

Calculus Cheat Sheet

$$1. \frac{d}{dx}(x^n) = nx^{n-1}$$

$$2. \frac{d}{dx}(fg) = fg' + gf'$$

$$3. \frac{d}{dx}\left(\frac{f}{g}\right) = \frac{gf' - fg'}{g^2}$$

$$4. \frac{d}{dx}f(g(x)) = f'(g(x))g'(x)$$

$$5. \frac{d}{dx}(\sin x) = \cos x$$

$$6. \frac{d}{dx}(\cos x) = -\sin x$$

$$7. \frac{d}{dx}(\tan x) = \sec^2 x$$

$$8. \frac{d}{dx}(\cot x) = -\csc^2 x$$

$$9. \frac{d}{dx}(\sec x) = \sec x \tan x$$

$$10. \frac{d}{dx}(\csc x) = -\csc x \cot x$$

$$11. \frac{d}{dx}(e^x) = e^x$$

$$12. \frac{d}{dx}(a^x) = a^x \ln a$$

$$13. \frac{d}{dx}(\ln x) = \frac{1}{x}$$

$$14. \frac{d}{dx}(\text{Arc sin } x) = \frac{1}{\sqrt{1-x^2}}$$

$$15. \frac{d}{dx}(\text{Arc tan } x) = \frac{1}{1+x^2}$$

$$16. \frac{d}{dx}(\text{Arc sec } x) = \frac{1}{|x|\sqrt{x^2-1}}$$

$$17. \frac{d}{dx}(\text{Arccos } x) = \frac{-1}{\sqrt{1-x^2}}$$

$$18. \frac{d}{dx}(\text{Arccsc } x) = \frac{-1}{x\sqrt{x^2-1}}$$

$$19. \frac{d}{dx}(\text{Arccot } x) = \frac{-1}{1+x^2}$$

$$18. \frac{d}{dx}(\sinh x) = \cosh x$$

$$19. \frac{d}{dx}(\cosh x) = \sinh x$$

$$20. \frac{d}{dx}(\tanh x) = \text{sech}^2 x$$

$$21. \frac{d}{dx}(\coth x) = -\text{csch}^2 x$$

$$22. \frac{d}{dx}(\text{sech } x) = -\text{sech } x \tanh x$$

$$23. \frac{d}{dx}(\text{csch } x) = -\text{csch } x \coth x$$

$$24. \frac{d}{dx}(\sinh^{-1} x) = \frac{1}{\sqrt{1+x^2}}$$

$$25. \frac{d}{dx}(\cosh^{-1} x) = \frac{1}{\sqrt{x^2-1}}, x > 1$$

$$26. \frac{d}{dx}(\tanh^{-1} x) = \frac{1}{1-x^2}, |x| < 1$$

$$27. \frac{d}{dx}(\coth^{-1} x) = \frac{-1}{1-x^2}, x^2 > 1$$

$$28. \frac{d}{dx}(\text{sech}^{-1} x) = \frac{-1}{\pm x^2 \sqrt{1-x^2}}, 0 < x < 1$$

$$29. \frac{d}{dx}(\text{csch}^{-1} x) = \frac{-1}{x^2 \sqrt{1+\frac{1}{x^2}}}, x^2 > 0$$

$$30. \frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx} \quad \text{Chain Rule}$$

1. $\int a \, dx = ax + C$
2. $\int x^n \, dx = \frac{x^{n+1}}{n+1} + C, \quad n \neq -1$
3. $\int \frac{1}{x} \, dx = \ln|x| + C$
4. $\int e^x \, dx = e^x + C$
5. $\int a^x \, dx = \frac{a^x}{\ln a} + C$
6. $\int \ln x \, dx = x \ln x - x + C$
7. $\int \sin x \, dx = -\cos x + C$
8. $\int \cos x \, dx = \sin x + C$
9. $\int \tan x \, dx = \ln|\sec x| + C$ or $-\ln|\cos x| + C$
10. $\int \cot x \, dx = \ln|\sin x| + C$
11. $\int \sec x \, dx = \ln|\sec x + \tan x| + C$
12. $\int \csc x \, dx = \ln|\csc x - \cot x| + C$
13. $\int \sec^2 x \, dx = \tan x + C$
14. $\int \sec x \tan x \, dx = \sec x + C$
15. $\int \csc^2 x \, dx = -\cot x + C$
16. $\int \csc x \cot x \, dx = -\csc x + C$
17. $\int \tan^2 x \, dx = \tan x - x + C$
18. $\int \frac{dx}{a^2 + x^2} = \frac{1}{a} \operatorname{Arctan} \left(\frac{x}{a} \right) + C$
19. $\int \frac{dx}{\sqrt{a^2 - x^2}} = \operatorname{Arcsin} \left(\frac{x}{a} \right) + C$
20. $\int \frac{dx}{x\sqrt{x^2 - a^2}} = \frac{1}{a} \operatorname{Arcsec} \frac{|x|}{a} + C = \frac{1}{a} \operatorname{Arcos} \left| \frac{a}{x} \right| + C$
21. $\int fg' = fg - \int f'g$
23. $\int \sinh x \, dx = \cosh x$
24. $\int \cosh x \, dx = \sinh x$
25. $\int \tanh x \, dx = \ln(\cosh x)$
26. $\int \coth x \, dx = \ln(\sinh x)$
27. $\int \operatorname{sech} x \, dx = \operatorname{Arc tan}(\sinh x)$
28. $\int \operatorname{csch} x \, dx = \operatorname{Arc tan}(\cosh x)$
29. $\int \frac{dx}{\sqrt{x^2 + a^2}} = \sinh^{-1} \frac{x}{a} + C$
30. $\int \frac{dx}{\sqrt{x^2 - a^2}} = \cosh^{-1} \frac{x}{a} + C$
31. $\int \frac{dx}{a^2 - x^2} = \frac{1}{a} \tanh^{-1} \frac{x}{a} + C$
32. $\int \frac{dx}{x^2 - a^2} = -\frac{1}{a} \coth^{-1} \frac{x}{a} + C$
33. $\int \frac{dx}{x\sqrt{a^2 - x^2}} = -\frac{1}{a} \operatorname{sech}^{-1} \frac{x}{a} + C$
34. $\int \frac{dx}{x\sqrt{x^2 + a^2}} = -\frac{1}{a} \operatorname{csch}^{-1} \frac{x}{a} + C$
35. $\int \operatorname{Arc tan} x \, dx = x \operatorname{Arctan} x - \frac{1}{2} \ln \sqrt{1 + x^2}$
36. $\int \operatorname{Arc cot} x \, dx = x \operatorname{Arctan} x + \frac{1}{2} \ln \sqrt{1 + x^2}$
37. $\int \operatorname{Arc sin} x \, dx = x \operatorname{Arcsin} x + \sqrt{1 - x^2}$
38. $\int \operatorname{Arc cos} x \, dx = x \operatorname{Arccos} x - \sqrt{1 - x^2}$
39. $\int \operatorname{Arcsec} x \, dx = x \operatorname{Arcsec} x - \ln(x + \sqrt{x^2 - 1})$
40. $\int \operatorname{Arc csc} x \, dx = x \operatorname{Arc csc} x + \ln(x + \sqrt{x^2 - 1})$
41. $\int \sinh^{-1} x \, dx = x \sinh^{-1} x - \sqrt{1 + x^2}$
42. $\int \cosh^{-1} x \, dx = x \cosh^{-1} x - \sqrt{x^2 - 1}$
43. $\int \tanh^{-1} x \, dx = x \tanh^{-1} x + \frac{1}{2} \ln(1 - x^2)$
44. $\int \coth^{-1} x \, dx = x \coth^{-1} x + \frac{1}{2} \ln(x^2 - 1)$

Some Reduction Formulae

- $\int \sin^n ax \, dx = \frac{\sin^{n-1} ax \cos ax}{na} + \frac{n-1}{n} \int \sin^{n-2} ax \, dx$
- $\int \cos^n ax \, dx = \frac{\cos^{n-1} ax \sin ax}{na} + \frac{n-1}{n} \int \cos^{n-2} ax \, dx$
- $\int \sec^n ax \, dx = \frac{1}{n-1} \sec^{n-2} x \tan x + \frac{n-2}{n-1} \int \sec^{n-2} ax \, dx$
- $\int \tan^n ax \, dx = \frac{\tan^{n-1} ax}{a(n-1)} - \int \tan^{n-2} ax \, dx, \quad n \neq 1$
- 45. $\int \operatorname{sech}^{-1} x \, dx = x \operatorname{sech}^{-1} x - \operatorname{Arc tan} \left(\frac{x \sqrt{\frac{1-x}{1+x}}}{x-1} \right)$
- 46. $\int \operatorname{csch}^{-1} x \, dx = x \operatorname{csch}^{-1} x + \ln \left(x \left(\sqrt{\frac{x^2+1}{x^2}} + 1 \right) \right)$