

Class 11

Important Formulas

Introduction to Three dimensional Geometry

1. In three dimensions, the coordinate axes of a rectangular Cartesian coordinate system are three mutually perpendicular lines. The axes are called the x , y and z axes.
2. The three planes determined by the pair of axes are the coordinate planes. These planes are called xy , yz and zx planes and they divide the space into eight regions known as octants.
3. The coordinates of a point P in the space are the perpendicular distances from P on three mutually perpendicular coordinate planes YZ , ZX and XY respectively. The coordinates of a point P are written in the form of triplet like (x, y, z) .
4. The coordinates of a point are also the distances from the origin of the feet of the perpendiculars from the point on the respective coordinate axes.
5. The coordinates of any point on:
(i) x -axis are of the form $(x, 0, 0)$ (ii) y -axis are of the form $(0, y, 0)$
(iii) z -axis are of the form $(0, 0, z)$ (iv) xy -plane are of the form $(x, y, 0)$
(v) yz -plane are of the form $(0, y, z)$ (vi) zx - plane are of the form $(x, 0, z)$

6. The distance between two points $P(x_1, y_1, z_1)$ and $Q(x_2, y_2, z_2)$ is given by

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

7. The distance of a point $P(x, y, z)$ from the origin $O(0, 0, 0)$ is given by $OP = \sqrt{x^2 + y^2 + z^2}$.

8. The coordinates of the point R which divides the line segment joining two points $P(x_1, y_1, z_1)$ and $Q(x_2, y_2, z_2)$ internally and externally in the ratio $m:n$ are given by

$$\left(\frac{m x_2 + n x_1}{m + n}, \frac{m y_2 + n y_1}{m + n}, \frac{m z_2 + n z_1}{m + n} \right) \text{ and } \left(\frac{m x_2 - n x_1}{m - n}, \frac{m y_2 - n y_1}{m - n}, \frac{m z_2 - n z_1}{m - n} \right)$$

respectively.

9. The coordinates of the mid-point of the line segment joining two points (x_1, y_1, z_1) and (x_2, y_2, z_2) are $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}, \frac{z_1 + z_2}{2} \right)$.
10. The coordinates of the centroid of the triangle whose vertices are (x_1, y_1, z_1) , (x_2, y_2, z_2) and (x_3, y_3, z_3) are $\left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3}, \frac{z_1 + z_2 + z_3}{3} \right)$.