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Determinants and the area of a triangle

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

Result	Formula	Units or note
Order 2	det [[a,b],[c,d]] = ad - bc Valid when: 2 x 2 determinant	dimensionless
Cofactor	C(i,j) = (-1)^(i+j) M(i,j); det A = sum of a(i,j) C(i,j) along a row Valid when: square matrix; expand along any row or column	dimensionless
Transpose	det A^T = det A Valid when: any square matrix	dimensionless
Scalar multiple	det(kA) = k^n det A for n x n Valid when: n x n matrix, any scalar k	dimensionless
Product	det(AB) = det A x det B Valid when: square matrices of the same order	dimensionless
Row operation	R2 to R2 + c R1 leaves det unchanged; swapping rows flips sign Valid when: row operations on a determinant	dimensionless
Triangle area	Area = (1/2) |det of rows (x, y, 1)| Valid when: vertices given as (x, y) in a plane	square units of the axes
Collinearity	Points collinear if and only if the determinant with rows (x, y, 1) is 0 Valid when: three points in a plane	dimensionless
Vandermonde	rows (1, a, a^2), (1, b, b^2), (1, c, c^2) give (b - a)(c - a)(c - b) Valid when: rows of the form (1, a, a^2) for three numbers	dimensionless

Full lesson with worked examples:
https://www.engineeringrise.in/learn/learn/jee-main/mathematics/matrices-and-determinants/determinants-and-the-area-of-a-triangle

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