## Derivative and Integral Formulas

**Derivative Formulas** $u$ and $v$ are functions of $x$; $c_1$ and $c_2$ are constants.

1. $\frac{d}{dx}(c_1u + c_2v) = c_1u' + c_2v'$ (Sum Rule)
2. $\frac{d}{dx}uv = uv' + vu'$ (Product Rule)
3. $\frac{d}{dx}\frac{u}{v} = \frac{vu' - uv'}{v^2}$ (Quotient Rule)
4. $\frac{dy}{dx} = \frac{dy}{du}\cdot\frac{du}{dx}$ (Chain Rule)
5. $\frac{d}{dx}u^n = nu^{n-1}\frac{du}{dx}$ (Power Rule)
6. $\frac{d}{dx}\ln u = \frac{1}{u}\frac{du}{dx}$
7. $\frac{d}{dx}e^u = e^u\frac{du}{dx}$
8. $\frac{d}{dx}b^u = b^u \ln b\frac{du}{dx}$
9. $\frac{d}{dx}\sin u = \cos u\frac{du}{dx}$
10. $\frac{d}{dx}\cos u = -\sin u\frac{du}{dx}$
11. $\frac{d}{dx}\tan u = \sec^2 u\frac{du}{dx}$
12. $\frac{d}{dx}\cot u = -\csc^2 u\frac{du}{dx}$
13. $\frac{d}{dx}\sec u = \sec u\tan u\frac{du}{dx}$
14. $\frac{d}{dx}\csc u = -\csc u\cot u\frac{du}{dx}$
15. $\frac{d}{dx}\sin^{-1}u = \frac{1}{\sqrt{1-u^2}}\frac{du}{dx}$
16. $\frac{d}{dx}\cos^{-1}u = \frac{-1}{\sqrt{1-u^2}}\frac{du}{dx}$
17. $\frac{d}{dx}\tan^{-1}u = \frac{1}{1+u^2}\frac{du}{dx}$
18. $\frac{d}{dx}\sec^{-1}u = \frac{1}{|u|\sqrt{u^2-1}}\frac{du}{dx}$
19. $\frac{d}{dx}\sinh u = \cosh u\frac{du}{dx}$
20. $\frac{d}{dx}\cosh u = \sinh u\frac{du}{dx}$
21. $\frac{d}{dx}\sinh^{-1}u = \frac{1}{\sqrt{u^2+1}}\frac{du}{dx}$
22. $\frac{d}{dx}\cosh^{-1}u = \frac{1}{\sqrt{u^2-1}}\frac{du}{dx}$
23. $\frac{d}{dx}\tanh^{-1}u = \frac{1}{1-u^2}\frac{du}{dx}, \quad |u| < 1$
24. $\frac{d}{dx}\coth^{-1}u = \frac{1}{1-u^2}\frac{du}{dx}, \quad |u| > 1$

**Integral Formulas** $u$ and $v$ are functions of $x$; $c_1$, $c_2$, $C$, and $a$ are constants.

1. $\int (c_1u + c_2v)\,dx = c_1\int u\,dx + c_2\int v\,dx$
2. $\int u\,dv = uv - \int v\,du$ (integration by parts)
3. $\int u^n\,du = \dfrac{u^{n+1}}{n+1} + C, n \neq -1$
4. $\int \dfrac{1}{u}\,du = \ln|u| + C$
5. $\int b^u\,du = \dfrac{b^u}{\ln b} + C$
6. $\int e^u\,du = e^u + C$
7. $\int \cos u\,du = \sin u + C$
8. $\int \sin u\,du = -\cos u + C$
9. $\int \sec^2 u\,du = \tan u + C$
10. $\int \csc^2 u\,du = -\cot u + C$
11. $\int \sec u \tan u\,du = \sec u + C$
12. $\int \csc u \cot u\,du = -\csc u + C$
13. $\int \dfrac{1}{\sqrt{a^2 - u^2}}\,du = \sin^{-1}\dfrac{u}{a} + C$
14. $\int \dfrac{1}{a^2 + u^2}\,du = \dfrac{1}{a}\tan^{-1}\dfrac{u}{a} + C$
15. $\int \cosh u\,du = \sinh u + C$
16. $\int \sinh u\,du = \cosh u + C$
17. $\int \dfrac{1}{\sqrt{u^2 + a^2}}\,du = \begin{cases} \sinh^{-1}\dfrac{u}{a} + C \\ \ln(u + \sqrt{u^2 + a^2}) + C \end{cases}$
18. $\int \dfrac{1}{\sqrt{u^2 - a^2}}\,du = \begin{cases} \cosh^{-1}\dfrac{u}{a} + C \\ \ln(u + \sqrt{u^2 - a^2}) + C \end{cases}$
19. $\int \dfrac{1}{a^2 - u^2}\,du = \begin{cases} \dfrac{1}{a}\tanh^{-1}\dfrac{u}{a} + C, |u| < a \\ \dfrac{1}{a}\coth^{-1}\dfrac{u}{a} + C, |u| > a \end{cases}$
20. $\int \dfrac{1}{a^2 - u^2}\,du = \dfrac{1}{2a}\ln\left|\dfrac{a+u}{a-u}\right| + C$
21. $\int \tan u\,du = -\ln|\cos u| + C$

**22.** $\int \cot u \, du = \ln|\sin u| + C$

**23.** $\int \sec u \, du = \ln|\sec u + \tan u| + C$

**24.** $\int \csc u \, du = \ln|\csc u - \cot u| + C$