PHYSICS

Ques-1 - Show that distance betn the point (5,4,2) and (0,3,1) is $3\sqrt{3}$.

Soln $\sqrt{(5-0)^2+(4-3)^2+(2-1)^2} = \sqrt{5^2+1^2+1^2}$

$\Rightarrow \sqrt{25+2} = \sqrt{27} = 3\sqrt{3}$ Ans

Ques 2 Show that the distance betn $(a-b, a+b, c)$ and the origin is $\sqrt{2a^2+2b^2+c^2}$.

Soln $\sqrt{(a-b-0)^2+(a+b-0)^2+(c-0)^2}$

$\Rightarrow \sqrt{a^2+b^2-\cancel{2ab}+a^2+b^2+\cancel{2ab}+c^2}$

$\Rightarrow \sqrt{2a^2+2b^2+c^2}$ Ans (Hence proved)

Ques-3 find the point in x-y plane which are at unit distance from the origin and equidistant from the x and y axis.

Soln let the point be at (x, y, z) $(x=y)$ given

$\sqrt{(x-0)^2+(x-0)^2+(z-0)^2} = 1$

point is at x-y plane i.e $z=0$

$\sqrt{x^2+x^2+0^2} = 1$

$\sqrt{2x^2} = 1$ $x = \frac{1}{\sqrt{2}}$ Ans

Ques 4: find the point which are at the distance of 5 units from the origin and whose distances from both ~~y~~ the xy and zx planes are $2\sqrt{2}$ units.

Solⁿ distance from $xy = 2\sqrt{2}$ i.e. $z = 2\sqrt{2}$

similarly, $zx = 2\sqrt{2}$ i.e $y = 2\sqrt{2}$

let the point be (x, y, z)

$(x, 2\sqrt{2}, 2\sqrt{2})$

$$\sqrt{(x-0)^2 + (2\sqrt{2}-0)^2 + (2\sqrt{2}-0)^2}$$

$$\sqrt{x^2 + 4(2) + 4(2)} = 5$$

$25 = x^2 + 16 \Rightarrow x^2 = 9$ $\quad x = \pm 3$ Ans

Ques-5 find the points which are at a distance of $1/\sqrt{2}$ from every axis.

Solⁿ $x = 1/\sqrt{2}$ $\quad y = 1/\sqrt{2}$ $\quad z = 1/\sqrt{2}$

$\left(1/\sqrt{2}, 1/\sqrt{2}, 1/\sqrt{2}\right)$ point Ans.

Ques-6 Find the perimeter of the triangle whose vertices lie at the points $(1,0,0)$ $(0,1,0)$ $(0,0,1)$
(A) (B) (C)

Sol^n $\overline{AB} = \sqrt{(1-0)^2 + (0-1)^2 + (0-0)^2} = \sqrt{1+1} = \sqrt{2}$

similarly $\overline{AC} = \overline{BC} = \sqrt{2}$

Hence the perimeter $= 3\sqrt{2}$ Ans

Ques-7 Show that it is ~~important~~ impossible for a line through the origin to be inclined at angles of $60°, 120°, 30°$ to the x axis, y-axis, z axis respectively, but the angles of $60°, 120°, 135°$ are possible.

Sol^n $(\cos 60°)^2 + (\cos 120°)^2 + (\cos 30°)^2 = 1$.

$\because l^2 + m^2 + n^2 = 1$

$\left(\frac{1}{2}\right)^2 + \left[\cos(180° - 60°)\right]^2 + \left(\frac{\sqrt{3}}{2}\right)^2 = 1$

$\frac{1}{4} + (-\cos 60°)^2 + \frac{3}{4} = 1$

$\frac{1}{4} + \left(-\frac{1}{2}\right)^2 + \frac{3}{4} = 1$ $\Rightarrow \frac{1}{4} + \frac{1}{4} + \frac{3}{4} = 1$

$\Rightarrow \frac{5}{4} \neq 1$

LHS $\neq$ RHS

hence $60°, 120°, 30°$ Not possible.

Whereas —

$(\cos 60°)^2 + (\cos 120°)^2 + (\cos 135°)^2 = 1$

$\left(\frac{1}{2}\right)^2 + \left(-\frac{1}{2}\right)^2 + \left[\cos(180 - 45°)\right]^2 = 1$

$\frac{1}{4} + \frac{1}{4} + (-\cos 45°)^2 = 1$ $\Rightarrow \frac{1}{4} + \frac{1}{4} + \frac{1}{2} = 1$

$\Rightarrow \frac{1}{2} + \frac{1}{2} = 1$ Ans

Hence proved LHS = RHS

Ques 8 find the ~~distance~~ dirn cosines of the line joining the origin to the point $(6,2,5)$.

Soln (Directn Ratios) $\left[(6-0)\hat{i} + (2-0)\hat{j} + (5-0)\hat{k}\right]$

$\hookrightarrow \left[(6-0), (2-0), (5-0)\right]$ Vector :

Directn Cosines - - -

$$\frac{6-0}{\sqrt{6^2+2^2+5^2}}, \frac{2-0}{\sqrt{6^2+2^2+5^2}}, \frac{5-0}{\sqrt{6^2+2^2+5^2}}$$

$$\Rightarrow \frac{5}{\sqrt{64}}, \frac{2}{\sqrt{64}}, \frac{5}{\sqrt{64}}$$

$$\Rightarrow \frac{5}{8}, \frac{2}{8}, \frac{5}{8}.$$

Ques (9) find dirn ~~cosines~~ ratios for the line which makes angle of $45°$ with the x-axis and makes an angle of $45°$ with y-axis and which lies in positive (octant) → mean contain x, y, z all positive.

Soln We Know that $l^2+m^2+n^2=1$

$$\cos^2 45° + \cos^2 45° + \cos^2 \gamma = 1$$

$$\left(\frac{1}{\sqrt{2}}\right)^2 + \left(\frac{1}{\sqrt{2}}\right)^2 + \cos^2\gamma = 1$$

$\cos^2\gamma = 0$ $\cos\gamma = 0$ $\cos 90° = 0$

$$\gamma = 90°$$

~~Numerator of to direction Ratio is direction to~~

Numerator of direction cosines are direction Ratio.

$l = \cos 45^\circ = 1/\sqrt{2}$

$m = \cos 45^\circ = 1/\sqrt{2}$

$n = \cos 90^\circ = 0/\sqrt{2}$

So, direction Ratios are –

(1, 1, 0) Ans