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 mutaually perpendicular coordinates 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 3 $OP = \sqrt{x^2 + y^2 + z^2}$.
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 $\left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3}, \frac{z_1 + z_2 + z_3}{3}\right)$.