
Differentiation

1. $\frac{d}{dx}(C) = 0$
2. $\frac{d}{dx}x^n = nx^{n-1}$
3. $\frac{d}{dx}e^x = e^x$
4. $\frac{d}{dx}a^x = a^x \log_e a$
5. $\frac{d}{dx} \log_e x = \frac{1}{x}$
6. $\frac{d}{dx} \log_a x = \frac{1}{x \log_e a}$
7. $\frac{d}{dx} \sin x = \cos x$
8. $\frac{d}{dx} \cos x = -\sin x$
9. $\frac{d}{dx} \tan x = \sec^2 x$
10. $\frac{d}{dx} \cot x = -\operatorname{cosec}^2 x$
11. $\frac{d}{dx} \sec x = \sec x \tan x$
12. $\frac{d}{dx} \operatorname{cosec} x = -\operatorname{cosec} x \cot x$
13. $\frac{d}{dx} \sin^{-1} x = \frac{1}{\sqrt{1-x^2}}$
14. $\frac{d}{dx} \cos^{-1} x = \frac{-1}{\sqrt{1-x^2}}$
15. $\frac{d}{dx} \tan^{-1} x = \frac{1}{1+x^2}$
16. $\frac{d}{dx} \cot^{-1} x = -\frac{1}{1+x^2}$
17. $\frac{d}{dx} \sec^{-1} x = \frac{1}{x\sqrt{x^2-1}}$

Integration

1. $\int C dx = Cx + C$
2. $\int x^n dx = \frac{x^{n+1}}{n+1} + C$
3. $\int e^x dx = e^x + C$
4. $\int a^x dx = \frac{a^x}{\log_e a} + C$
5. $\int \frac{1}{x} dx = \log|x| + C$
6. $\int \sin x dx = -\cos x + C$
7. $\int \cos x dx = \sin x + C$
8. $\int \sec^2 x dx = \tan x + C$
9. $\int \operatorname{cosec}^2 x dx = -\cot x + C$
10. $\int \sec x \tan x dx = \sec x + C$
11. $\int \operatorname{cosec} x \cot x dx = -\operatorname{cosec} x + C$
12. $\int \tan x dx = \log|\sec x| + C$
13. $\int \sec x dx = \log|\sec x + \tan x| + C$
14. $\int \operatorname{cosec} x dx = \log|\operatorname{cosec} x - \cot x| + C$
15. $\int \frac{dx}{\sqrt{a^2-x^2}} = \sin^{-1}\left(\frac{x}{a}\right) + C$
16. $\int \frac{dx}{x^2+a^2} = \frac{1}{a} \tan^{-1} \frac{x}{a} + C$
17. $\int \frac{dx}{x\sqrt{x^2-a^2}} = \frac{1}{a} \sec^{-1} \frac{x}{a} + C$

$$18. \frac{d}{dx} \operatorname{cosec}^{-1} x = \frac{-1}{x\sqrt{x^2-1}}$$

$$19. \frac{d}{dx} \sqrt{x} = \frac{1}{2\sqrt{x}}$$

$$20. \frac{d}{dx} x^x = x^x (1 + \log x)$$

$$21. \text{ If } y = \sqrt{f(x) + \sqrt{f(x) + \sqrt{f(x) + \dots \infty}}} \frac{dy}{dx} = \frac{f'(x)}{2y-1}$$

$$22. \frac{d}{dx} [f(x)]^{f(x)} = [f(x)]^{f(x)} [1 + \log f(x)] f'(x)$$

$$23. \frac{d}{dx} [f(x)]^{g(x)} = [f(x)]^{g(x)} \left[g(x) \frac{f'(x)}{f(x)} + g'(x) \log f(x) \right]$$

$$24. \text{ If } y = [f(x)]^y \text{ then } \frac{dy}{dx} = \frac{y^2 f'(x)}{f(x)(1 - \log y)}$$

$$25. x^m y^n = (x+y)^{m+n} \text{ then } \frac{dy}{dx} = \frac{y}{x}$$

$$26. \frac{d}{dx} (U.V) = U \frac{dv}{dx} + V \frac{du}{dx}$$

$$27. \frac{d}{dx} \left(\frac{U}{V} \right) = \frac{V \frac{d}{dx} U - U \frac{d}{dx} V}{V^2}$$

$$18. \int \frac{dx}{x^2 - a^2} = \frac{1}{2a} \log \left| \frac{x-a}{x+a} \right| + C$$

$$19. \int \frac{dx}{a^2 - x^2} = \frac{1}{2a} \log \left| \frac{a+x}{a-x} \right| + C$$

$$20. \int \frac{dx}{\sqrt{a^2 + x^2}} = \log \left| x + \sqrt{a^2 + x^2} \right| + C$$

$$21. \int \frac{dx}{\sqrt{x^2 - a^2}} = \log \left| x + \sqrt{x^2 - a^2} \right| + C$$

$$22. \int \sqrt{a^2 - x^2} dx = \frac{x}{2} \sqrt{a^2 - x^2} + \frac{a^2}{2} \sin^{-1} \frac{x}{a} + C$$

$$23. \int \sqrt{a^2 + x^2} dx = \frac{x}{2} \sqrt{a^2 + x^2} + \frac{a^2}{2} \log \left| x + \sqrt{a^2 + x^2} \right| + C$$

$$24. \int \sqrt{x^2 - a^2} dx = \frac{x}{2} \sqrt{x^2 - a^2} - \frac{a^2}{2} \log \left| x + \sqrt{x^2 - a^2} \right| + C$$

$$25. \int U.V dx = U \int V dx - \left[\frac{d}{dx} U \int V dx \right] dx$$

$$26. \int e^x [f(x) + f'(x)] dx = e^x f(x) + C$$

Some Important Standard Substitutions

$$1. x^2 + a^2 \text{ or } \sqrt{x^2 + a^2}$$

Put $x = a \tan \theta$ or $a \cot \theta$

$$2. x^2 - a^2 \text{ or } \sqrt{x^2 - a^2}$$

Put $x = a \sec \theta$ or $a \operatorname{cosec} \theta$

$$3. a^2 - x^2 \text{ or } \sqrt{a^2 - x^2}$$

Put $x = a \sin \theta$ or $a \cos \theta$

$$4. \sqrt{a+x} \text{ and } \sqrt{a-x} \text{ both are present then}$$

Put $x = a \operatorname{cosec} \theta$