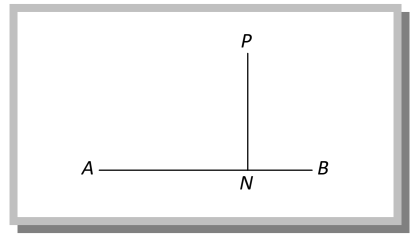
Projection.

(1) **Projection of a point on a line:** The projection of a point P on a line AB is the foot N of the perpendicular PN from P on the line AB.

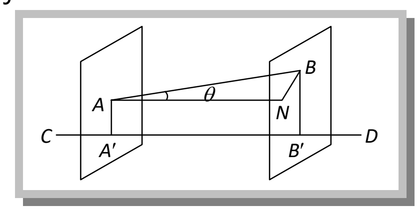
N is also the same point where the line AB meets the plane through P and perpendicular to AB.



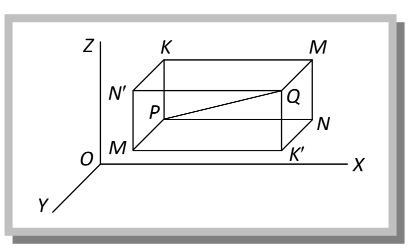
(2) **Projection of a segment of a line on another line and its length:** The projection of the segment AB of a given line on another line CD is the segment A′B′ of CD where A′ and B′ are the projections of the points A and B on the line CD.

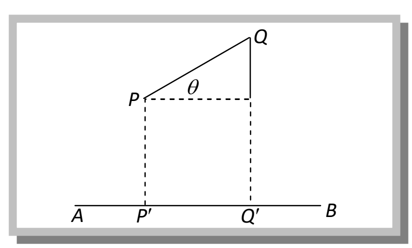
The length of the projection A′ B′.

$A'B' = AN = AB\cos\theta$



(3) **Projection of a line joining the points P(x_1, y_1, z_1) and Q(x_2, y_2, z_2) on another line whose direction cosines are l, m and n :** Let PQ be a line segment where $P \equiv (x_1, y_1, z_1)$ and $Q = (x_2, y_2, z_2)$ and AB be a given line with d.c.'s as l, m, n. If the line segment PQ makes angle θ with the line AB, then





Projection of PQ is P′Q′ = PQ cosθ $= (x_2 - x_1)\cos\alpha + (y_2 - y_1)\cos\beta + (z_2 - z_1)\cos\gamma$

$= (x_2 - x_1)l + (y_2 - y_1)m + (z_2 - z_1)n$

Important Tips

- For x-axis, $l = 1$, $m = 0$, $n = 0$.

Hence, projection of PQ on x-axis = $x_2 - x_1$, Projection of PQ on y-axis = $y_2 - y_1$ and Projection of PQ on z-axis = $z_2 - z_1$

- If P is a point (x_1, y_1, z_1), then projection of OP on a line whose direction cosines are l, m, n, is $l_1x_1 + m_1y_1 + n_1z_1$, where O is the origin.
- If l_1, m_1, n_1 and l_2, m_2, n_2 are the d.c.'s of two concurrent lines, then the d.c.'s of the lines bisecting the angles between them are proportional to $l_1 \pm l_2$, $m_1 \pm m_2$, $n_1 \pm n_2$.