

DIFFERENTIATION FORMULAE:

1. $\frac{d}{dx} \text{Constant} = 0$

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

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

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

5. $\frac{d}{dx}e^x = e^x$

6. $\frac{d}{dx}a^x = a^x \log a$

7. $\frac{d}{dx}\log x = \frac{1}{x}$

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

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

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

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

12. $\frac{d}{dx}\cot x = -\operatorname{cosec}^2 x$

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

14. $\frac{d}{dx}\operatorname{cosec} x = -\operatorname{cosec} x \cdot \cot x$

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

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

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

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

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

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

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

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

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

24. $\frac{d}{dx}\coth x = -\operatorname{cosech}^2 x$

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

26. $\frac{d}{dx}\operatorname{cosech} x = -\operatorname{cosech} x \cdot \coth x$

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

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

29. $\frac{d}{dx}\tanh^{-1} x = \frac{1}{1-x^2}$

30. $\frac{d}{dx}\coth^{-1} x = \frac{1}{1-x^2}$

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

32. $\frac{d}{dx}\operatorname{cosech}^{-1} x = \frac{-1}{x\sqrt{1+x^2}}$

33. $\frac{d}{dx}(U V) = U'V + UV'$

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

INTEGRATION FORMULAE:

35. $\int k \, dx = kx$

36. $\int x^n \, dx = \frac{x^{n+1}}{n+1}$

37. $\int \frac{1}{x} \, dx = \log x$

38. $\int e^x \, dx = e^x$

39. $\int x e^x \, dx = e^x(x - 1)$

40. $\int a^x \, dx = \frac{a^x}{\log a}$

41. $\int \frac{1}{ax+b} \, dx = \frac{1}{a} \log(ax+b)$

42. $\int \frac{ax+b}{cx+d} \, dx = \int \left(\frac{a}{c} - \frac{(ad-bc)}{c(cx+d)} \right) dx$

43. $\int e^x(f(x) + f'(x)) \, dx = e^x f(x)$

44. $\int \sin x \, dx = -\cos x$

45. $\int \cos x \, dx = \sin x$

46. $\int \tan x \, dx = \log |\sec x|$

$$47. \int \cot x \, dx = -\log |\cosec x| \\ = \log |\sin x|$$

$$48. \int \sec x \, dx = \log |\sec x + \tan x|$$

$$49. \int \cosec x \, dx = -\log |\cosec x + \cot x|$$

$$50. \int \sec x \tan x \, dx = \operatorname{Sec} x$$

$$51. \int \cosec x \cot x \, dx = -\cosec x$$

$$52. \int \operatorname{Sec}^2 x \, dx = \tan x$$

$$53. \int \cosec^2 x \, dx = -\cot x$$

$$54. \int \sinh x \, dx = \cosh x$$

$$55. \int \cosh x \, dx = \sinh x$$

$$56. \int \tanh x \, dx = \log |\cosh x|$$

$$57. \int \coth x \, dx = \log |\sinh x|$$

$$58. \int \operatorname{sech}^2 x \, dx = \tanh x$$

$$59. \int \cosech^2 x \, dx = -\coth x$$

$$60. \int \operatorname{sech} x \tanh x \, dx = -\operatorname{sech} x$$

$$61. \int \cosech x \coth x \, dx = -\cosech x$$

$$62. \int \frac{f'(x)}{f(x)} \, dx = \log |f(x)|$$

$$63. \int \frac{d}{dx} f(x) \, dx = f(x)$$

$$64. \int \frac{f'(x)}{\sqrt{f(x)}} \, dx = 2\sqrt{f(x)}$$

$$65. \int \frac{1}{\sqrt{1-x^2}} \, dx = \sin^{-1} x$$

$$66. \int \frac{-1}{\sqrt{1-x^2}} \, dx = \cos^{-1} x$$

$$67. \int \frac{1}{1+x^2} \, dx = \tan^{-1} x$$

$$68. \int \frac{-1}{1+x^2} \, dx = \cot^{-1} x$$

$$69. \int \frac{1}{x\sqrt{x^2-1}} \, dx = \sec^{-1} x$$

$$70. \int \frac{-1}{x\sqrt{x^2-1}} \, dx = \cosec^{-1} x$$

$$71. \int \frac{1}{x^2+a^2} \, dx = \frac{1}{a} \tan^{-1} \frac{x}{a}$$

$$72. \int \frac{1}{x^2-a^2} \, dx = \frac{1}{2a} \log \left(\frac{x-a}{x+a} \right)$$

$$73. \int \frac{1}{a^2-x^2} \, dx = \frac{1}{2a} \log \left(\frac{a+x}{a-x} \right)$$

$$74. \int \frac{1}{\sqrt{x^2+a^2}} \, dx = \sinh^{-1} \frac{x}{a} \\ = \log |x + \sqrt{x^2 + a^2}|$$

$$75. \int \frac{1}{\sqrt{x^2-a^2}} \, dx = \cosh^{-1} \frac{x}{a} \\ = \log |x + \sqrt{x^2 - a^2}|$$

$$76. \int \frac{1}{\sqrt{a^2-x^2}} \, dx = \sin^{-1} \frac{x}{a}$$

$$77. \int \sqrt{x^2+a^2} \, dx = \frac{x}{2} \sqrt{x^2+a^2} + \frac{a^2}{2} \sinh^{-1} \frac{x}{a}$$

$$78. \int \sqrt{x^2-a^2} \, dx = \frac{x}{2} \sqrt{x^2-a^2} - \frac{a^2}{2} \cosh^{-1} \frac{x}{a}$$

$$79. \int \sqrt{a^2-x^2} \, dx = \frac{x}{2} \sqrt{a^2-x^2} + \frac{a^2}{2} \sin^{-1} \frac{x}{a}$$

$$80. \int e^{ax} \sin(bx+c) = \frac{e^{ax}}{a^2+b^2} (a \sin bx - b \cos bx)$$

$$81. \int e^{ax} \cos(bx+c) = \frac{e^{ax}}{a^2+b^2} (a \cos bx - b \sin bx)$$

$$82. \int (f(x))^n f'(x) \, dx = \frac{(f(x))^{n+1}}{n+1}$$

$$83. \int uv = u \int v - \int [u' \int v]$$

$$84. \int uv = uv_1 - u'v_2 + u''v_3 - u'''v_4 + \dots$$

$$85. \int_{-a}^a f(x) \, dx = \begin{cases} 0 & \text{if } f(x) \text{ is odd} \\ 2 \int_0^a f(x) \, dx & \text{if } f(x) \text{ is even} \end{cases}$$

$$86. \int_0^{2a} f(x) \, dx = 2 \int_0^a f(x) \, dx \\ \text{if } f(2a-x) = f(x)$$

$$87. \int_0^{\pi/2} \sin^m x \, dx = \int_0^{\pi/2} \cos^m x \, dx =$$

$$\begin{cases} \frac{(m-1)(m-3) \dots 1}{m(m-2)(m-4) \dots 2} \times 1 & \text{if } m \text{ is odd} \\ \frac{(m-1)(m-3) \dots 1}{m(m-2)(m-4) \dots 2} \times \frac{\pi}{2} & \text{if } m \text{ is even} \end{cases}$$

$$88. \int_0^{\pi/2} \sin^m x \cos^n x \, dx =$$

$$\begin{cases} \frac{[(m-1)(m-3) \dots 1][(n-1)(n-3) \dots 1]}{(m+n)(m+n-2)(m+n-4) \dots 2} \times \frac{\pi}{2} & \text{if } m, n \text{ both even} \\ \frac{[(m-1)(m-3) \dots 1][(n-1)(n-3) \dots 1]}{(m+n)(m+n-2)(m+n-4) \dots 2} \times 1 & \text{(other wise)} \end{cases}$$

TRIGONOMETRY FORMULAE:

$$1. \sin^2 A + \cos^2 A = 1$$

$$2. \sec^2 A - \tan^2 A = 1$$

$$3. \csc^2 A - \cot^2 A = 1$$

$$4. \sin 2A = 2\sin A \cos A = \frac{2\tan A}{1+\tan^2 A}$$

$$\begin{aligned} 5. \cos 2A &= \cos^2 A - \sin^2 A \\ &= 1 - 2\sin^2 A \\ &= 2\cos^2 A - 1 \\ &= \frac{1-\tan^2 A}{1+\tan^2 A} \end{aligned}$$

$$6. \sin^2 A = \frac{1-\cos 2A}{2}$$

$$7. \cos^2 A = \frac{1+\cos 2A}{2}$$

$$8. \tan 2A = \frac{2\tan A}{1-\tan^2 A}$$

$$9. \cot 2A = \frac{\cot^2 A - 1}{2\cot A}$$

$$10. \sin 3A = 3\sin A - 4\sin^3 A$$

$$11. \cos 3A = 4\cos^3 A - 3\cos A$$

$$12. \tan 3A = \frac{3\tan A - \tan^3 A}{1 - 3\tan^2 A}$$

$$13. \cot 3A = \frac{3\cot A - \cot^3 A}{1 - 3\cot^2 A}$$

$$14. \sin(A+B) = \sin A \cos B + \cos A \sin B$$

$$15. \sin(A-B) = \sin A \cos B - \cos A \sin B$$

$$16. \cos(A+B) = \cos A \cos B - \sin A \sin B$$

$$17. \cos(A-B) = \cos A \cos B + \sin A \sin B$$

$$18. \tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$

$$19. \tan(A-B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$$

$$20. \cot(A+B) = \frac{\cot A \cdot \cot B - 1}{\cot B + \cot A}$$

$$21. \cot(A-B) = \frac{\cot A \cdot \cot B + 1}{\cot B - \cot A}$$

$$22. \sin(A+B) + \sin(A-B) = 2\sin A \cos B$$

$$23. \sin(A+B) - \sin(A-B) = 2\cos A \sin B$$

$$24. \cos(A+B) + \cos(A-B) = 2\cos A \cos B$$

$$25. \cos(A-B) - \cos(A+B) = 2\sin A \sin B$$

$$\begin{aligned} 26. \sin(A+B) \sin(A-B) &= \sin^2 A - \sin^2 B \\ &= \cos^2 B - \cos^2 A \end{aligned}$$

$$\begin{aligned} 27. \cos(A+B) \cos(A-B) &= \cos^2 A - \sin^2 B \\ &= \cos^2 B - \sin^2 A \end{aligned}$$

$$28. \tan(A+B) \tan(A-B) = \frac{\tan^2 A - \tan^2 B}{1 - \tan^2 A \tan^2 B}$$

$$29. \cot(A+B) \cot(A-B) = \frac{\cot^2 A \cdot \cot^2 B - 1}{\cot^2 B - \cot^2 A}$$

$$30. \sin C + \sin D = 2 \sin \frac{C+D}{2} \cos \frac{C-D}{2}$$

$$31. \sin C - \sin D = 2 \cos \frac{C+D}{2} \sin \frac{C-D}{2}$$

$$32. \cos C + \cos D = 2 \cos \frac{C+D}{2} \cos \frac{C-D}{2}$$

$$33. \cos C - \cos D = 2 \sin \frac{C+D}{2} \sin \frac{D-C}{2}$$

$$34. \sinh x = \frac{e^x - e^{-x}}{2}$$

$$35. \cosh x = \frac{e^x + e^{-x}}{2}$$

$$36. \tanh x = \frac{e^x - e^{-x}}{e^x + e^{-x}}$$

$$37. \log ab = \log a + \log b$$

$$38. \log \frac{a}{b} = \log a - \log b$$

$$39. \frac{\log a}{\log b} = \log_b a$$

$$40. (1-x)^{-1} = 1 + x + x^2 + x^3 + \dots$$

$$41. (1+x)^{-1} = 1 - x + x^2 - x^3 + \dots$$

$$42. (1-x)^{-2} = 1 + 2x + 3x^2 + 4x^3 + \dots$$

$$43. (1+x)^{-2} = 1 - 2x + 3x^2 - 4x^3 + \dots$$