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NCERT Class 12- Mathematics: Chapter – 11 Three Dimensional Geometry Part 2

11.2 Solved Examples

Short Answer (S. A)

Question 1: If the direction ratios of a line are 1,1,2, find the direction cosines of the line.

Answer:

The direction cosines are given by

$$l = \frac{a}{\sqrt{a^2 + b^2 + c^2}}, m = \frac{b}{\sqrt{a^2 + b^2 + c^2}}, n = \frac{c}{\sqrt{a^2 + b^2 + c^2}}$$

Here a, b, c are 1, 1, 2, respectively.

Therefore,
$$l = \frac{1}{\sqrt{1^2 + 1^2 + 2^2}}, m = \frac{1}{\sqrt{1^2 + 1^2 + 2^2}}, n = \frac{2}{\sqrt{1^2 + 1^2 + 2^2}}$$

i.e.,
$$l = \frac{1}{\sqrt{6}}$$
, $m = \frac{1}{\sqrt{6}}$, $n = \frac{2}{\sqrt{6}}$ *i.e.* $\pm \left(\frac{1}{\sqrt{6}}, \frac{1}{\sqrt{6}}, \frac{2}{\sqrt{6}}\right)$ are D. C's of the line.

Question 2:

Find the direction cosines of the line passing through the points P(2,3,5) and Q(-1,2,4).

Answer:

The direction cosines of a line passing through the points $P(x_1, y_1, z_1)$ and $Q(x_2, y_2, z_2)$ are

$$x_2 - x_1, y_2 - y_1, z_2 - z_1 \\ PO, PO, PO$$

Here
$$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$$

= $\sqrt{(-1 - 2)^2 + (2 - 3)^2 + (4 - 5)^2} = \sqrt{9 + 1 + 1} = \sqrt{11}$

Hence D. C. s are

$$\pm \left(\begin{array}{ccc} -3 & -1 & -1 \\ \sqrt{11} & \sqrt{11} & \sqrt{11} \end{array} \right) \text{ or } \pm \left(\begin{array}{ccc} 3 & 1 & 1 \\ \sqrt{11} & \sqrt{11} & \sqrt{11} \end{array} \right).$$

Question 3: If a line makes an angle of $30^{\circ}, 60^{\circ}, 90^{\circ}$ with the positive direction of x, y, z - axes, respectively, then find its direction cosines.

Answer:

The direction cosines of a line which makes an angle of α, β, γ with the axes, are $\cos \alpha, \cos \beta, \cos \gamma$

Therefore, D. C. s of the line are $\cos 30^\circ, \cos 60^\circ, \cos 90^\circ$ i.e., $\pm \left(\frac{\sqrt{3}}{2}, \frac{1}{2}, 0\right)$

Question 4:

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

Answer:

Let the point P divide QR in the ratio $\lambda:1$, then the co-ordinate of P are

$$\begin{pmatrix} 5\lambda + 2 & \lambda + 2 & -2\lambda + 1 \\ \lambda + 1 & \lambda + 1 & \lambda + 1 \end{pmatrix}$$

But x_- coordinate of P is . Therefore,

$$\frac{5\lambda + 2}{\lambda + 1} = 4 \Rightarrow \lambda = 2$$

Hence, the z- coordinate of , is $\frac{-2\lambda+1}{\lambda+1}=-1$

Question 5: Find the distance of the point whose position vector is $(2\hat{\imath} + \hat{\jmath} - \hat{k})$ from the plane \vec{r} . $(\hat{\imath} - 2\hat{\jmath} + 4\hat{k}) = 9$

Answer:

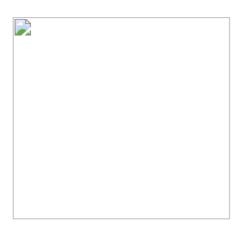
Here
$$\vec{a} = 2\hat{i} + \hat{j} - \hat{k}$$
, $\vec{n} = \hat{i} - 2\hat{j} + 4\hat{k}$ and $\vec{d} = 9$

So, the required distance is $\frac{\left|\left(2\hat{\imath}+\hat{\jmath}-\hat{k}\right).\left(\hat{\imath}-2\hat{\jmath}+4\hat{k}\right)-9\right|}{\sqrt{1+4+16}}$

$$= \frac{|2-2-4-9|}{\sqrt{21}} = \frac{13}{\sqrt{21}}$$

Question 6:

Find the distance of the point (-2, 4, -5) from the line $\begin{cases} x+3 \\ 3 \end{cases} = \begin{cases} y-4 \\ 5 \end{cases} = \begin{cases} z+8 \\ 6 \end{cases}$



Answer:

Here P(-2,4,-5) is the given point.

Any point $_{o}$ on the line is given by $(3\lambda-3,5\lambda+4,(6\lambda-8))$,

$$\overrightarrow{PQ} = (3\lambda - 1)\,\hat{\imath} + 5\lambda\hat{\jmath} + (6\lambda - 3)\,\hat{k} \ .$$

Since $\overrightarrow{PQ} \perp (3\hat{\imath} + 5\hat{\jmath} + 6\hat{k})$, we have

$$3(3\lambda - 1) + 5(5\lambda) + 6(6\lambda - 3) = 0$$

$$9\lambda + 25\lambda + 36\lambda = 21, i.e.\lambda = \frac{3}{10}$$

Thus
$$\overrightarrow{PQ} = \frac{1}{10}\hat{i} + \frac{15}{10}\hat{j} - \frac{12}{10}\hat{k}$$

Hence
$$|\overrightarrow{PQ}| = \frac{1}{10}\sqrt{1 + 225 + 144} = \sqrt{\frac{37}{10}}$$
.