MATHS

BOOKS - RD SHARMA MATHS (HINGLISH)

DIRECTION COSINES AND DIRECTION RATIOS

Solved Examples And Exercises

1. Show that the line through the points $(1, -1, 2)$ and $(3, 4-2)$ is perpendicular to the line through the points $(0, 3, 2)$ and $(3, 5, 6)$.

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2. Show that the points $(2, 3, 4), (-1, -2, 1), (5, 8, 7)$ are collinear.

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3. Find the acute angle between the lines whose direction ratios are proportional to $2:3:6$ and $1:2:2$.

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4. Show that the line joining the origin to the point $(2, 1, 1)$ is perpendicular to the line determined by the points $(3, 5, -1)$ and $(4, 3, -1)$.

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5. Find the angle between the lines whose direction ratios are proportional a, b, c and $b-c, c-a, a-b$.

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6. Find the angle between the vectors whose direction cosines are proportional to $2, 3, -6$ and $3, -4, 5$.

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7. Find the angle between the vectors with direction ratios proportional to $1, -2, 1$ and $4, 3, 2$.

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8. Show that the line through points $(4, 7, 8)$ and $2, 3, 4)$ is parallel to the line through the points $(-1, -2, 1)$ and $(1, 2, 5)$.

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9. If the coordinates of the points A, B, C, D are $(1, 2, 3), (4, 5, 7), (-4, 3, -6)$ and $(2, 9, 2)$, then find the angle between AB and CD.

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10. Find the direction cosines of the lines, connected by the relations: $l + m + n = 0$ and $2lm + 2\ln - mn = 0$.

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11. Find the direction cosines of the two lines which are connected by th relations. $l - 5m + 3n = 0$ and $7l^2 + 5m^2 - 3n^2 = 0$

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12. A line makes angles α, β, γ and δ with the diagonals of a cube, prove that $\cos^2\alpha + \cos^2\beta + \cos^2\gamma + \cos^2\delta = \frac{4}{3}$

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13. Show that the straight lines whose direction cosines are given by the equations $al + bm + cn = 0 and \frown 2 + zm^2 = vn^2 + wn^2 = 0$ are

parallel or perpendicular as

$$\frac{a^2}{u}+\frac{b^2}{v}+\frac{c^2}{w}=0 \text{ or } a^2(v+w)+b^2(w+u)+c^2(u+v)=0.$$

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14. If three mutually perpendicular lines have direction cosines $(l_1, m_1, n_1), (l_2, m_2, n_2)$ and (L_3, m_3, n_3), then the line having direction cosines $l_1+l_2+l_3, m_1+m_2+m_3,$ and $n_1+n_2+n_3$, make an angle of

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15. Find the direction cosines of the sides of the triangle whose vertices are $(3, 5, 4)$, $(1, 1, 2)$ and $(5, 5, 2)$.

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16. The x-coordinates of a point on t line joining the points $Q(2, 2, 1) and R(5, 1, -2) is 4$. Find its z-coordinate.

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17. Given that $P(3, 2, -4), Q(5, 4, -6)$ and $R(9, 8, -10)$ are collinear. Find the ratio in which Q divide PR.

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18. Find the coordinates of the foot of the perpendicular drawn from the point $A(1, 2, 1)$ to the line joining $B(1, 4, 6)$ and $C(5, 4, 4)$.

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19. Find the angle between the vectors with direction ratios proportional to $4, \ -3, 5$ and $3, 4, 5$.

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20. Determine the point in XY-plane which is equidistant from thee points $A(2, 0, 3), B(0, 3, 2) and C(0, 0, 1)$.

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21. Find the angle between the lines whose direction cosines are given by the equations $3l + m + 5n = 0, 6mm - 2nl + 5l = 0$

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22. Find the distance between the points $AandB$ with position vectors $\hat{i} - \hat{j}$ and $2\hat{i} + \hat{j} + 2\hat{k}$.

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23. Find the locus of the point which is equidistant from the points $A(0, 2, 3)$ and $B(2, -2, 1)$.

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24. Find the distance between the points P(-2,4,1) and Q(1,2,5).

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25. Prove by using distance formula that the points $P(1, 2, 3), !(-1, -1, -1) and R(3, 5, 7)$ are collinear.

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26. Show that the points $A(0, 1, 2), B(2, -1, 3) and C(1, -3, 1)$ are vertices of an isosceles right-angled triangle.

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27. Find the coordinates of the point which divides the joint of $P(2, -1, 4) and q(4, 3, 2)$ in the ratio 2:3 (i) internally (ii) externally.

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28. Find the ratio in which the line joining the points $(1, 2, 3) and (-3, 4, -5)$ is divided by the $xy - plane$. Also, find the coordinates of the point of division.

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29. The mid-points of the sides of a triangle are $(1, 5, -1), (0, 4, -2) and (2, 3, 4)$. Find its vertices.

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30. Find the coordinates of the foot of the perpendicular drawn from the point $A(1, 2, 1)$ to the line joining $B(1, 4, 6) and C(5, 4, 4)$.

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31. Find the angle between the vectors with direction ratios proportional to $4, \ -3, 5 and 3, 4, 5.$

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32. $\mathrm{P}(6, \ 3, \ 2), \ \mathrm{Q}(5, \ 1, \ 3) \mathrm{and} \mathrm{R}(3, \ 3, \ 5)$ are three vertices of a triangle $\mathrm{P} \ \mathrm{Q} \ \mathrm{R}.$ Find $\angle \mathrm{P} \ \mathrm{Q} \ \mathrm{R}.$

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33. Find the direction cosines of the line which is perpendicular to the lines with direction cosines proportional to 1, -2, -2 and 0, 2, 1

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34. If $l_1, (\backslash m)_1, (\backslash n)_1 (\backslash and \backslash l)_2, (\backslash m)_2, n_2$ be the direction cosines of two mutually perpendicular lines, show that the direction cosines of the line perpendicular to both of them are $\left(m_1(\backslash n)_2 - m_2 n_1\right), \backslash \ (n_1 l_2 - n_2 l_1), \backslash \ (l_1 m_2 - l_2 m_1)$.

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35. Show that the angle between two diagonals of a cube is $\cos^{-1} \sqrt{\frac{1}{3}}$.

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36. If a line makes angle $90o$, $60o$and $30o$with the positive direction of x, y and z-axis respectively, find its direction cosines.

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37. If as line has direction ratios 2, -1, -2, determine its direction cosines.

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38. Find the direction cosines of the line passing through two points

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39. Using direction ratios show that the points A(2,3,-4), B(1,-2,3) and C(3,8,-11) are collinear.

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40. Find the direction cosines of the sides of the triangle whose vertices are (3, 5, -4), (-1, 1, 1) and (-5, -5, -2).

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41. Find the angel between the vectors with direction ratios proportional to 1, -2, 1 and 4, 3, 2.

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42. Find the acute angle between the lines whose direction ratios are proportional to $2:3:6$ and $1:2:2$.

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43. Show that the points $(2, 3, 4), (-1, -2, 1), (5, 8, 7)$ are collinear.

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44. Show that the line through the points $(4, 7, 8), (2, 3, 4)$is parallel to the line through the points $(1, 2, 1),(1, 2, 5)$.

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45. Show that the line joining the origin to the point (2,1,1) is perpendicular to the line determined by the points $(3, 5, -1)$ and $(4, 3, -1)$.

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46. Find the angle between the lines whose direction ratios are proportional a, b, c and $b-c, c-a, a-b$.

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47. If the coordinates of the points $A,\ B,\ C,\ D$ be $(1,\ 2,\ 3),\ (4,\ 5,\ 7),\ (-4,\ 3,\ -6)$ and $(2,\ 9,\ 2)$ respectively then find the angle between the lines AB and CD.

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48. Find the direction cosines of the lines, connected by the relations: $l+m+n=0$ and $2lm+2\ln-mn=0$.

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49. Find the angle between the lines whose direction cosine are given by the equation: $l-m+n=0$ and $l^2-m^2-n^2=0$

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50. Find the direction cosines of x, y and z-axis.

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51. Find the direction cosines of x, y and z-axis.

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52. What are the direction cosines of Z-axis?

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53. Write the ratio in which YZ plane divides the segment joining $P(-2, 5, 9) \text{and} \backslash Q(3, -2, 4)$.

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54. A line makes an angle of 60^0 with each of X-axis and Y-axis. Find the acute angle made by the line with Z-axis.

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55. If a line makes angle $\text{alpha}, \text{beta} \backslash \text{and} \backslash \text{gamma}$ with the coordinate axes, find the value of $\cos 2\text{alpha} + \cos 2\text{beta} + \cos 2\text{gamma}$.

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56. Write the angle between the lines whose direction ratios are proportional to 1, -2, 1 and 4, 3, 2.

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57. Write the distance of the point from plane.

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58. Find the distance of the point (2, 3, 4) from the axis.

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59. If a line has direction ratios proportional to 2, -1, -2, then what are its direction cosines?

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60. Write the direction cosines of a line parallel to z-axis.

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61. If a unit vector a makes an angle $\frac{\mathrm{pi}}{3}$ with $\hat{\mathrm{i}}$, $\frac{\mathrm{pi}}{4}$ with $\hat{\mathrm{j}}$ and an acute angle theta with $\hat{\mathrm{k}}$, then find the value of theta.

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62. For every point $P(x,\ y,\ z)$ on the xy-plane, a. $x = 0$ b. $y = 0$ c. $z = 0$ d. $x = y = z = 0$

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63. If the x-coordinate of a point P on the join of $Q(22, 1) and R(5, 1, -2) is 4,$ then find its $z-$ coordinate.

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64. The distance of the point $P(a, b, c)$ from the x-axis is a. $\sqrt{b^2 + c^2}$ b. $\sqrt{a^2 + c^2}$ c. $\sqrt{a^2 + b^2}$ d. none of these

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65. If O is the origin, $OP = 3$ with direction ratios $-1, 2, and -2,$ then find the coordinates of P.

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66. Show that the angle between two diagonals of a cube is $\cos^{-1}\sqrt{\frac{1}{3}}$.

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67. A line makes angles α, β, $\gamma$and $\delta$with the diagonals of a cube, prove that $\cos^2\alpha+\cos^2\beta+\cos^2\gamma+\cos^2\delta=\frac{4}{3}$

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Others

1. If a variable line in two adjacent positions has direction cosins $l, m, nandI+\delta l, m+\delta mm, n+\delta n,$ show that he small angel

$\delta\theta$ between two positions is given by

$(\delta\theta)^2 = (\delta l)^2 + (\delta m)^2 + (\delta n)^2$

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2. Prove that the straight lines whose direction cosines are given by the relations $al + bm + cn = 0 and fmn + gnl + hlm = 0$ are perpendicular, if $\frac{f}{a} + \frac{g}{b} + \frac{h}{c} = 0$ and parallel, if $a^2f^2 + b^2g^2 + c^2h^2 - 2abfg - 2bcgh - 2achf = 0.$

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3. For every point (x, y, z) on the x- axis (except the origin) a. $x = 0,\ y = 0,\ z \neq 0$ b. $x = 0,\ z = 0,\ y \neq 0$ c. $y = 0,\ z = 0,\ x \neq 0$ d. $x = y = z = 0$

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4. A rectangular parallelepiped is formed by planes drawn through the points (5, 7, 9) and (2, 3, 7) parallel to the coordinate planes the length of an edge of this rectangular parallelepiped is a. 2 b. 3 c. 4 d. all of these

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5. A parallelepiped is formed by planes drawn through the points (2, 3, 5) and (5, 9, 7), parallel to the coordinate lanes. The length of a diagonal of the parallelepiped is a. 7 b. $\sqrt{38}$ c. $\sqrt{155}$ d. none of these

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6. The xy-plane divided the line joining thepoints (-1, 3, 4) and (2, -5, 6) a. Internally in the ratio 2:3 b. Internally in the ratio 3:2 c. externally in the ratio 2:3 d. externally in the ratio 3:2

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7. Ratio in which the xy-plane divides the join of (1, 2, 3) and (4, 2, 1) is a. 3:1 internally b. 3:1 externally c. 1:2 internally d. 2:1 externally

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8. $A(3, 2, 0), B(5, 3, 2)$ and $C(-9, 6, -3)$are the vertices of t triangle if the bisector of $\angle ABC$ meets then coordinates of are

a. $\left(\frac{19}{8}, \frac{57}{16}, \frac{17}{16}\right)$ b. $\left(-\frac{19}{8}, \frac{57}{16}, \frac{17}{16}\right)$ c. $\left(\frac{19}{8}, -\frac{57}{16}, \frac{17}{16}\right)$

d. none of these

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