3-D GEOMETRY

Fundamentals of 3-D Geometry

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

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

(2) $The\ co-ordinate\ of\ the\ point\ R\ which\ divides\ the\ join\ of\ the\ points$

$P(x_1, y_1, z_1)\ and\ Q(x_2, y_2, z_2)\ internally\ in\ the\ ratio\ m:n\ are$

$\left(\frac{mx_2 + nx_1}{m + n}, \frac{my_2 + ny_1}{m + n}, \frac{mz_2 + nz_1}{m + n}\right).$

(3) $The\ co-ordinate\ of\ the\ point\ R\ which\ divides\ the\ join\ of\ the\ points$

$P(x_1, y_1, z_1)\ and\ Q(x_2, y_2, z_2)\ externally\ in\ the\ ratio\ m:n\ are$

$\left(\frac{mx_2 - nx_1}{m - n}, \frac{my_2 - ny_1}{m - n}, \frac{mz_2 - nz_1}{m - n}\right).$

(4) $The\ co-ordinates\ of\ the\ mid\ point\ of\ PQ\ are$

$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}, \frac{z_1 + z_2}{2}\right).$

(5) $If\ A(x_1, y_1, z_1), B(x_2, y_2, z_2)\ and\ C(x_3, y_3, z_3)\ be\ the\ vertices\ of\ \Delta ABC,\ then\ the\ co-ordinates\ of\ the\ centroid\ G\ of\ \Delta ABC\ are$

$\left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3}, \frac{z_1 + z_2 + z_3}{3}\right).$

(6) (i) $Equation\ of\ XY-plane\ is\ z = 0.$

(ii) $Equation\ of\ YZ-plane\ is\ x = 0.$

(iii) $Equation\ of\ ZX-plane\ is\ y = 0.$

(7) (i) $If\ a\ point\ lies\ on\ XY-plane, then\ its\ co-ordinates\ are\ (x, y, 0).$

(ii) $If\ a\ point\ lies\ on\ YZ-plane, then\ its\ co-ordinates\ are\ (0, y, z).$

(iii) $If\ a\ point\ lies\ on\ ZX-plane, then\ its\ co-ordinates\ are\ (x, 0, z).$

(8) (i) $Direction\ cosines\ of\ X-axis\ are\ 1,0,0.$

(ii) $Direction\ cosines\ of\ Y-axis\ are\ 0,1,0.$

(iii) $Direction\ cosines\ of\ Z-axis\ are\ 0,0,1.$

(9) $If\ l, m, n\ be\ the\ direction\ cosines\ of\ any\ line,\ then\ l^2 + m^2 + n^2 = 1.$

(10) $l = \cos\alpha, m = \cos\beta, n = \cos\gamma.$

(11) $\cos^2\alpha + \cos^2\beta + \cos^2\gamma = 1.$

(12) $If\ a, b, c\ be\ three\ numbers\ proportional\ to\ the\ actual\ direction\ cosines$

$l, m, n\ of\ a\ straight\ line, then$