Derivative Formulas

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

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

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

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. $\frac{d}{dx}\left(\cot u\right) = -\csc^2 u \, \frac{du}{dx}$ The Derivative of the Cotangent.

15. $\frac{d}{dx}\left(\sec u\right) = \sec u \, \tan u \, \frac{du}{dx}$ The Derivative of the Secant.

16. $\frac{d}{dx}\left(\csc u\right) = -\csc u \, \cot u \, \frac{du}{dx}$ The Derivative of the Cosecant.

17. $\frac{d}{dx}\left(\mathrm{Sin}^{-1} u\right) = \frac{1}{\sqrt{1-u^2}} \, \frac{du}{dx}$ The Derivative of the Inverse Sine.

18. $\frac{d}{dx}\left(\mathrm{Cos}^{-1} u\right) = \frac{-1}{\sqrt{1-u^2}} \, \frac{du}{dx}$ The Derivative of the Inverse Cosine.

19. $\frac{d}{dx}\left(\mathrm{Tan}^{-1} u\right) = \frac{1}{1+u^2} \, \frac{du}{dx}$ The Derivative of the Inverse Tangent.

20. $\frac{d}{dx}\left(\mathrm{Cot}^{-1} u\right) = \frac{-1}{1+u^2} \, \frac{du}{dx}$ The Derivative of the Inverse Cotangent.

21. $\frac{d}{dx}\left(\mathrm{Sec}^{-1} u\right) = \frac{1}{|u|\sqrt{u^2-1}} \, \frac{du}{dx}$ The Derivative of the Inverse Secant.

22. $\frac{d}{dx}\left(\mathrm{Csc}^{-1} u\right) = \frac{-1}{|u|\sqrt{u^2-1}} \, \frac{du}{dx}$ The Derivative of the Inverse Cosecant.

23. $\frac{d}{dx}\left(\ln u\right) = \frac{1}{u} \, \frac{du}{dx}$ The Derivative of the Natural Log.

24. $\frac{d}{dx}\left(\log_a u\right) = \frac{1}{u \, \ln a} \, \frac{du}{dx}$ The Derivative of the log to base a.

25. $\frac{d}{dx}\left(e^u\right) = e^u \, \frac{du}{dx}$ The Derivative of e raised to a variable.

26. $\frac{d}{dx}\left(a^u\right) = a^u \ln a \, \frac{du}{dx}$ The Derivative of a constant raised to a variable.