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Differentiation rules and derivatives of order two

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

Result	Formula	Units or note
Product rule	(u v)' = u' v + u v' Valid when: u and v differentiable at x	units of u times units of v, per unit of x
Quotient rule	(u/v)' = (u' v - u v')/v^2 Valid when: u and v differentiable, v not zero	units of u over units of v, per unit of x
Chain rule	d/dx f(g(x)) = f'(g(x)) x g'(x) Valid when: g differentiable at x and f differentiable at g(x)	units of f per unit of x
Inverse trigonometric	(sin^(-1) x)' = 1/sqrt(1 - x^2); (cos^(-1) x)' = -1/sqrt(1 - x^2); (tan^(-1) x)' = 1/(1 + x^2) Valid when: |x| < 1 for sin^(-1) and cos^(-1); x in radians	radians per unit of x
Exponential and logarithm	(a^x)' = a^x ln a; (e^x)' = e^x; (ln x)' = 1/x Valid when: x > 0 for ln x; a > 0 for a^x	per unit of x
Trigonometric	(sin x)' = cos x; (cos x)' = -sin x; (tan x)' = sec^2 x Valid when: x in radians	x in radians
Logarithmic differentiation	y = f^g => y' = y [g' ln f + g f'/f]; y = x^x => y' = x^x (1 + ln x) Valid when: f > 0 and f, g differentiable; x > 0 for x^x	not applicable
Second derivative	y double prime = d/dx (dy/dx); y = x^x => x^x [(1 + ln x)^2 + 1/x] Valid when: y differentiable twice; x > 0 for x^x	units of y per unit of x squared

Full lesson with worked examples:
https://www.engineeringrise.in/learn/learn/jee-main/mathematics/limits-continuity-and-differentiability/differentiation-rules-and-deriva

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