CHAPTER 1

# REVIEW OF CO-ORDINATES AND DIRECTION COSINES

## Some Formulae

(1) Distance between two points $(x_1, y_1, z_1)$ and $(x_2, y_2, z_2)$ is

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

(2) Coordinate of the point that divides the line joining the points $(x_1, y_1, z_1)$ and $(x_2, y_2, z_2)$ be,

(i) Internally in the ratio $m_1 : m_2$ then,

$$x = \frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \quad y = \frac{m_1y_2 + m_2y_1}{m_1 + m_2}, \quad z = \frac{m_1z_2 + m_2z_1}{m_1 + m_2}.$$

(ii) Externally in the ratio $m_1 : m_2$ then

$$x = \frac{m_1x_2 - m_2x_1}{m_1 + m_2}, \quad y = \frac{m_1y_2 - m_2y_1}{m_1 + m_2}, \quad z = \frac{m_1z_2 - m_2z_1}{m_1 + m_2}$$

(3) If a, b, c are direction ratios of a line then the directions cosines of the line are,

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

(4) If $l_1, m_1, n_1$ are direction cosines of a line and $l_2, m_2, n_2$ are direction cosines of second line and

(i) if q be the angle between the lines, then

$$\cos q = l_1l_2 + m_1m_2 + n_1n_2.$$

Or, equivalently, if $a_1, b_1, c_1$ are direction ratios of a line and $a_2, b_2, c_2$ are direction ratios of second line and if q be the angle between the lines, then

$$\cos q = \frac{a_1a_2 + b_1b_2 + c_1c_2}{\sqrt{(a_1^2 + b_1^2 + c_1^2)}\sqrt{(a_2^2 + b_2^2 + c_2^2)}}$$

(ii) if the lines are perpendicular to each other then

$l_1l_2 + m_1m_2 + n_1n_2 = 0$ OR, equivalently, $a_1a_2 + b_1b_2 + c_1c_2 = 0$.

(iii) if the lines are parallel then

$l_1 = l_2, m_1 = m_2, n_1 = n_2$ OR, equivalently, $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

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