Calculus Cheat Sheet

1. $\frac{d}{dx}(x^n) = nx^{n-1}$
2. $\frac{d}{dx}(fg) = fg' + gf'$
3. $\frac{d}{dx}(\frac{f}{g}) = \frac{gf' - fg'}{g^2}$
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. $\frac{d}{dx}(Arc\sin x) = \frac{1}{\sqrt{1-x^2}}$
15. $\frac{d}{dx}(Arc\tan x) = \frac{1}{1+x^2}$
16. $\frac{d}{dx}(Arc\sec x) = \frac{1}{|x|\sqrt{x^2-1}}$
17. $\frac{d}{dx}(Arc\cos x) = \frac{-1}{\sqrt{1-x^2}}$
18. $\frac{d}{dx}(Arc\csc x) = \frac{-1}{x\sqrt{x^2-1}}$
19. $\frac{d}{dx}(Arc\cot x) = \frac{-1}{1+x^2}$

18. $\frac{d}{dx}(\sinh x) = \cosh x$
19. $\frac{d}{dx}(\cosh x) = \sinh x$
20. $\frac{d}{dx}(\tanh x) = \operatorname{sech}^2 x$
21. $\frac{d}{dx}(\coth x) = -\operatorname{csch}^2 x$
22. $\frac{d}{dx}(\operatorname{sech} x) = -\operatorname{sec}\text{h}x \tanh x$
23. $\frac{d}{dx}(\operatorname{csch} x) = -\operatorname{csc}\text{h}x \coth x$
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. $\frac{d}{dx}(\operatorname{sech}^{-1} x) = \frac{-1}{\pm x^2\sqrt{1-x^2}}, 0 < x < 1$
29. $\frac{d}{dx}(\operatorname{csch}^{-1} x) = \frac{-1}{x^2\sqrt{1+\frac{1}{x^2}}}, x^2 > 0$
30. $\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$ *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. $\int \frac{dx}{a^2 + x^2} = \frac{1}{a} Arc\tan\left(\frac{x}{a}\right) + C$

19. $\int \frac{dx}{\sqrt{a^2 - x^2}} = Arc\sin\left(\frac{x}{a}\right) + C$

20. $\int \frac{dx}{x\sqrt{x^2 - a^2}} = \frac{1}{a} Arc\sec\frac{|x|}{a} + C = \frac{1}{a} Arc\cos\left|\frac{a}{x}\right| + C$

21. $\int fg' = fg - \int f'g$

$$\int \sin^2 x\,dx = \frac{1}{2}x - \frac{1}{4}\sin 2x + C$$

$$\int \cos^2 x\,dx = \frac{1}{2}x + \frac{1}{4}\sin 2x + C$$

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. $\int \operatorname{sech} x\,dx = Arc\tan(\sinh x)$

28. $\int \operatorname{csch} x\,dx = Arc\tan(\cosh x)$

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. $\int Arc\tan x\,dx = x\ Arc\tan x - \frac{1}{2}\ln\sqrt{1 + x^2}$

36. $\int Arc\cot x\,dx = x\ Arc\tan x + \frac{1}{2}\ln\sqrt{1 + x^2}$

37. $\int Arc\sin x\,dx = x\ Arc\sin x + \sqrt{1 - x^2}$

38. $\int Arc\cos x\,dx = x\ Arc\cos x - \sqrt{1 - x^2}$

39. $\int Arc\sec x\,dx = x\ Arc\sec x - \ln\left(x + \sqrt{x^2 - 1}\right)$

40. $\int Arc\csc x\,dx = x\ Arc\csc x + \ln\left(x + \sqrt{x^2 - 1}\right)$

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. $\int \coth^{-1} x\,dx = x\coth^{-1} x + \frac{1}{2}\ln(x^2 - 1)$

45. $\int \operatorname{sech}^{-1} x\,dx = x\operatorname{sech}^{-1} x - Arc\tan\left(\frac{x\sqrt{\frac{1-x}{1+x}}}{x-1}\right)$

46. $\int \operatorname{csch}^{-1} x\,dx = x\operatorname{csch}^{-1} x + \ln\left(x\left(\sqrt{\frac{x^2+1}{x^2}} + 1\right)\right)$