EngineeringRise

Frames of reference and vectors in motion

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

Result	Formula	Units or note
Components	A_x = A cos(theta); A_y = A sin(theta) Valid when: theta measured from the x-axis	same unit as A
Magnitude and direction	|A| = sqrt(A_x^2 + A_y^2); tan(theta) = A_y/A_x Valid when: components along perpendicular axes; add 180 degrees when A_x < 0 (quadrant)	same unit as A, dimensionless
Resultant of two vectors	R = sqrt(A^2 + B^2 + 2AB cos(theta)) Valid when: theta is the angle between the two vectors placed tail to tail	same unit as A
Equal vectors	R = 2A cos(theta/2) Valid when: two vectors of equal magnitude A, theta between them	same unit as A
Velocity and acceleration	v = dr/dt; a = dv/dt Valid when: any motion; r, v are vectors	m/s (m/s^2)
Change in velocity	Delta v = v_final - v_initial (vector) Valid when: any motion; vector difference, not difference of speeds	m/s
Moving frame	v in frame = v ground - V frame Valid when: frame moving at constant velocity, speeds far below light speed	m/s

Full lesson with worked examples:
https://www.engineeringrise.in/learn/learn/jee-main/physics/kinematics/frames-of-reference-and-vectors-in-motion

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