EngineeringRise

Functions, limits and standard limits

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

Result	Formula	Units or note
Sine and tangent	sin x/x -> 1 and tan x/x -> 1 as x -> 0 (x in radians) Valid when: x in radians, x tends to 0	dimensionless; x in radians
Cosine	(1 - cos x)/x^2 -> 1/2 as x -> 0 Valid when: x in radians, x tends to 0	dimensionless
Exponential	(e^x - 1)/x -> 1 and (a^x - 1)/x -> ln a as x -> 0 Valid when: x tends to 0; a > 0	dimensionless
Logarithm	ln(1 + x)/x -> 1 as x -> 0 Valid when: x tends to 0	dimensionless
The number e	(1 + x)^(1/x) -> e as x -> 0; (1 + k/x)^x -> e^k as x -> infinity Valid when: x tends to 0 (first form), x tends to infinity (second)	dimensionless
Power limit	(x^n - a^n)/(x - a) -> n a^(n-1) as x -> a; ((1 + x)^n - 1)/x -> n Valid when: n a real number; a not 0 for the first form	dimensionless
1 to the power infinity	limit = e^L, with L = limit of (base - 1) x (exponent) Valid when: base tends to 1 and exponent tends to infinity	dimensionless
Expansions near 0	sin x = x - x^3/6; cos x = 1 - x^2/2; tan x = x + x^3/3; e^x = 1 + x + x^2/2 Valid when: x near 0 and in radians; keep terms to the order needed	x in radians for the trigonometric forms

Full lesson with worked examples:
https://www.engineeringrise.in/learn/learn/jee-main/mathematics/limits-continuity-and-differentiability/functions-limits-and-standard-li

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