1.11.3

AI25BTECH11001 - ABHISEK MOHAPATRA

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Question:
If a line makes 60° and 45° angles with the positive directions of the X axis and Z axis respectively, then find the angle that it makes with the positive direction of the Y-axis. Hence, write the direction cosines of the lines.
Solution: From the given information,angles made with positive direction of X and Z axis are 45° and 60° respectively.
So, as we know,

$$cos^2(\alpha) + cos^2(\beta) + cos^2(\gamma) = 1 \tag{0.1}$$

Where α, β, γ are angles with the positive direction of X,Y,Z axes respectively.

Putting the values,

$$cos^2(45^\circ) + cos^2(60^\circ) + cos^2(\gamma) = 1 \tag{0.2}$$

$$\Rightarrow (\frac{1}{\sqrt{2}})^2 + (\frac{1}{2})^2 + cos^2(\gamma) = 1 \tag{0.3}$$

$$\Rightarrow (\frac{1}{2}) + (\frac{1}{4}) + cos^2(\gamma) = 1 \tag{0.4}$$

$$\Rightarrow cos^2(\gamma) = \frac{1}{4} \tag{0.5}$$

Rejecting the negative vales as we want the smaller angle,

$$\Rightarrow cos(\gamma) = \frac{1}{2} \tag{0.6}$$

$$\Rightarrow \gamma = 60^\circ \tag{0.7}$$

Therefore the angle with Y axis is 60°. And the direction cosines of the line is

$$\frac{1}{2} : \frac{1}{2} : \frac{1}{\sqrt{2}} \tag{0.8}$$