MATHS

AIMED AT STUDENTS PREPARING FOR IIT JEE EXAMINATION

DIRECTION COSINES & RATIOS

Solved Examples

1. If P(2,3,-6) , Q (3, -4,5) are two points, find the d.c's of $\overrightarrow{OP}$, $\overrightarrow{QO}$ and $\overrightarrow{PQ}$ where O is the origin.

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2. Find the dr's and dc'r of the line joining the points (4,-7,3),(6,-5,2).

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3. If the d.c's of a line are proportional to (1,-2,1) find d.c's

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4. Show that the line joining the points P(0,1,2) and Q(3,4,8) is parallel to the line joining the points $R\left(-2, \frac{3}{2}, -3\right)$ and $S\left(\frac{5}{2}, 6, 6\right)$

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5. Show that the line joining the points A(2,3,-1) and B(3,5,-3) is perpendicular to the line joining C(1,2,3) and $D(3, 5, 7)$.

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6. Show that the points A(1,2,3) , B(4,0,4), C (-2,4,2) are collinear

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7. Show that the lines whose d.c's are proportional to (2,1,1), $\left(4, \sqrt{3}-1, -\sqrt{3}-1\right)$ are inclined to one another at angle $\frac{\pi}{3}$.

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8. ΔABC is formed by a (1,8,4), B (0, -11,4) and C(2,-3,1) . If D is the foot of the perpendicular from A to BC . Then the coordinates of D are

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9. Lines $\overline{OA}, \overline{OB}$ are drawn from O with direction cosines proportional to (1,-2,-1), (3,-2,3). Find the direction cosines of the normal to the plane AOB.

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10. If the d.c. 's (l, m, n) of two lines are connected by the relations $l+m+n=0, 2lm-mn+2nl=0$ then the d.c.'s of the two lines are

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11. If a variable line in two adjacent positions has direction cosines (l,m,n) and $(l+\delta l, m+\delta m, n+\delta n)$, then show that the small angle $\delta\theta$ between the two position is given by $(\delta\theta)^2 = (\delta l)^2 + (\delta m)^2 + (\delta n)^2$

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12. There are three straight lines through the origin with direction cosines proportional to (1,2,2), (2,3,6) (3,4,12), Find the direction cosines of a a line equally inclined to the given lines.

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13. Find the direction ratios of the line bisecting the angles between the lines whose direction cosines are l_1, m_1, n_1 and l_2, m_2, n_2 and the angle between the lines is θ.

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Additional Solved Examples

1. Show that tha angles between the diagonals of a rectangular parallelopiped having sides a,b and c are $\cos^{-1}\left(\frac{|\alpha|}{a^2+b^2+c^2}\right)$, where $\alpha = \pm a^2 \pm b^2 \pm c^2$ and $|\alpha| \neq a^2+b^2+c^2$. Hence find the angle between the diagonals of a cube.

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Exercise 6 Very Sort Answer Questions

1. A line makes angles $90^\circ, 60^\circ, 30^\circ$ with the positive direction of X,Y,Z axes respectively. Find its direction cosisnes.

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2. If the d.c's of a line are $(1/c, 1/c, 1c)$ then find c.

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3. If the dirction cosines of a line are $\left(\frac{1}{2}, 0, n\right)$ and $n < 0$, then find n.

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4. A ray makes angles $\pi/3, \pi/3$ with $\overline{OX}$ and $\overline{OY}$ respectively. Find the angle made by it with $\overline{OZ}$

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5. A straight line is inclined to the axes of x and y at angles of 60° and 45° respectively. Find the its inclination to the z-axis.

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6. If α, β, γ are the angles made by a line with the positive directions of the coordinate axes, then $\sin^2\alpha + \sin^2\beta + \sin^2\gamma =$

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7. If a line makes angles α, β, λ with the coordinate axes $\overrightarrow{OX}, \overrightarrow{OY}, \overrightarrow{OZ}$ find the value of $\cos 2\alpha + \cos 2\beta + \cos 2\lambda$,

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8. Find the d.c's of a line that makes equal angles with the axes, and find number of such lines.

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9. Find the direction ratios of the line joining the points (3,4,0) and (4,4,4).

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10. The direction ratios of a line are (-6,2,3) Find its direction cosines.

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11. If the direction ratios of a line are (3,4,0) find its direction cosines and also the angles made with the coordinate axes.

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12. If $P\left(\sqrt{3}, 1, 2\sqrt{3}\right)$ is a point in space, find direction cosines of $\overrightarrow{OP}$.

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13. Find the direction cosines of the line joining the points (-4,1,7),(2,-3,2)`

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14. If P(-2,4,-5) and Q(1,2,3) are two points. Find the direction cosines of $\overline{PQ}$

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15. Find the conine of the angle between the lines whose direction cosines are $\left(\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}\right)$ and $\left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, 0\right)$.

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16. Find the angle between the lines whose direction ratios are $(1, 1, 2)\left(\sqrt{3}, -\sqrt{3}, 0\right)$

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17. Show that the lines with direction cosines $\left(\frac{12}{13}, \frac{-3}{13}, \frac{-4}{13}\right)$ and $\left(\frac{4}{13}, \frac{12}{13}, \frac{3}{13}\right)$ are perpendicular to each other.

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18. Find 'x' if the angle between he lines with direction ratios (x,4,5) and (2,-1,2) is 90°

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19. O is the origin, P(2,3,4) and Q(1,k,1) are points such that $\overline{OP} \perp \overline{OQ}$. Find k.

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20. Find the angle between $\overline{DC}$ and $\overline{AB}$ where A = (3,4,5), B = (4,6,3), C = (-1,2,4) and D(1,0,5_

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21. Show that the lines $\overline{PQ}$ and $\overline{RS}$ are parallel where P,Q,R,S are the poits (2,3,4), (4,7,8), (-1,-2,1) and (1,2,5) respectively.

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

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

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24. For that value of 'x' the line joining A(4,1,2), B(5,x,0) is perpendicular to the line joining C(1,2,3), D(3,5,7) ?

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Exercise 6 Very Short Questions

1. 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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2. If (6,10,10),(1,0,-5), (6,-10,0) are vertices of a triangle, find the direciton ratios of its sides. Determine wherther it is right angled or isosceles.

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3. If the vertices of a triangle are $A(1, 4, 2), B(-2, 1, 2), C(2, 3, -4)$ then find $\angle A, \angle B, \angle C$.

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4. The direction cosines of a line are proportional to (2,3,6). A point P on the parallel line through the origin is distant 14 units from the origin. Find its coordinates.

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5. Show that the points (2,3,-4), (1,-2,3) and (3,8,-11) are collinear.

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6. Show that the points (4,7,8), (2,3,4) and (-1,-2,1),(1,2,5) are vertices of a parallelogram.

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7. Show that the four points (5,-1,1),(-1,-3,4) (1,-6,10) and (7,-4,7) taken in order form a rhombus.

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8. A(6,-16,-3), B(3,-1,4), C(-2,5,0) are vertices of a triangle, Find the coordinates of the foot of the perpendicular drawn from A to $\overline{BC}$.

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9. Find the direciton cosines of a line which is perpendicular to the lines whose direcition ratios are (1,-2,3) and (2,1,-1)

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10. If $(l_1, m_1, n_1), (l_2, m_2, n_2)$ are d.c.s of two intersecting lines, show that d.c.s of two lines bisecting the angles between them are proportional to $l_1 + l_2, m_1 + m_2, n_1 + n_2$.

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11. A (-1,2-3), B(5,0,-6), C(0,4,-1) are three points, Show that direction cosines of the bisectors of $\lfloor BAC$ are proportional to (25,8,5)and (-11,20,23).

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Exercise 6 Long Answerquestions

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

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2. Find the angle between the lines whose direction cosines satisfy the equaitons $l + m + n = 0, l^2 + m^2 - n^2 = 0.$

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3. Find the angle between the lines whose direction cosines are given by the equation 3l + m + 5n = 0 and 6mn - 2nl + 5lm = 0

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4. Show that the lines whose d.c's are given by l + m + n = 0,2mn + 3nl - 5ln = 0 are perpendicular to each other.

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5. The angle between any two diagonals of a cube is

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6. If a line makes angles $\alpha, \beta, \lambda, \delta$ with the four diagonals of a cube, then show that $\cos^2\alpha + \cos^2\beta + \cos^2\lambda + \cos^2\delta = \frac{4}{3}$.

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Additional Exercise

1. find the number of straight lines that are equally inclined to three-dimensional coordinate axes, is

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2. If $(l_1, m_1, n_1), (l_2, m_2, n_2)$ are d.c's of two lines then find the value of $(l_1m_2 - l_2m_1)^2 + (m_1n_2 - n_1m_2)^2 + (n_1l_2 - n_2l_1)^2 + (l_1l_2 + m_1m_2 + n_1$

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3. Show that the condition that tha concurrent lines with direction cosines $(l_1.\, m_1, n_1), (l_2, m_2, n_2)$ and (l_3, m_3, n_3) are coplanar is $l_1(m_2n_3 - m_3n_2) + m_1(n_2l_3 - n_3l_2) + n_1(l_2m_3 - l_3n_2) = 0$

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4. Light from a point source at A(7,0,0) strikes a small mirror at the origin the normal to which has direction ratios (2,1,2). Find the actual direction cosines of the reflected ray.

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Exercise I

1. If the line joining the points (2, 3, 4), (0,1,2) is perpendicular to the line joining the points (x, 0, 4), (7, -4,3) then x =

A. 1

B. 2

C. 3

D. 4

Answer: B

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2. If O is origin, and $P = (1, -2, 1)$ and $OP \perp OQ$ then Q =

A. (4, 3, 2)

B. (3, 2, 4)

C. (2, -3, 4)

D. (1, -2, 3)

Answer: A

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3. The d.r's of two parallel lines are 4, - 3, -1 and $\lambda + \mu, 1 + \mu, 2$. Then (λ, μ) is

A. (1,7)

B. (-1,-7)

C. (7,1)

D. (-13,5)

Answer: D

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4. A straight line is equally inclined to all the three coordinate axes. Then an angle made by the line with the y - axis

A. $\cos^{-1}\left(\frac{1}{3}\right)$

B. $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$

C. $\cos^{-1}\left(\frac{2}{\sqrt{3}}\right)$

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

Answer: B

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Exercise Ii

1. A line passes through the points (6,-7,-1) and (2,-3,1). The d.c's of the line so directed that the angle made by it with the positive direction of x-axis is acute are

A. $\left(\frac{2}{3}, \frac{-2}{3}, \frac{1}{3}\right)$

B. $\left(\frac{2}{3}, \frac{2}{3}, \frac{-1}{3}\right)$

C. $\left(\frac{-2}{3}, \frac{-2}{3}, \frac{1}{3}\right)$

D. $\left(\frac{2}{3}, \frac{-2}{3}, \frac{-1}{3}\right)$

Answer:

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2. If the angle between the lines whose direcrtion cosines are $\left(-\frac{2}{\sqrt{21}}, \frac{C}{\sqrt{21}}, \frac{1}{\sqrt{21}}\right)$ and $\left(\frac{3}{\sqrt{54}}, \frac{3}{\sqrt{54}}, \frac{-6}{\sqrt{54}}\right)$ is $\frac{\pi}{2}$, then the value of C is

A. 6

B. 4

C. -4

D. 2

Answer:

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3. Any point on a line has the coordinates $(r+1, r-3, r\sqrt{2}+4)$ where r is any real number. The d.r's of the line are

A. $\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$

B. $\frac{1}{2}, \frac{1}{2}, \frac{1}{\sqrt{2}}$

C. $\frac{1}{2}, \frac{1}{2}, -\frac{1}{\sqrt{2}}$

D. $1, 1, \sqrt{2}$

Answer:

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4. If $(l_1, m_1, n_1), (l_2, m_2, n_2)$ are d.c's of two lines then find the value of

$(l_1m_2 - l_2m_1)^2 + (m_1n_2 - n_1m_2)^2 + (n_1l_2 - n_2l_1)^2 + (l_1l_2 + m_1m_2 + n_1$

A. I,II

B. II,III

C. I,III

D. all the three

Answer:

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5. If the vertices of a triangle are (1,4,2),(-2,1,2),(2,3,-4) then the angles are

A. $90^\circ, \cos^{-1}\sqrt{\frac{9}{28}}, \left[90^\circ - \cos^{-1}\sqrt{\frac{9}{28}}\right]$

B. $\cos^{-1}\left(\frac{1}{\sqrt{5}}\right), 90^\circ, \cos^{-1}\frac{\sqrt{5}}{3}$

C. $90^\circ, 120^\circ, 30^\circ$

D. $30^\circ, 60^\circ, 90^\circ$

Answer:

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6. The angle between the lines joining the points (1,1,0), $(-3, \sqrt{3}+1, 3)$ and $(0, -1, 0), (-1, \sqrt{3}-1\lambda)$ is $\cos^{-1}\left(\sqrt{\frac{7}{16}}\right)$.

If λ is an integer then λ is

A. 1

B. 0

C. -1

D. 2

Answer:

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7. If $(a_1, b_1, c_1), (a_2, b_2, c_2)$ are direction ratio of two lines such that $\left(a_1^2 + b_1^2 + c_1^2\right)(a_1a_2 + b_1b_2 + c_1c_2)^2 = 0$ then the two lines

A. are parallel

B. are perpendicular

C. include an angle $\frac{\pi}{4}$

D. include angle $\frac{\pi}{3}$

Answer:

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8. The angle between any two diagonals of a cube is

A. $\cos^{-1}\left(\frac{1}{3}\right)$

B. $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$

C. $\cos^{-1}\sqrt{\frac{2}{3}}$

D. $\cos^{-1}\frac{2}{3}$

Answer:

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9. In a unit cube. Find The angle between a diagonal of a cube and the diagonal of a face of the cube

A. $\cos^{-1}\left(\frac{1}{3}\right)$

B. $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$

C. $\cos^{-1}\sqrt{\frac{2}{3}}$

D. $\cos^{-1}\frac{2}{3}$

Answer:

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10. Angle between a diagonal of a cube with edge of lenth 1 is

A. $\cos^{-1}\left(\frac{1}{3}\right)$

B. $\cos^{-1}\left(\frac{1}{2}\right)$

C. $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$

D. $\cos^{-1}(\sqrt{3})$

Answer:

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11. If a line makes angles $\alpha, \beta, \lambda, \delta$ with the four diagonals of a cube, then show that $\cos^2\alpha + \cos^2\beta + \cos^2\lambda + \cos^2\delta = \frac{4}{3}$.

A. $\frac{1}{2}$

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

C. $\frac{1}{5}$

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

Answer:

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12. If a line makes angles $\alpha, \beta, \lambda, \delta$ with the 4 diagonals of a cube then $\sin^2\alpha + \sin^2\beta + \sin^2\lambda + \sin^2\delta$

A. $5/3$

B. $4/3$

C. $8/3$

D. $2/3$

Answer:

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13. If the edges of rectangular parllelopiped are 3,2,1 then the angle between two diagonals out of 4 diagonals id

A. $\cos^{-1}\left(\frac{6}{7}\right)$

B. $\cos^{-1}\left(\frac{2}{3}\right)$

C. $\cos^{-1}\left(\frac{13}{14}\right)$

D. $\cos^{-1}\left(\frac{9}{14}\right)$

Answer:

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14. If $(l_1, m_1, n_1), (l_2, m_2, n_2)$ are d.c's of two lines whose angle between them is 30°, then d.c's of a line perpendicular to both these lines are $k(m_1n_2 - m_2n_1, n_1l_2 - n_2l_1, l_1m_2 - l_2m_1)$, k =

A. 1

B. 2

C. 3

D. 4

Answer:

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15. If the d.r.s of the two lines are 1,1,2, -1,2,1 then d.c.s of a line which is perpendicular to both of them are

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

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

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

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

Answer:

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16. If the d.r.s of OA, OB are (1,1,-1),(1-2,1) then the d.c.s of the normal to the plane AOB are

A. $\frac{1}{\sqrt{14}}, \frac{2}{\sqrt{14}}, \frac{3}{\sqrt{14}}$

B. $\frac{2}{\sqrt{29}}, \frac{3}{\sqrt{29}}, \frac{4}{\sqrt{29}}$

C. $\frac{2}{\sqrt{14}}, \frac{-2}{\sqrt{14}}, \frac{3}{\sqrt{14}}$

D. $\frac{1}{14}, \frac{2}{14}, \frac{3}{14}$

Answer:

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17. If (1,2,1), (1,-3,2) are the direction ratios of two lines and (l, m,n) are the direction cosines of a line perpendicular to the given lines, then l + m + n

A. 1

B. $\pm \frac{1}{5\sqrt{3}}$

C. $\pm \frac{1}{3\sqrt{5}}$

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

Answer:

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18. If the d.r's of the lines are 2,1,-2 and 3,-2,6 then the d.r,s of the line perpendicular to both the given lines is

A. 2,-18,-7

B. 2,18,-4

C. 2,-18,7

D. 2,18,4

Answer:

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Practice Exercise

1. Match the following

List-1	List-II
(A)D.C's of x-axis	(1)1,1,1
(B) D.C of y-axis	(2) $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$
(C)D.C of z-axis	(3)1,0,0
(D)D.C's of a line which makes equal angles with axes	(4)0,1,0
	(5)0,0,1

A. $\begin{matrix} A & B & C & D \\ 3 & 4 & 5 & 2 \end{matrix}$

B. $\begin{matrix} A & B & C & D \\ 1 & 2 & 3 & 4 \end{matrix}$

C. $\begin{matrix} A & B & C & D \\ 2 & 3 & 4 & 5 \end{matrix}$

D.

A	B	C	D
5	4	3	2

Answer: A

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2. The number of lines which are equally inclined to the coordinate axes is

A. 3

B. 4

C. 5

D. 6

Answer: B

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3. If the d.c.s of the line joining the oints P(4,3,5) and Q(1,1,k) are $\frac{3}{7}, \frac{2}{7}, \frac{6}{7}$ then k =

A. -1

B. 11

C. 1

D. -11

Answer: A

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4. If d.c's of the line joining the origin and a point unit distance from the origin are $\frac{1}{\sqrt{3}}, \frac{1}{-(2)}, \lambda$ then the point is

A. $\left(\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{2}}, \frac{1}{2}\sqrt{\frac{5}{3}}\right)$

B. $\left(\frac{2}{\sqrt{3}}, -1, \sqrt{\frac{5}{4}}\right)$

C. $\left(\frac{-2}{\sqrt{3}}, 1-\sqrt{\frac{5}{4}}\right)$

D. $\left(\frac{1}{2}, \frac{1}{3}, \sqrt{\frac{5}{3}}\right)$

Answer: A

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5. If (1,2,-2) are the D.R's of a line then Statement-I : The D.C's of the are $\left[\frac{-1}{3}, \frac{-2}{3}, \frac{2}{3}\right]$

Statement-II : The D. C's of the line are $\left[\frac{1}{3}, \frac{2}{3}, \frac{2}{3}\right]$

Which of the above statement is correct :

A. Only I

B. Only II

C. Both I and II

D. Neither I nor II

Answer: A

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6. Assertion (A) : If a line make angles $45^\circ, 45^\circ$ with the x and y axis repectively then it makes angle 60° with z - axis

Reason (R) : If α, β, λ are the angle made by a line with the coordinate axes then $\cos^2\alpha + \cos^2\beta + \cos^2\lambda = 1$

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

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

C. A is true but R is false

D. A is false but R is true

Answer: D

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7. If a line makes angles $\cos^{-1}(1/5), \cos^{-1}(3/5)$ with X and Y- axes respectively, then the angle made by the line with Z-axis is

A. $\cos^{-1}(1/5)$

B. $\cos^{-1}(2/5)$

C. $\cos^{-1}\sqrt{3/5}$

D. $\cos^{-1}(4/5)$

Answer: C

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8. The angle between the two lines whose direction cosines are $\left(\frac{\sqrt{3}}{4}, \frac{1}{4}, \frac{\sqrt{3}}{2}\right)$ and $\left(\frac{\sqrt{3}}{4}, \frac{1}{4}, -\frac{\sqrt{3}}{2}\right)$

A. π

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

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

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

Answer: D

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9. The angle between the line passing through the points (3,1,-2) and (4,0,-4) and the line passing through the points (4,-3,3) and (6,-2,2) is

A. $\cos^{-1}\left(\frac{2}{63}\right)$

B. $\cos^{1}\left(\frac{20}{63}\right)$

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

D. $\frac{\pi}{5}$

Answer: D

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10. If the d.r's of two lines are (x,3,5) and (2,-1,2) and if the anlgle between those lines is 45°, then x =

A. 4

B. 5

C. 2

D. 1

Answer:

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11. The d.r.s of two perpendicular lines are 1,-3,5 and $\lambda, 1+\lambda, 2+\lambda$ then λ is

A. $-7/3$

B. $7/2$

C. $-1/4$

D. $1/2$

Answer: A

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12. If the line joining the points (-1,2,3) (2,-1,4) is perpendicular to the line joining (x,-2,4) and (1,2,3) then x =

A. 3

B. 10

C. $\frac{-3}{10}$

D. $\frac{-10}{3}$

Answer: D

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13. If (1,-2,-2) and (0,2,1) are direction ratios of two lines, then direction cosines of a line perpendicular to both the lines are

A. $\left(\frac{1}{3}, -\frac{1}{3}, \frac{2}{3}\right)$

B. $c\left(\frac{2}{3}, -\frac{1}{3}, \frac{2}{3}\right)$

C. $\left(-\frac{2}{3}, \frac{1}{3}, \frac{2}{3}\right)$

D. $\left(\frac{2}{\sqrt{14}}, -\frac{1}{\sqrt{14}}, \frac{3}{\sqrt{14}}\right)$

Answer: B

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14. If the line joining the points (1,4,2) and (-2,1,2) is inclined at an angle of $\frac{\pi}{3}$ to the line joining the points (1,2,3), $(2, \lambda, 1)$ then λ =

A. $\pm\sqrt{7}$

B. $\pm\sqrt{9}$

C. $\pm\sqrt{5}$

D. $\pm\sqrt{3}$

Answer: A

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15. If the d.r's of $\overline{OA}$, $\overline{OB}$ are (1,-2,3),(-3,4,5) then the d.c's of the normal to the plane $\overline{OAB}$ are

A. $\left(\frac{4}{\sqrt{29}}, \frac{3}{\sqrt{29}}, -\frac{2}{\sqrt{29}}\right)$

B. $\left(\frac{11}{\sqrt{171}}, \frac{7}{\sqrt{171}}, \frac{1}{\sqrt{171}}\right)$

C. $\left(\frac{3}{\sqrt{29}}, -\frac{2}{\sqrt{29}}, -\frac{4}{\sqrt{29}}\right)$

D. $\left(\frac{3}{\sqrt{29}}, -\frac{2}{\sqrt{29}}, -\frac{4}{\sqrt{29}}\right)$

Answer: B

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16. If $(l_1, m_1, n_1), (l_2, m_2, n_2)$ are d.c's of two lines then find the value of $(l_1m_2 - l_2m_1)^2 + (m_1n_2 - n_1m_2)^2 + (n_1l_2 - n_2l_1)^2 + (l_1l_2 + m_1m_2 + n_1$

A. 3

B. 2

C. 1

D. 4

Answer: C

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17. If the d.c's of the two lines are $\frac{2}{3}, \frac{2}{3}, \frac{1}{3}, \frac{5}{13}, \frac{12}{13}, 0$ then the d.r.s of the line bisecting the angle between the lines are

A. 40, 60, 13

B. 41, 60, 10

C. 41, 62, 13

D. 41, 60, 13

Answer: C

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18. If (6,-2,-3),(1,2,2) are d.r's of two lines then the d.c's of line bisecting the angle between them are

A. $\left(\frac{25}{\sqrt{714}}, \frac{8}{\sqrt{714}}, \frac{5}{\sqrt{714}}\right)$

B. $\left(\frac{13}{\sqrt{714}}, \frac{4}{\sqrt{714}}, \frac{5}{\sqrt{714}}\right)$

C. $\left(\frac{-25}{\sqrt{714}}, \frac{8}{\sqrt{714}}, \frac{-5}{\sqrt{714}}\right)$

D. $\left(\frac{25}{\sqrt{714}}, \frac{8}{\sqrt{714}}, \frac{5}{\sqrt{714}}\right)$

Answer:

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19. If $(l_1, m_1, n_1), (l_2, m_2, n_2)$ are direction cosines of two lines which inculude an angle 120°, then the direction cosines of the line which bisects the angle between them is

A. $(l_1 + l_2), (m_1 + m_2), (n_1 + n_2)$

B. $\left(\frac{l_1 - l_2}{\sqrt{3}}, \frac{m_1 - m_2}{\sqrt{3}}, \frac{n_1 - n_2}{\sqrt{3}}\right)$

C. $\left(\frac{l_1 - l_2}{2}, \frac{m_1 - m_2}{2}, \frac{n_1 - n_2}{2}\right)$

D. $\left(\frac{l_1 - l_2}{\sqrt{2}}, \frac{m_1 - m_2}{\sqrt{2}}, \frac{n_1 - n_2}{\sqrt{2}}\right)$

Answer: B

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20. If the d.c's (l,m,n) of two lines are related as l + m + n = 0, 2lm - mn + 2nl = 0, then the angle between the lines is

A. 30°

B. 45°

C. 90°

D. 120°

Answer: D

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21. If the d.c's (l,m,n) of two lines are connected by the relations 3l+m+5n=0, 6mn - 2nl + 5lm=0 then the angle between the lines is

A. $\cos^{-1}\left(\frac{1}{6}\right)$ or $\pi - \cos^{-1}\left(\frac{1}{6}\right)$

B. 45°

C. 60° or 120°

D. $\cos^{-1}\frac{19}{\sqrt{364}}$

Answer: A

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22. If the direction rations of two lines are given by 3lm-4ln+mn = 0 and l + 2m + 3n = 0 then the angle between the lines is

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

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

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

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

Answer: A

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23. If the d.c's of two lines are such that l+3m+n = 0, $3l^2 + 5m^2 - 4n^2 = 0$, then the angle between them is

A. $\pi/3$

B. $\pi/2$

C. $\pi/4$

D. $\pi/6$

Answer: B

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24. If the d.c's (l,m,n) of two lines are connected by the relations $7l^2 + 5m^2 - 3n^2 = 0$, l - 5m + 3n = 0 then the d.c's of the two lines are

A. $\left(\frac{1}{\sqrt{6}}, -\frac{1}{\sqrt{6}}, \frac{1}{\sqrt{6}}\right), \left(\frac{1}{\sqrt{6}}, -\frac{2}{\sqrt{6}}, \frac{1}{\sqrt{6}}\right)$

B. $\left(\frac{1}{\sqrt{14}}, -\frac{2}{\sqrt{14}}, \frac{3}{\sqrt{6}}\right), \left(\frac{1}{\sqrt{6}}, \frac{1}{\sqrt{6}}, -\frac{2}{\sqrt{6}}\right)$

C. $\left(\frac{1}{\sqrt{14}}, \frac{2}{\sqrt{14}}, \frac{3}{\sqrt{14}}\right), \left(-\frac{1}{\sqrt{6}}, \frac{1}{\sqrt{6}}, \frac{2}{\sqrt{6}}\right)$

D. $\left(\frac{1}{\sqrt{4}}, \frac{2}{\sqrt{4}}, \frac{3}{\sqrt{4}}\right), \left(\frac{-1}{\sqrt{3}}, \frac{1}{\sqrt{8}}, \frac{-2}{\sqrt{8}}\right)$

Answer: C

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25. The angle between two lines whose d.c's satisfy the equation n = l + m and m = 2l + 3n is

A. 0°

B. 90°

C. 60°

D. 30°

Answer: A

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26. Assertion (A): The points A(2,3,5) B(4,6,10), C(8,12,20) are collinear.

Reason (R) : Two lines will be parallel if their D.R's are proportional.

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

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

C. A is true but R is false

D. A is false But R is true

Answer: A

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27. The projection of a vector on the three coordinate axes are 6,-3,2 respectively. The direction cosines of the vector are

A. 6,-3,2

B. $\frac{6}{5}, \frac{-3}{5}, \frac{2}{5}$

C. $\frac{6}{7}, \frac{-3}{7}, \frac{2}{7}$

D. $\frac{-6}{7}, \frac{-3}{7}, \frac{2}{7}$

Answer: C

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28. The projection of the join of the points (3,4,2), (5,1,8) on the line whose d.c's are $\left(\frac{2}{7}, \frac{-3}{7}, \frac{6}{7}\right)$ is

A. 7

B. $\frac{46}{13}$

C. $\frac{42}{13}$

D. $\frac{38}{13}$

Answer: A

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29. The projection of the join of the two points (1,4,5), (6,7,2) on the line whose d.r's are (4,5,6) is

A. $\frac{17}{\sqrt{77}}$

B. $\frac{7}{6}$

C. 21

D. $\frac{7}{9}$

Answer: A

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30. A $(x_1, y_1, z_1), B(x_2, y_2, z_2)$ are two points. Then the lenghts of projection on

List - I	List - II
A) x - axis	1) $\lvert x_2 - x_1 \rvert$
B) y - axis	2) $\lvert y_2 - y_1 \rvert$
C) z - axis	3) $\lvert z_2 - z_1 \rvert$
	4) $\lvert x - x_1 \rvert + \lvert y_2 - y_1 \rvert + \lvert z_2 - z_1 \rvert$

A. $\begin{matrix} A & B & C \\ 1 & 2 & 3 \end{matrix}$

B. $\begin{matrix} A & B & C \\ 3 & 5 & 9 \end{matrix}$

C. $\begin{matrix} A & B & C \\ 5 & 9 & 6 \end{matrix}$

D. $\begin{matrix} A & B & C \\ 4 & 2 & 3 \end{matrix}$

Answer: A

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31. If A(1,2,3), B(6,7,7), C(9,9,0) are three points, then the foot of the perpendicular drawn from the point A to the joining the points B and C is

A. (3,5,7)

B. (3,5,9)

C. (5,9,6)

D. (4,2,3)

Answer: B

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32. Assertion (A): $A(x_1, y_1, z_1), B(x_2, y_2, z_2)$. The projection of AB on the line with D.C's (l,m,n) is $l(x_2 - x_1) + m(y_2 - y_1) + n(z_2 - z_1)$

Reason (R) : The projection of the join of A $(x_1, y_1, z_1), B(x_2, y_2, z_2)$ on yz plane is $\sqrt{(y_2 - y_1)^2 + (z_2 - z_1)^2}$

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

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

C. A is true but R is flase

D. A is flase but R is true

Answer: B

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33. A line makes the same angle θ, with each of the x and z axis. If the angle β, which it makes with y - axis, is such that $\sin^2 \beta' = 3\sin^2 \theta$ then $\cos^2 \theta$=

A. $2/3$

B. $1/5$

C. $3/5$

D. $2/5$

Answer: C

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34. If a makes an angle of $\pi/4$ with the positive direction of each of x-axis and y - axis, then the angle that the line makes with the positive direction of the z-axis is

A. $\pi/2$

B. $\pi/6$

C. $\pi/3$

D. $\pi/4$

Answer: A

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35. A tetrahedron has vertices at O(0,0,0), A(1,2,1), B(2,1,3) and C(-1,1,2). Then the angle between the faces OAB and ABC will be

A. $\pi/2$

B. $\cos^{-1}\left(\frac{19}{35}\right)$

C. $\cos^{-1}\left(\frac{17}{31}\right)$

D. $\pi/6$

Answer: C

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36. Tha angle between the lines whose d.c's satisfy the equation $l+m+n=0$ and $l^2=m^2+n^2$ is

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

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

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

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

Answer: C

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