▎Differentiation Rules

1. Constant: $\dfrac{d}{dx}c = 0$

2. Constant Multiple: $\dfrac{d}{dx}cf(x) = cf'(x)$

3. Sum: $\dfrac{d}{dx}[f(x) \pm g(x)] = f'(x) \pm g'(x)$

4. Product: $\dfrac{d}{dx}f(x)g(x) = f(x)g'(x) + g(x)f'(x)$

5. Quotient: $\dfrac{d}{dx}\dfrac{f(x)}{g(x)} = \dfrac{g(x)f'(x) - f(x)g'(x)}{[g(x)]^2}$

6. Chain: $\dfrac{d}{dx}f(g(x)) = f'(g(x))g'(x)$

7. Power: $\dfrac{d}{dx}x^n = nx^{n-1}$

8. Power: $\dfrac{d}{dx}[g(x)]^n = n[g(x)]^{n-1}g'(x)$

▎Derivatives of Functions

Trigonometric:

9. $\dfrac{d}{dx}\sin x = \cos x$

10. $\dfrac{d}{dx}\cos x = -\sin x$

11. $\dfrac{d}{dx}\tan x = \sec^2 x$

12. $\dfrac{d}{dx}\cot x = -\csc^2 x$

13. $\dfrac{d}{dx}\sec x = \sec x \tan x$

14. $\dfrac{d}{dx}\csc x = -\csc x \cot x$

Inverse trigonometric:

15. $\dfrac{d}{dx}\sin^{-1}x = \dfrac{1}{\sqrt{1-x^2}}$

16. $\dfrac{d}{dx}\cos^{-1}x = -\dfrac{1}{\sqrt{1-x^2}}$

17. $\dfrac{d}{dx}\tan^{-1}x = \dfrac{1}{1+x^2}$

18. $\dfrac{d}{dx}\cot^{-1}x = -\dfrac{1}{1+x^2}$

19. $\dfrac{d}{dx}\sec^{-1}x = \dfrac{1}{|x|\sqrt{x^2-1}}$

20. $\dfrac{d}{dx}\csc^{-1}x = -\dfrac{1}{|x|\sqrt{x^2-1}}$

Hyperbolic:

21. $\dfrac{d}{dx}\sinh x = \cosh x$

22. $\dfrac{d}{dx}\cosh x = \sinh x$

23. $\dfrac{d}{dx}\tanh x = \operatorname{sech}^2 x$

24. $\dfrac{d}{dx}\coth x = -\operatorname{csch}^2 x$

25. $\dfrac{d}{dx}\operatorname{sech} x = -\operatorname{sech} x \tanh x$

26. $\dfrac{d}{dx}\operatorname{csch} x = -\operatorname{csch} x \coth x$

Inverse hyperbolic:

27. $\dfrac{d}{dx}\sinh^{-1}x = \dfrac{1}{\sqrt{x^2+1}}$

28. $\dfrac{d}{dx}\cosh^{-1}x = \dfrac{1}{\sqrt{x^2-1}}$

29. $\dfrac{d}{dx}\tanh^{-1}x = \dfrac{1}{1-x^2}, |x| < 1$

30. $\dfrac{d}{dx}\coth^{-1}x = \dfrac{1}{1-x^2}, |x| > 1$

31. $\dfrac{d}{dx}\operatorname{sech}^{-1}x = -\dfrac{1}{x\sqrt{1-x^2}}$

32. $\dfrac{d}{dx}\operatorname{csch}^{-1}x = -\dfrac{1}{|x|\sqrt{x^2+1}}$

Exponential:

33. $\dfrac{d}{dx}e^x = e^x$

34. $\dfrac{d}{dx}b^x = b^x(\ln b)$

Logarithmic:

35. $\dfrac{d}{dx}\ln|x| = \dfrac{1}{x}$

36. $\dfrac{d}{dx}\log_b x = \dfrac{1}{x(\ln b)}$

Of an integral:

37. $\dfrac{d}{dx}\displaystyle\int_a^x g(t)\,dt = g(x)$

38. $\dfrac{d}{dx}\displaystyle\int_a^b g(x, t)\,dt = \int_a^b \dfrac{\partial}{\partial x}g(x, t)\,dt$

▎ Integration Formulas

1. $\displaystyle\int u^n\,du = \frac{u^{n+1}}{n+1} + C,\, n \neq -1$

2. $\displaystyle\int \frac{1}{u}\,du = \ln|u| + C$

3. $\displaystyle\int e^u\,du = e^u + C$

4. $\displaystyle\int b^u\,du = \frac{1}{\ln b}b^u + C$

5. $\displaystyle\int \sin u\,du = -\cos u + C$

6. $\displaystyle\int \cos u\,du = \sin u + C$

7. $\displaystyle\int \sec^2 u\,du = \tan u + C$

8. $\displaystyle\int \csc^2 u\,du = -\cot u + C$

9. $\displaystyle\int \sec u \tan u\,du = \sec u + C$

10. $\displaystyle\int \csc u \cot u\,du = -\csc u + C$

11. $\displaystyle\int \tan u\,du = -\ln|\cos u| + C$

12. $\displaystyle\int \cot u\,du = \ln|\sin u| + C$

13. $\displaystyle\int \sec u\,du = \ln|\sec u + \tan u| + C$

14. $\displaystyle\int \csc u\,du = \ln|\csc u - \cot u| + C$

15. $\displaystyle\int u \sin u\,du = \sin u - u \cos u + C$

16. $\displaystyle\int u \cos u\,du = \cos u + u \sin u + C$

17. $\displaystyle\int \sin^2 u\,du = \tfrac{1}{2}u - \tfrac{1}{4}\sin 2u + C$

18. $\displaystyle\int \cos^2 u\,du = \tfrac{1}{2}u + \tfrac{1}{4}\sin 2u + C$

19. $\displaystyle\int \sin au \sin bu\,du = \frac{\sin(a-b)u}{2(a-b)} - \frac{\sin(a+b)u}{2(a+b)} + C$

20. $\displaystyle\int \cos au \cos bu\,du = \frac{\sin(a-b)u}{2(a-b)} + \frac{\sin(a+b)u}{2(a+b)} + C$

21. $\displaystyle\int e^{au} \sin bu\,du = \frac{e^{au}}{a^2+b^2}(a \sin bu - b \cos bu) + C$

22. $\displaystyle\int e^{au} \cos bu\,du = \frac{e^{au}}{a^2+b^2}(a \cos bu + b \sin bu) + C$

23. $\displaystyle\int \sinh u\,du = \cosh u + C$

24. $\displaystyle\int \cosh u\,du = \sinh u + C$

25. $\displaystyle\int \operatorname{sech}^2 u\,du = \tanh u + C$

26. $\displaystyle\int \operatorname{csch}^2 u\,du = -\coth u + C$

27. $\displaystyle\int \tanh u\,du = \ln(\cosh u) + C$

28. $\displaystyle\int \coth u\,du = \ln|\sinh u| + C$

29. $\displaystyle\int \ln u\,du = u \ln u - u + C$

30. $\displaystyle\int u \ln u\,du = \tfrac{1}{2}u^2 \ln u - \tfrac{1}{4}u^2 + C$

31. $\displaystyle\int \frac{1}{\sqrt{a^2-u^2}}\,du = \sin^{-1}\frac{u}{a} + C$

32. $\displaystyle\int \frac{1}{\sqrt{a^2+u^2}}\,du = \ln\left|u + \sqrt{a^2+u^2}\right| + C$

33. $\displaystyle\int \sqrt{a^2-u^2}\,du = \frac{u}{2}\sqrt{a^2-u^2} + \frac{a^2}{2}\sin^{-1}\frac{u}{a} + C$

34. $\displaystyle\int \sqrt{a^2+u^2}\,du = \frac{u}{2}\sqrt{a^2+u^2} + \frac{a^2}{2}\ln\left|u + \sqrt{a^2+u^2}\right| + C$

35. $\displaystyle\int \frac{1}{a^2-u^2}\,du = \frac{1}{a}\ln\left|\frac{a+u}{a-u}\right| + C$

36. $\displaystyle\int \frac{1}{a^2+u^2}\,du = \frac{1}{a}\tan^{-1}\frac{u}{a} + C$

37. $\displaystyle\int \frac{1}{\sqrt{u^2-a^2}}\,du = \ln\left|u + \sqrt{u^2-a^2}\right| + C$

38. $\displaystyle\int \sqrt{u^2-a^2}\,du = \frac{u}{2}\sqrt{u^2-a^2} - \frac{a^2}{2}\ln\left|u + \sqrt{u^2-a^2}\right| + C$