MATHS

BOOKS - KC SINHA ENGLISH

3D - ANGLE BETWEEN TWO LINES

Solved Examples

1. Find the direction cosines of the vector $2\hat{i}+2\hat{j}-\hat{k}$

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2. Find the angle at which the vector $\hat{i} - \hat{j} + \hat{k}$ is inclined to each of the coordinte axes.

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3. Show by using direction ratios, that the points

$(2, -4, 5), (1, -1, 3)$ and $(5, -13, 11)$

are collinear

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4. Find the values of a for which points $(8, -7, a), (5, 2, 4)$ and $(6, -1, 2)$ are collinear.

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5. If Q be the foot of perpendicular from $P(2, 4, 3)$ on the line joining the points $A(1, 2, 4)$and $B(3, 4, 5)$, then co-ordinate of Q is given by

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6. 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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7. can $-\frac{1}{2\sqrt{2}}-\frac{1}{\sqrt{2}},-\frac{1}{\sqrt{3}}$ be the direction cosines of any directed line? Justify your answer.

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8. If a line marks angles α, β and γ with the coordinates axes, prove that $\sin^2\alpha + \sin^2\beta + \sin^2\gamma = 2$.

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9. A line OP through origin O is inclined at 60^0 and 45^0 to OX and OY respectivey, where O is the origin. Find the angle at which it is inclined to OZ.

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10. What are the direction cosines of a line which is equally inclined to the axes?

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11. What are the direction cosines of a line whose direction ratios are 3,4,12?

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12. Find the angles at which a line with direction ratios $2, -1, 2$ is inclined to each of the coordinate axes.

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13. A line passes through the points $(6, -7, -1) and (2, -3, 1)$. Find te direction cosines off the line if the line makes an acute angle with the positive direction of the x-axis.

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14. Show that the three lines drawn from the origin with direction cosines proportional to (1,-1,1),(2,-3,0) and (1,0,3) are coplanar

15. If l_1, m_1, n_1 and l_2, m_2, n_2 are the direction cosines of two mutually perpendicular lines, show that the direction cosines of the line perpendicular to both of these are $m_1n_2 - m_2n_1, n_1l_2 - n_2l_1, l_1m_2 - l_2m_1$.

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16. The direction cosines of two lines satisfying the conditions $l + m + n = 0$ and $3lm - 5mn + 2nl = 0$ where l, m, n are the direction cosines. The value of $(l - m)^2 + (m - n)^2 + (n - l)^2$ is

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17. The direction cosines of two lines are given by the equations

$3m + n5l = 0, 6nl - 2lm + 5mn = 0,$

then the direction cosines are

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18. Find the angle between any two diagonals of a cube.

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19. Find the projection of the line joining (1,2,3) and (-1,4,2)` on the line having direction ratios 2,3,-6.

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20. If $P, Q, R, Sare(3, 6, 4), (2, 5, 2), (6, 4, 4), (0, 2, 1)$ respectively. The projection of PQ on RS is .....

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21. Find the intercepts made on the coordinate axes by the plane $2x + y - 2z = 3$ and find also the direction cosines of the normal to the plane.

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Exercise

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

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2. If a line makes angles 90^o, 135^o, 45^o with the x, y and z-axes respectively, find its direction cosines.

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3. If $\vec{r} = 2\hat{i} - 3\hat{j} + 2\hat{k}$ find the direction cosines of vector.

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4. Find the direction COSINES of the line joining the points $P(4, 3, -5)$ and $Q(-2, 1, -8)$

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5. If a line has direction ratios $-18, -12, -4$ then what are its direction cosines?

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6. Show that the joint of the points (1,2,3), (4,5,7) is parallel to the join of the points (-4,3,-6),(2,9,2).

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7. Show that the line joining the points (1,2,3), (-1,-2,-3) is perpendicular to the line joining (-2,1,5),(3,3,2).

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

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9. Show that the points $A(2, 3, -4)$, $B(1, -2, 3)$ and $C(3, 8, -11)$ are collinear.

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10. 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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11. Determine the value of k so that the line joining points $A(k, 1, -1)$ and $B(2, 0, 2k)$ is perpendicular to the line joining the points $C(4, 2k, 1)$ and $D(2, 3, 2)$.

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12. Determine the values of x and y so that the line joining the points $A(x, 3, 1), B(1, 1, -2)$ is parallel to the line joining the points $C(2, 5, 3), D(-4, y, -6)$.

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13. Find the direction cosines of the lines connected by the relations: $\mathrm{l}+\mathrm{m}+\mathrm{n}=0 \backslash \text{ and } \backslash \ 2\mathrm{l}\,\mathrm{m}+2\mathrm{ln}-\mathrm{m}\,\mathrm{n}=0.$

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14. Find the coordinates of the foot of the perpendicular from $P(2, 1, 3)$ on the lines joining the points $A(1, 2, 4)$ and $B(3, 4, 5)$.

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15. If O be the origin and OP makes an angle of 45^0 and 60^0 with the positive direction of x and y axes respectively and OP=12 units, find the coordinates of P.

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16. Find the angles of $\triangle ABC$ whose vertices are

$A((-1, 3, 2), B(2, 3, 5)$ and $C(3, 5, -2).$

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17. Find the angle between the lines whose direction-cosines are give

$l + 2m + 3n = 0$ and $3lm - 4\ln + mn = 0$

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18. The angle between the line whose d.c.'s are connected by the relations $l^2 + m^2 - n^2 = 0$ and l+m+n=0 is

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19. Find the projection of the line segment joining (2,-1,3) and (4, 2, 5) on a line which makes equal acute angles with co-ordinate axes.

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20. The length of the line segment whose projection on the coordinate axes are of magnitudes 12,4,3 is (1) 13 (2) 17 (3) 19 (4) 21

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21. The direction cosines of x-axis are (A) 0,0,1 (B) 1,0,0 (C) 0,1,0 (D) 0,1,1

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22. The direction cosines of any normal to the xy-plane are (A) 1,0,0 (B) 0,1,0 (C) 1,1,0 (D) 0,01

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23. How many lines through the origin make equal angles with the coordinate axes? (A) 1 (B) 4 (C) 8 (D) 2

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24. The number 3,4,5 can be

(A) direction cosines of a line in space

(B) direction numbers of a line in space

(C) coordinates of a point on the line $y = 4z = 0$

(D) coordinates of a point in the plane $x + y - z = 0$

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25. If the direction cosines of a straighat line are k,k,k the (A) $k > 0$ (B) $0 < k < 1$ (C) $k = 1$

(D) $k = \frac{1}{\sqrt{3}}$ or $-\frac{1}{\sqrt{3}}$

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26. The direction cosines of line joining $(1, -1, 1)$ and $(-1, 1, 1)$ are (A) $2, -2, 0$ (B) $1, -1, 0$ (C) $\frac{1}{\sqrt{2}} - \frac{1}{\sqrt{2}}, 0$ (D) none of these

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27. If α, β, γ are the angle which a half ray makes with the positive direction of the axes then $\sin^2\alpha + \sin^2\beta + \sin^2\gamma =$

(A) 1

(B) 2

(C) 0

(D) -1

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28. The direction cosines of the ray from $(0, 0, 0) \to (2, -3, 6)$ are (A) $-\frac{2}{7}, \frac{3}{7}, -\frac{6}{7}$

(B) $\frac{2}{7}, 37, \frac{6}{7}$ (C) $-\frac{2}{7}, -\frac{3}{7}, \frac{6}{7}$ (D) $\frac{2}{7}, -\frac{3}{7}, \frac{6}{-}$

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29. Two lines with direction cosines l_1, m_1, n_1 and l_2, m_2, n_2 are at righat angles iff (A) $l_1l_2 + m_1m_2 + n_1n_2 = 0$ (B) $l_1 = l_2, m_1 = m_2, n_1 = n_2$ (C) $\frac{l_1}{l_2} = \frac{m_1}{m_2} = \frac{n_1}{n_2}$ (D) $l_1l_2 = m_1m_2 = n_1n_2$

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30. The projections of the segment PQ on the coordinate axes are -9,12,-8 respectively. The direction cosines of the line PQ are

(A) $-\frac{9}{\sqrt{17}}, \frac{12}{\sqrt{17}}, -\frac{8}{\sqrt{17}}$

(B) $-\frac{9}{288}, \frac{12}{289}, -\frac{8}{289}$

(C) $-\frac{9}{17}, \frac{12}{17}, -\frac{8}{17}$

(D) none of these

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31. If the direction cosines of a line are $\frac{1}{c}, \frac{1}{c}, \frac{1}{c}$ rthen (A) $c.0$ (B) $0 < c < 1$ (C)

$c = \pm\sqrt{3}$ (D) $c > 2$

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32. A line making angles 45^0 and 60^0 with the positive directions of the x and y axes respectively , makes with the positive direction of z-axis an angle of (A) 60^0 (B) 120^0 (C) 60^0 or 120^0 (D) none of these

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33. Find the angle between the following pair of lines: A lines with direction ratios 2,2,1 A line joning (3,1,4)to (7,2,12)

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34. Show that the direction cosines of a vector equally inclined to the axes OX, OY and OZ are $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$.

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35. If a line makes angles α, β, γ with the axes then $\cos 2\alpha + \cos 2\beta + \cos 2\gamma =$

$(A) -2 (B) -1 (C) 1 (D) 2$

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