1 Derivative rules

1.1 Constant Rule

$$\frac{\mathrm{d}}{\mathrm{d}x}c = 0$$

1.2 Constant Multiple Rule

$$\frac{\mathrm{d}}{\mathrm{d}x}[cf(x)] = cf'(x)$$

1.3 Power Rule

$$\frac{\mathrm{d}}{\mathrm{d}x}\left(x^n\right) = nx^{n-1}$$

1.4 Sum Rule

$$\frac{\mathrm{d}}{\mathrm{d}x}[f(x) + g(x)] = f'(x) + g'(x)$$

1.5 Difference Rule

$$\frac{\mathrm{d}}{\mathrm{d}x}[f(x) - g(x)] = f'(x) - g'(x)$$

1.6 Product Rule

$$\frac{\mathrm{d}}{\mathrm{d}x}[f(x)g(x)] = f(x)g'(x) + g(x)f'(x)$$

1.7 Quotient Rule

$$\frac{\mathrm{d}}{\mathrm{d}x}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x)f'(x) - f(x)g'(x)}{g(x)^2}$$

1.8 Chain Rule

$$\frac{\mathrm{d}}{\mathrm{d}x}f(g(x)) = f'(g(x))g'(x)$$

2 Integration Rules

1 Known Derivatives

1. $\dfrac{\mathrm{d}}{\mathrm{d}x}k = 0$
2. $\dfrac{\mathrm{d}}{\mathrm{d}x}x = 1$
3. $\dfrac{\mathrm{d}}{\mathrm{d}x}x^2 = 2x$
4. $\dfrac{\mathrm{d}}{\mathrm{d}x}x^3 = 3x^2$
5. $\dfrac{\mathrm{d}}{\mathrm{d}x}x^n = nx^{n-1}$
6. $\dfrac{\mathrm{d}}{\mathrm{d}x}e^x = e^x$
7. $\dfrac{\mathrm{d}}{\mathrm{d}x}e^{kx} = ke^{kx}$
8. $\dfrac{\mathrm{d}}{\mathrm{d}x}\ln(x) = \dfrac{\mathrm{d}}{\mathrm{d}x}\log_e(x) = \dfrac{1}{x}$
9. $\dfrac{\mathrm{d}}{\mathrm{d}x}\sin x = \cos x$
10. $\dfrac{\mathrm{d}}{\mathrm{d}x}\cos x = -\sin x$
11. $\dfrac{\mathrm{d}}{\mathrm{d}x}\cos kx = -k\sin kx$
12. $\dfrac{\mathrm{d}}{\mathrm{d}x}\tan x = \dfrac{\mathrm{d}}{\mathrm{d}x}\dfrac{\sin x}{\cos x} = \sec^2 x$
13. $\dfrac{\mathrm{d}}{\mathrm{d}x}\tan kx = k\sec^2 kx$
14. $\dfrac{\mathrm{d}}{\mathrm{d}x}\csc x = \dfrac{\mathrm{d}}{\mathrm{d}x}\dfrac{1}{\sin x} = -\csc x\cot x$
15. $\dfrac{\mathrm{d}}{\mathrm{d}x}\sec x = \dfrac{\mathrm{d}}{\mathrm{d}x} = \sec x\tan x$
16. $\dfrac{\mathrm{d}}{\mathrm{d}x}\cot x = \dfrac{\cos x}{\sin x} = -\csc^2 x$
17. $\dfrac{\mathrm{d}}{\mathrm{d}x}\arcsin x = \dfrac{1}{\sqrt{1-x^2}}$
18. $\dfrac{\mathrm{d}}{\mathrm{d}x}\arccos x = -\dfrac{1}{\sqrt{1-x^2}}$
19. $\dfrac{\mathrm{d}}{\mathrm{d}x}\arctan x = \dfrac{1}{1+x^2}$
20. $\dfrac{\mathrm{d}}{\mathrm{d}x}\operatorname{arcsec} x = \dfrac{1}{|x|\sqrt{x^2-1}}$
21. $\dfrac{\mathrm{d}}{\mathrm{d}x}\operatorname{arccsc} x = \dfrac{-1}{|x|\sqrt{x^2-1}}$
22. $\dfrac{\mathrm{d}}{\mathrm{d}x}\operatorname{arccot} x = \dfrac{-1}{1+x^2}$

2 Known Integrals

1. $\displaystyle\int [af(x)+bg(x)]\,\mathrm{d}x = a\int f(x)\ \mathrm{d}x + b\int g(x)\ \mathrm{d}x\ +\ C$
2. $\displaystyle\int [f(x)+g(x)]\,\mathrm{d}x = \int f(x)\ \mathrm{d}x + \int g(x)\ \mathrm{d}x\ +\ C$
3. $\displaystyle\int [f(x)-g(x)]\,\mathrm{d}x = \int f(x)\ \mathrm{d}x - \int g(x)\ \mathrm{d}x\ +\ C$
4. $\displaystyle\int af(x)\,\mathrm{d}x = a\int f(x)\ \mathrm{d}x\ +\ C$
5. $\displaystyle\int u(x)v'(x)\,\mathrm{d}x = u(x)v(x) - \int u'(x)v(x)\ \mathrm{d}x\ +\ C$
6. $\displaystyle\int f\big(y(x)\big)y'(x)\,\mathrm{d}x = F\big(y(x)\big)$
   where $\displaystyle F(y) = \int f(y)\ \mathrm{d}y$
7. $\displaystyle\int a\,\mathrm{d}x = ax\ +\ C$
8. $\displaystyle\int x^a\,\mathrm{d}x = \frac{x^{a+1}}{a+1} + C$ if $a \neq -1$
9. $\displaystyle\int \frac{1}{x}\,\mathrm{d}x = \ln|x| + C$
10. $\displaystyle\int [g(x)^a g'(x)]\,\mathrm{d}x = \frac{g(x)^{a+1}}{a+1} + C$ if $a \neq -1$
11. $\displaystyle\int \sin x\,\mathrm{d}x = -\cos x + C$
12. $\displaystyle\int \cos x\,\mathrm{d}x = \sin x + C$
13. $\displaystyle\int \tan x\,\mathrm{d}x = \ln|\sec x| + C$
14. $\displaystyle\int g'(x)\sin g(x)x\,\mathrm{d}x = -\cos g(x) + C$
15. $\displaystyle\int \csc x\,\mathrm{d}x = \ln|\csc x - \cot x| + C$
16. $\displaystyle\int \sec x\,\mathrm{d}x = \ln|\sec x + \tan x| + C$
17. $\displaystyle\int \cot x\,\mathrm{d}x = \ln|\sin x| + C$
18. $\displaystyle\int \sec^2 x\,\mathrm{d}x = \tan x + C$
19. $\displaystyle\int \csc^2 x\,\mathrm{d}x = -\cot x + C$
20. $\displaystyle\int \sec x\tan x\,\mathrm{d}x = \sec x + C$
21. $\displaystyle\int \csc x\cot x\,\mathrm{d}x = -\csc x + C$
22. $\displaystyle\int e^x\,\mathrm{d}x = e^x + C$
23. $\displaystyle\int e^{g(x)}g'(x)\,\mathrm{d}x = e^{g(x)} + C$

24. $\int e^{ax} x \,\mathrm{d} = \frac{1}{a}\ e^{ax} + C$

25. $\int a^x \,\mathrm{d}x = \frac{1}{\ln a}\ a^x + C$

26. $\int \ln x \,\mathrm{d}x = x \ln x - x + C$

27. $\int \frac{1}{\sqrt{1 - x^2}} \,\mathrm{d}x = \arcsin x + C$

28. $\int \frac{g'(x)}{\sqrt{1 - g(x)^2}} \,\mathrm{d}x = \arcsin g(x) + C$

29. $\int \frac{1}{\sqrt{a^2 - x^2}} \,\mathrm{d}x = \arcsin \frac{x}{a} + C$

30. $\int \frac{1}{1 + x^2} \,\mathrm{d}x = \arctan x + C$

31. $\int \frac{g'(x)}{1 + g(x)^2} \,\mathrm{d}x = \arctan g(x) + C$

32. $\int \frac{1}{a^2 + x^2} \,\mathrm{d}x = \frac{1}{a} \arctan \frac{x}{a} + C$

33. $\int \frac{1}{x\sqrt{x^2 - 1}} \,\mathrm{d}x = \operatorname{arcsec} x + C \text{ for } x > 1$

1 Pythagoean Identities

$\sin^2\theta + \cos^2\theta = 1$ $\quad \sec^2\theta = 1 + \tan^2\theta$ $\quad \csc^2\theta = 1 + \cot^2\theta$

2 Cofunction Identities

$\sin\theta = \cos\left(\frac{\pi}{2} - \theta\right)$ $\quad \sec\theta = \csc\left(\frac{\pi}{2} - \theta\right)$ $\quad \tan\theta = \cot\left(\frac{\pi}{2} - \theta\right)$

$\cos\theta = \sin\left(\frac{\pi}{2} - \theta\right)$ $\quad \csc\theta = \sec\left(\frac{\pi}{2} - \theta\right)$ $\quad \cot\theta = \tan\left(\frac{\pi}{2} - \theta\right)$

3 Even Odd Identities

$\sin(-\theta) = -\sin\theta$ $\quad \tan(-\theta) = -\tan\theta$ $\quad \cos(-\theta) = \cos\theta$

$\csc(-\theta) = -\csc\theta$ $\quad \cot(-\theta) = -\cot\theta$ $\quad \sec(-\theta) = \sec\theta$

4 Supplement Angle Identities

$\sin(\pi - \theta) = \sin\theta$ $\quad \cos(\pi - \theta) = -\cos\theta$ $\quad \tan(\pi - \theta) = -\tan\theta$

$\csc(\pi - \theta) = \csc\theta$ $\quad \sec(\pi - \theta) = -\sec\theta$ $\quad \cot(\pi - \theta) = -\cot\theta$

$\sin(\pi + \theta) = -\sin\theta$ $\quad \cos(\pi + \theta) = -\cos\theta$ $\quad \tan(\pi + \theta) = \tan\theta$

$\csc(\pi + \theta) = -\csc\theta$ $\quad \sec(\pi + \theta) = -\sec\theta$ $\quad \cot(\pi + \theta) = \cot\theta$

5 Addition and Subtraction Identities

$\sin(A + B) = \sin A\cos B + \cos A\sin B$

$\cos(A + B) = \cos A\cos B - \sin A\sin B$

$$\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A\ tanB}$$

$\sin(A - B) = \sin A\cos B - \cos A\sin B$

$\cos(A - B) = \cos A\cos B + \sin A\sin B$

$$\tan(A - B) = \frac{\tan A - \tan B}{1 + \tan A\ tanB}$$

6 Double-Angle Identities

$\sin(2\theta) = 2\sin\theta\cos\theta$ $\quad \cos(2\theta) = 1 - 2\sin^2\theta$

$\cos(2\theta) = \cos^2\theta - \sin^2\theta$ $\quad \cos(2\theta) = 2\cos^2\theta - 1$

$$\tan(2\theta) = \frac{2\tan\theta}{1 - \tan^2\theta}$$