

Derivative Formulas

In the following, u and v are functions of x , and n , e , a , and k are constants.

$$1. f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

The Definition of the Derivative.

$$2. \frac{d}{dx}(k) = 0$$

The derivative of a constant is zero.

$$3. \frac{d}{dx}(k(u(x))) = k \frac{du}{dx}$$

The derivative of a constant times a function.

$$4. \frac{d}{dx}(u^n) = nu^{n-1} \frac{du}{dx}$$

The Power Rule (Variable raised to a constant).

$$5. \frac{d}{dx}(u+v) = \frac{du}{dx} + \frac{dv}{dx}$$

The Sum Rule.

$$6. \frac{d}{dx}(u-v) = \frac{du}{dx} - \frac{dv}{dx}$$

The Difference Rule.

$$7. \frac{d}{dx}(uv) = uv' + vu'$$

The Product Rule. $u'v + uv'$

$$8. \frac{d}{dx}\left(\frac{u}{v}\right) = \frac{vu' - uv'}{v^2}$$

The Quotient Rule. $\frac{u'v - uv'}{v^2}$

$$9. \frac{dy}{dx} = \frac{dy}{du} \frac{du}{dx}$$

The Chain Rule.

$$10. \frac{d}{dx}(f(g(x))) = f'(g(x))g'(x)$$
 Another Form of the Chain Rule.

$$11. \frac{d}{dx}(\sin u) = \cos u \frac{du}{dx}$$

The Derivative of the Sine.

$$12. \frac{d}{dx}(\cos u) = -\sin u \frac{du}{dx}$$

The Derivative of the Cosine.

$$13. \frac{d}{dx}(\tan u) = \sec^2 u \frac{du}{dx}$$

The Derivative of the Tangent.

14. $\frac{d}{dx}(\cot u) = -\csc^2 u \frac{du}{dx}$ The Derivative of the Cotangent.
15. $\frac{d}{dx}(\sec u) = \sec u \tan u \frac{du}{dx}$ The Derivative of the Secant.
16. $\frac{d}{dx}(\csc u) = -\csc u \cot u \frac{du}{dx}$ The Derivative of the Cosecant.
17. $\frac{d}{dx}(\sin^{-1} u) = \frac{1}{\sqrt{1-u^2}} \frac{du}{dx}$ The Derivative of the Inverse Sine.
18. $\frac{d}{dx}(\cos^{-1} u) = \frac{-1}{\sqrt{1-u^2}} \frac{du}{dx}$ The Derivative of the Inverse Cosine.
19. $\frac{d}{dx}(\tan^{-1} u) = \frac{1}{1+u^2} \frac{du}{dx}$ The Derivative of the Inverse Tangent.
20. $\frac{d}{dx}(\cot^{-1} u) = \frac{-1}{1+u^2} \frac{du}{dx}$ The Derivative of the Inverse Cotangent.
21. $\frac{d}{dx}(\sec^{-1} u) = \frac{1}{|u|\sqrt{u^2-1}} \frac{du}{dx}$ The Derivative of the Inverse Secant.
22. $\frac{d}{dx}(\csc^{-1} u) = \frac{-1}{|u|\sqrt{u^2-1}} \frac{du}{dx}$ The Derivative of the Inverse Cosecant.
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23. $\frac{d}{dx}(\ln u) = \frac{1}{u} \frac{du}{dx}$ The Derivative of the Natural Log.
24. $\frac{d}{dx}(\log_a u) = \frac{1}{u \ln a} \frac{du}{dx}$ The Derivative of the log to base a.
25. $\frac{d}{dx}(e^u) = e^u \frac{du}{dx}$ The Derivative of e raised to a variable.
26. $\frac{d}{dx}(a^u) = a^u \ln a \frac{du}{dx}$ The Derivative of a constant raised to a variable.