-4x+3y=k then k=

A. 3

B. -6

C. -12

D. 12

Answer: D

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52. The equation of the hyperbola whose asymptotes are 3x+4y-2=0, 2x+y+1=0 and which passes through the point (1, 1) is

A. $6x^2 + 41xy - 44y^2 - 30x + 2y - 22 = 0$

B. $6x^2 + 11xy + 4y^2 - x + 2y - 22 = 0$

C. $6x^2 - 15xy + 14y^2 - 6x + 12y - 12 = 0$

D. $6x^2 + 13xy + 6y^2 - 38x - 37y - 98 = 0$

Answer: B

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53. No part of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$. Lies between which of the following

A. x=-2a and x=2a

B. x=-a and x=a

C. y=-2b and y=2b

D. y=-b and y=b

Answer: A

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54. Assertion (A): The pair of asymtotes of $\frac{x^2}{10} - \frac{y^2}{4} = 1$ and the pair of asymptotes of $\frac{x^2}{10} - \frac{y^2}{4} = -1$ coincide.

Reason (R) : A hyperbola and its conjugate hyperbola posses the same pair of asymptotes. The correct answer is

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true and R is not the correct explanation of A

C. A is true, R is false

D. A is false, R is true

Answer: B

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55. A hyperbola whose transverse axis is along the major of the conic, (x^2)/3+(y^2)/4=4 and has vertices at the foci of this conic. If the eccentricity of the hyperbola is $\frac{3}{2}$, then which of the following points does NOT lie on it?

A. $\left(\sqrt{5}, 2\sqrt{2}\right)$

B. (0,2)

C. $\left(5, 2\sqrt{3}\right)$

D. $\left(\sqrt{10}, 2\sqrt{3}\right)$

Answer: C

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Examples

1. The equations of the transverse and conjugate axes of a hyperbola are respectively 3x + 4y - 7 = 0 , 4x - 3y + 8 = 0 and their respective lengths are 4 and 6. Find the equation of the hyperbola.

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2. Find the equation of tangent to the hyperbola $3x^2 - 4y^2 = 8at(2, -1)$

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3. Find the equation of tangent to the hyperbola $\frac{x^2}{3} - \frac{y^2}{2} = 1$ drawn from the point (3, 2)

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4. Find the equation of normal to the hyperobla $3x^2 - 2y^2 = 30at(4, -3)$

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5. Find the equation of the auxiliarly circle of the hyperbola $\frac{x^2}{6} - \frac{y^2}{4} = 1$

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6. Find the equation of the chord of contact of the point (2, -3) with respect to the hyperbola $3x^2 - 4y^2 = 12$

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7. The equation of asymptotes of the hyperbola $4x^2 - 9y^2 = 36$ is

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8. Find the asymptotes of the hyperbola xy - 3y - 2x = 0

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9. The asympototes of a hyperola having centre at (1,2) are parallel to 2x+3y=0 and 3x+2y=0 and hyperbola passes through the point (5,3). Find the equatioin of the hypberbola.

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10. If the normal at the point t_1 to the rectangle hyperola $xy = c^2$ meets it again at the point t_2 prove that $t_1^3 t_2 = -1$

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Exercise

1. One focus of a hyperbola is located at the point (1, -3) and the corresponding directrix is the line y = 2. Find the equation of the hyperbola if its eccentricity is $\frac{3}{2}$

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2. If the lines 3x- 4y = 12 and 3x + 4y = 12 meets on a hyperbola S = 0 then find the eccentricity of the hyperbola S = 0

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3. Find the equations of the hyperbola whose foci are $(\pm 5, 0)$, the transverse axis is of length 8.

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4. Find the equation of the hyperbola whose asymptotes are $x + 2y + 3 = 0$ and $3x + 4y + 5 = 0$ and which passes through (1,-1).

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5. If 3x - 4y + k = 0 is a tangent to $x^2 - 4y^2 = 5$ find the value of k.

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6. Show that product of lengths of the perpendicular from any point on the hyperbola $\frac{x^2}{16} - \frac{y^2}{9} = 1$ to its asymptotes is $\frac{144}{25}$.

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