MATHS

BOOKS - RD SHARMA MATHS (HINGLISH)

HYPERBOLA

Solved Examples And Exercises

1. Find the equation of the hyperbola whose foci are (8, 3) and (0, 3) and eccentricity is $\frac{4}{3}$.

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2. Show that the set all points such that the difference of their distances from $(4, 0) and (-4, 0)$ is always equal to 2 represents a hyperbola.

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3. If e and $\bar{e}$ the eccentricities of a hyperbola and its conjugate, prove that $\frac{1}{e^2} + \frac{1}{\bar{e}^2} = 1.$

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4. Find the locus of the point of intersection of the lines $\sqrt{3x} - y - 4\sqrt{3}t = 0 and \sqrt{3}tx + ty - 4\sqrt{3} = 0$ for different values of λ.

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5. Show that the equation $9x^2 - 16y^2 - 18x + 32y - 151 = 0$ represents a hyperbola. Find the coordinates of the centre, lengths of the axes, eccentricity, latus-rectum,

coordinates of foci and vertices, equations of the directrices of the hyperbola.

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6. For the following hyperbolas find the lengths of transverse and conjugate axes, eccentricity and coordinates of foci and vertices, length of the latus-rectum, equations of the directrices:

$6x^2 - 9y^2 = 144\ 3x^2 - 6y^2 = -18$

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

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

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9. Find the equation of the hyperbola, the length of whose latusrectum is 8 and eccentricity is $3/\sqrt{5}$.

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10. Referred to the principal axes as the axes of coordinates find the equation of the hyperbola whose foci are at $(0, \pm\sqrt{10})$ and which passes through the point $(2, 3)$.

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11. Find the equation of the hyperbola, referred to its principal axes of coordinates, in the following cases:

$Verticesat(\pm 5, 0), Fociat(\pm 7, 0)$

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12. Show that the equation $x^2 - 2y^2 - 2x + 8y - 1 = 0$ represents a hyperbola. Find the coordinates of the centre, lengths of the axes, eccentricity, latusrectum, .

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13. If P is any point on the hyperbola whose axis are equal, prove that $SP\dot{S}'P = CP^2$.

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14. Find the equation of the hyperbola whose conjugate axis is 5 and the distance between the foci is 13.

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

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16. If the distance between the foci of a hyperbola is 16 and its eccentricity is $\sqrt{2}$, then obtain its equation.

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17. The equation of the directrix of a hyperbola is $x - y + 3 = 0$. Its focus is (-1,1) and eccentricity 3. Find the equation of the hyperbola.

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18. Find the equation of the hyperbola whose : focus is (0,3) directrix is $x + y - 1 = 0$ and eccentricity $= 2$.

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19. Find the equation of the hyperbola whose : focus is (1,1) directrix is $3x + 4y + 8 = 0$ and eccentricity $= 2$

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

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21. Find the equation of the hyperbola whose : focus is (2,-1) directrix is $2x + 3y = 1$ and eccentricity $= 2$

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22. Find the equation of the hyperbola whose : focus $(a, 0)$, directrix is $2x - y + a = 0$ and eccentricity $= \frac{4}{3}$

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23. Find the equation of the hyperbola whose : focus is (2,2) directrix is $x + y = 9$ and eccentricity $= 2$.

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24. Find the eccentricity, coordinates of the foci ,equations of directrices and length of the latus rectum of the hyperbola :$9x^2 - 16y^2 = 144$

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25. Find the eccentricity, coordinates of the foci, equations of directrices and length of the latus rectum of the hyperbola $4x^2 - 3y^2 = 36$

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26. Find the eccentricity, coordinates of the foci ,equations of directrices and length of the latus rectum of the hyperbola $2x^2 - 3y^2 = 5.$

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27. Find the eccentricity, coordinates of the foci, equations of directrices and length of the latus rectum of the hyperbola $16x^2 - 9y^2 = 144$

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28. Find the eccentricity, coordinates of the foci, equations of directrices and length of the latus rectum of the hyperbola $3x^2 - y^2 = 4$

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29. Find the axes, eccentricity, latus rectum and the coordinates of the foci of the hyperbola $25x^2 - 36y^2 = 225.$

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30. Find the centre, eccentricity, foci and directrices of the hyperbola : $16x^2 - 9y^2 + 32x + 36y - 164 = 0$

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31. Find the centre, eccentricity, foci and directrices of the hyperbola : $x^2 - y^2 + 4x = 0$

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32. Find the centre, eccentricity, foci and directrices of the hyperbola : $x^2 - 3y^2 - 2x = 8.$

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33. Find the centre, eccentricity, foci and directrices of the hyperbola : $x^2 - y^2 + 4x = 0$

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34. Find the equation of the hyperbola whose: focus is at (5,2) vertex at (4,2) and centre at (3,2)

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35. In each of the following find the equations of the hyperbola satisfying he given condition: Vertices $(\pm 2, 0)$, $foci(\pm 3, 0)$

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36. Find the equations of the hyperbola satisfying the given conditions :Vertices $(0, \pm 5), foci(0, \pm 8)$

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37. In each of the following find the equations of the hyperbola satisfying he given condition: vertices $(0, \pm 3) foci\ (0, \pm 5)$

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38. In each of the following find the equations of the hyperbola satisfying he given condition: foci $(\pm 5, 0)$ transverse axis $= 8$

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39. In each of the following find the equations of the hyperbola satisfying he given condition: $foci\ (0,\ \pm 13)$ conjugate axis $= 24$

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40. In each of the following find the equations of the hyperbola satisfying the given condition: $foci\left(\pm 3\sqrt{5}, 0\right)$, the latus rectum $= 8$

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41. In each of the following find the equations of the hyperbola satisfying the given condition: $foci\ (\pm 4, 0)$ the latus rectum $= 12$

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42. In each of the following find the equations of the hyperbola satisfying the given condition: vertices $(0,\ \pm 6),\ e = \frac{5}{3}$

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43. In each of the following find the equations of the hyperbola satisfying the given condition: foci $(0, \pm\sqrt{10})$ passing through (2,3)

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44. In each of the following find the equations of the hyperbola satisfying the given condition: foci $(0, \pm 12)$ latus rectum $= 36$

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45. Write the eccentricity of the hyperbola $9x^2 - 16y^2 = 144.$

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46. Find the eccentricity of the hyperbola whose latusrectum is half of its transverse axis.

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47. Write the coordinates of the foci of the hyperbola $9x^2 - 16y^2 = 144.$

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48. Write the equation of the hyperbola of eccentricity $\sqrt{2}$ if it is known that the distance between its foci is 16.

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49. 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 write the value of b^2.

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50. Write the length of the latus rectum of the hyperbola $16x^2 - 9y^2 = 144$.

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

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52. Write the distance between the directrices of the hyperbola $x = 8sec\theta,\ y = 8tan\theta$.

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53. Write the equation of the hyperbola whose vertices are $(\pm 3, 0)$ and foci at $(\pm 5, 0)$

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54. If $e_1 and\ e_2$ are respectively the eccentricities of the ellipse $\frac{x^2}{18} + \frac{y^2}{4} = 1$ and the hyperbola

$\frac{x^2}{9} - \frac{y^2}{4} = 1$, then write the value of $2e_1^2 + e_2^2$.

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55. Equation of het hyperbola whose vertices are $(\pm 3, 0)$ and foci at $(\pm 5, 0)$ is a. $16x^2 - 9y^2 = 144$ b. $9x^2 - 16y^2 = 144$ c. $25x^2 - 9y^2 = 225$ d. $9x^2 - 25y^2 = 81$

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56. If $e_1 and\ e_2$ are respectively the eccentricities of the ellipse $\frac{x^2}{18} + \frac{y^2}{4} = 1$ and the hyperbola $\frac{x^2}{9} - \frac{y^2}{4} = 1$, then the relation between $e_1 and\ e_2$ is a. $2e_1^2 + e_2^2 = 3$ b. $e_1^2 + 2e_2^2 = 3$ c. $2e_1^2 + e_2^2 = 3$ d. $e_1^2 + 3e_2^2 = 2$

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57. The distance between the directrices of the hyperbola $x = 8sec\theta,\ y = 8\,tan\theta,$ a. $8\sqrt{2}$ b. $16\sqrt{2}$ c. $4\sqrt{2}$ d. $6\sqrt{2}$

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58. The equation of the conic with focus at (1,-1) directrix along $x - y + 1 = 0$ and eccentricity $\sqrt{2}$ is a. $xy = 1$ b. $2xy + 4x - 4y - 1 = 0$ c. $x^2 - y^2 = 1$ d. $2xy - 4x + 4y + 1 = 0$

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59. The eccentricity of the conic $9x^2 - 16y^2 = 144$ is a. $\frac{5}{4}$ b. $\frac{4}{3}$ c. $\frac{4}{5}$ d. $\sqrt{7}$

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60. The eccentricity of the hyperbola whose latus rectum is half of its transverse axis is a. $\frac{1}{\sqrt{2}}$ b. $\sqrt{\frac{2}{3}}$ c. $\sqrt{\frac{3}{2}}$ d. none of these

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61. The eccentricity of the hyperbola $x^2 - 4y^2 = 1$ is a. $\frac{\sqrt{3}}{2}$ b. $\frac{\sqrt{5}}{2}$ c. $\frac{2}{\sqrt{3}}$ d. $\frac{2}{\sqrt{5}}$

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62. The foci of the hyperbola $9x^2 - 16y^2 = 144$ are a.$(\pm 4, 0)$ b. $(0, \pm 4)$ c. $(\pm 5, 0)$ d. $(0, \pm 5)$

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63. The distance between the foci of a hyperbola is 16 and its eccentricity is $\sqrt{2}$ then equation of the hyperbola is a.$x^2 + y^2 = 32$ b. $x^2 - y^2 = 16$ c. $x^2 + y^2 = 16$ d. $x^2 - y^2 = 32$

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64. If e_1 is the eccentricity of the conic $9x^2 + 4y^2 = 36$ *and* e_2 is the eccentricity of the conic $9x^2 - 4y^2 = 36$ then a. $e_1^2 - e_2^2 = 2$ b. $e_2^2 - e_1^2 = 2$ c. $2 < e_2^2 - e_1^2 < 3$ d. $e_1^2 - e_2^2 > 3$

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65. If the eccentricity of the hyperbola $x^2 - y^2 \sec^2 \alpha = 5$ *is* $\sqrt{3}$ times the eccentricity the ellipse $x^2 \sec^2 \alpha + y^2 = 25$ *then* $\alpha =$ a. $\frac{\pi}{6}$ b. $\frac{\pi}{4}$ c. $\frac{\pi}{3}$ d. $\frac{\pi}{2}$

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66. The equation of the hyperbola whose foci are (6,4) and (-4,4) and eccentricity 2 is a. $\frac{(x-1)^2}{25/4} - \frac{(y-4)^2}{75/4} = 1$ b. $\frac{(x+1)^2}{25/4} - \frac{(y+4)^2}{75/4} = 1$ c. $\frac{(x-1)^2}{75/4} - \frac{(y-4)^2}{25/4} = 1$ d. none of these

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67. The length of the straight line $x - 3y = 1$ intercepted by the hyperbola $x^2 - 4y^2 = 1$ is a.

$\frac{6}{\sqrt{5}}$ b. $3\sqrt{\frac{2}{5}}$ c. $6\sqrt{\frac{2}{5}}$ d. none of these

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68. The latus rectum of the hyperbola $16x^2 - 9y^2 = 144$ is a.$16/3$ b. $32/3$ c. $8/3$ d. $4/3$

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69. The foci of the hyperbola $2x^2 - 3y^2 = 5$ are a.$\left(\pm 5\sqrt{6}, 0\right)$ b. $\left(\pm 5/6, 0\right)$ c. $\left(\pm \sqrt{5}/6, 0\right)$ d.

none of these

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70. The eccentricity the hyperbola $x = \frac{a}{2}\left(t + \frac{1}{t}\right), y = \frac{a}{2}\left(t - \frac{1}{t}\right)$ is a.$\sqrt{2}$. b. $\sqrt{3}$ c. $2\sqrt{3}$ d. $3\sqrt{2}$

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71. The equation of the hyperbola whose centre is $(6, 2)$ one focus is $(4, 2)$ and of eccentricity 2

is

(A) $3(x-6)^2-(y-2)^2=3$

(B) $(x-6)^2-3(y-2)^2=1$

(C) $(x-6)^2-2(y-2)^2=1$

(D) $2(x-6)^2-(y-2)^2=1$

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72. The locus of the point of intersection of the lines

$\sqrt{3}x-y-4\sqrt{3}\lambda=0\ and\ \sqrt{3}\lambda x+\lambda y-4\sqrt{3}=0$

is a hyperbola of eccentricity

a.1

b. 2

c. 3

d. 4

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Others

1. Find the eccentricity of the hyperbola, the length of whose conjugate axis is $\frac{3}{4}$ of the length of transverse axis.

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2. A point moves in a plane so that its distance PA and PB from who fixed points A and B in the plane satisfy the relation $PA - PB = k(k \neq 0)$ then the locus of P is a. a hyperbola b. a branch of the locus of P is c. a parabola d. an ellipse

A. a hyperbola

B. a branch of the locus of P

C. a parabola

D. an ellipse

Answer: a hyperbola

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