EngineeringRise

Skew lines and the shortest distance

Formulas and units, JEE Main. Status: Reviewed on 2026-11-20.

Result	Formula	Units or note
Vector form of a line	r = a + t d Valid when: a is a point on the line, d its direction, t real	length
Common perpendicular direction	d1 x d2 Valid when: d1, d2 direction vectors; zero if lines are parallel	length^2
Shortest distance (skew lines)	|(a2 - a1) . (d1 x d2)|/|d1 x d2| Valid when: skew lines; d1 x d2 not zero	length
Cartesian determinant form	numerator = determinant of rows (x2 - x1, y2 - y1, z2 - z1), (a1, b1, c1), (a2, b2, c2) Valid when: cartesian lines with ratios (a1,b1,c1), (a2,b2,c2); skew	length^3
Lines intersect	(a2 - a1) . (d1 x d2) = 0 with d1 x d2 not zero Valid when: lines in space, not parallel; coplanar means they meet	length^3
Distance between parallel lines	|(a2 - a1) x d|/|d| Valid when: parallel lines with common direction d	length
Feet of the common perpendicular	PQ . d1 = 0 and PQ . d2 = 0 with P = a1 + s d1, Q = a2 + t d2 Valid when: skew lines; P on first, Q on second line	parameters s, t
Shortcut for perpendicular directions	d1 . d2 = 0 gives |d1 x d2| = |d1||d2| Valid when: d1 perpendicular to d2	length^2

Full lesson with worked examples:
https://www.engineeringrise.in/learn/learn/jee-main/mathematics/three-dimensional-geometry/skew-lines-and-the-shortest-distance

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