CLASS 12 – CBSE | MATHEMATICS
INDEFINITE INTEGRATION

Find the anti derivative of the following functions :

1) $\int \frac{\sin x}{\sin(x-a)}\,dx$

2) $\int \frac{2+3\cos x}{\sin^2 x}\,dx$

3) $\int (7x-2)\sqrt{3x+2}\,.dx$

4) $\int \frac{\sin 2x}{(a+b\cos x)^2}\,dx$

5) $\int sinx\ sin2x \sin 3x\ dx$

6) $\int \frac{sin^8 x - cos^8 x}{1-2\,sin^2 x\,cos^2 x}\,dx$

7) $\int \sqrt{e^x - 1}\,dx$

8) $\int \frac{(x^4 - x)^{1/4}}{x^5}\,dx$

9) $\int \frac{1}{sinx\ cos^3 x}\,dx$

10) $\int \frac{1}{\sqrt{sin^3\ x\ \sin(x+\alpha)}}\,dx$

11) $\int \frac{\tan x}{a+b\ tan^2 x}\ dx$

12) $\int \frac{1}{1+e^x}\ dx$

13) $\int \frac{\tan^4 \sqrt{x}\ \sec^2 \sqrt{x}}{\sqrt{x}}\,dx$

14) $\int \frac{x+\sqrt{x+1}}{x+2}\,dx$

15) $\int \sin^3 x\ \cos^3 x\,dx$

16) $\int \frac{\sin 2x}{\sin 5x\ \sin 3x}\ dx$

17) $\int \frac{1}{1+\tan x}\,dx$

18) $\int \frac{\sqrt{1+x^2}}{x^4}\,dx$

19) $\int \frac{x^{1/2}}{x^{1/3}+x^{1/2}}\,dx$

20) $\int \frac{x^2+1}{x^4+1}\,dx$

21) $\int \frac{x^4+1}{x^2+1}\,dx$

22) $\int x^5 \sqrt{a^3 + x^3}\,dx$

23) $\int \frac{\cos^5 x}{\sin x}\,d$

24) $\int 2^{2^{2^x}}\,2^{2^x}\,2^x\,dx$

25) $\int \frac{(6x+7)}{\sqrt{(x-5)}\,\sqrt{(x-4)}}\,dx$

26) $\int (3x-2)\ \sqrt{x^2+x+1}\,.dx$

27) $\int \sqrt{\tan x} + \sqrt{\cot x}\,.dx$

28) $\int \sin^{-1} \sqrt{\frac{x}{a+x}}\,.dx$

29) $\int \sqrt{\frac{a-x}{a+x}}\,dx$

30) $\int \frac{x^{1/2}}{1+x^{3/4}}\,dx$

31) $\int \frac{1-x^2}{x\,(1-2x)}\,dx$

32) $\int \sqrt{\tan x}\,dx$

33) $\int \frac{(\cos x - \cos 2x)}{1-\cos x}\,dx$

34) $\int \frac{(\cos 5x + \cos 4x)}{1-2\cos 3x}\,dx$

35) $\int \frac{\sqrt{x}}{\sqrt{a^3-x^3}}\,dx$

36) $\int \sqrt{\sec x - 1}\,dx$

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37) $\int \frac{x^2}{x^4 - x^2 - 12}\, dx$

38) $\int \frac{x^2+1}{(x^2+4)(x^2+25)}\, dx$

39) $\int \frac{1-\cos x}{\cos x\,(1+\cos x)}\, dx$

40) $\int \frac{\sin x - x\cos x}{x\,(x+\sin x)}\, dx$

41) $\int \sqrt{\frac{1-\sqrt{x}}{1+\sqrt{x}}}\, dx$

42) $\int \frac{\sqrt{x^2+1}}{x^4}[\log(x^2+1) - 2\log x]\, dx$

43) $\int \frac{(x-4)\,e^x}{(x-2)^3}\, dx$

44) $\int \frac{(x^2+1)e^x}{(x+1)^2}\, dx$

45) $\int \frac{x+\sin x}{1+\cos x}\, dx$

46) $\int x\, \sin^{-1} x\, dx$

47) $\int (\sin^{-1} x)^2\, dx$

48) $\int e^{\tan^{-1} x}\left(\frac{1+x+x^2}{1+x^2}\right) dx$

49) $\int \frac{dx}{x(x^5+1)}\, dx$

50) $\int \frac{\sqrt{x}}{x+1}\, dx$

51) $\int \tan^{-1} x\, dx$

52) $\int \frac{dx}{sin^4 x + sin^2 x\, cos^2 x + cos^4 x}$

53) $\int \frac{dx}{\cos x + \sqrt{3}\sin x}$

54) $\int \frac{x^3-1}{x^3+x}\, dx$

55) $\int \frac{x\, dx}{1+\sin x}$

56) $\int \frac{\sqrt{x}}{x+1}\, dx$

57) $\int \frac{dx}{\sin(x-a)\sin(x-b)}$ is

58) $\int \frac{e^x(1+\sin x)}{1+\cos x}\, dx$

59) $\int \frac{(\log x)\, dx}{(x+1)^2}\, dx$

60) $\int \frac{dx}{\sec x + cosec\, x}$

61) $\int (x+3)\sqrt{3-4x-x^2}\, .dx$

62) $\int \frac{\sin x}{\sin 4x}\, dx$

63) $\int \frac{1}{x}\sqrt{\frac{1-x}{1+x}}\, dx$

64) $\int \frac{dx}{\sqrt{x}\,(\sqrt{x}+1)(\sqrt{x}+2)}$

65) $\int \frac{\sqrt{1-\sin x}}{1+\cos x}.e^{-x/2}\, dx$

66) $\int \sec^3 x \tan x\, dx$

67) $\int \frac{1-x^2}{(1-2x)}\, dx$

68) $\int \frac{1}{\sqrt{1-e^{2x}}}\, dx$

69) $\int \frac{1}{2sin\, x - 5cos\, x}\, dx$

70) $\int \frac{2x^2+3}{(x^2-1)(x^2+4)}\, dx =$

$a \log\left(\frac{x+1}{x-1}\right) + b \tan^{-1}\frac{x}{2}$,

then $find\ (a, b)$.

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INDEFINITE INTEGRATION- ANSWER KEY

1) $\int \frac{\sin x}{\sin(x-a)}\,dx = x\cos a + \sin a \ln|\sin(x-a)| + C$

2) $\int \frac{2+3\cos x}{\sin^2 x}\,dx = -2\cot x - 3\csc x + C$

3) $\int (7x-2)\sqrt{3x+2}\,dx = \frac{14}{45}(3x+2)^{5/2} - \frac{40}{27}(3x+2)^{3/2} + C$

4) $\int \frac{\sin 2x}{(a+b\cos x)^2}\,dx = -\frac{2}{b^2}\left[\ln|a+b\cos x| + \frac{a}{a+b\cos x}\right] + C$

5) $\int \sin x \sin 2x \sin 3x\,dx = -\frac{\cos 4x}{16} - \frac{\cos 2x}{8} + \frac{\cos 6x}{24} + C$

6) $\int \frac{\sin^8 x - \cos^8 x}{1-2\sin^2 x\cos^2 x}\,dx = -\frac{\sin 2x}{2} + C$

7) $\int \sqrt{e^x - 1}\,dx = 2\sqrt{e^x-1} - 2\tan^{-1}\sqrt{e^x-1} + C$

8) $\int \frac{(x^4-x)^{1/4}}{x^5}\,dx = \frac{4}{15}\left(1-\frac{1}{x^3}\right)^{5/4} + C$

9) $\int \frac{1}{\sin x\cos^3 x}\,dx = \ln|\tan x| + \frac{\tan^2 x}{2} + C$

10) $\int \frac{1}{\sqrt{\sin^3 x \sin(x+\alpha)}}\,dx = -\frac{2}{\sin\alpha}\sqrt{\cos\alpha + \sin\alpha\cot x} + C$

11) $\int \frac{\tan x}{a+b\tan^2 x}\,dx = \frac{1}{2(b-a)}\ln|a\cos^2 x + b\sin^2 x| + C, \quad b \neq a$

12) $\int \frac{1}{1+e^x}\,dx = x - \ln(1+e^x) + C$

13) $\int \frac{\tan^4\sqrt{x}\sec^2\sqrt{x}}{\sqrt{x}}\,dx = \frac{2}{5}\tan^5\sqrt{x} + C$

14) $\int \frac{x+\sqrt{x+1}}{x+2}\,dx = x + 2\sqrt{x+1} - 2\ln|x+2| - 2\tan^{-1}\sqrt{x+1} + C$

15) $\int \sin^3 x\cos^3 x\,dx = \frac{\sin^4 x}{4} - \frac{\sin^6 x}{6} + C$

16) $\int \frac{\sin 2x}{\sin 5x \sin 3x}\,dx = \frac{1}{3}\ln|\sin 3x| - \frac{1}{5}\ln|\sin 5x| + C$

17) $\int \frac{1}{1+\tan x}\,dx = \frac{x}{2} + \frac{1}{2}\ln|\sin x + \cos x| + C$

18) $\int \frac{\sqrt{1+x^2}}{x^4}\,dx = -\frac{(1+x^2)^{3/2}}{3x^3} + C$

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19) $\int \frac{x^{1/2}}{x^{1/3}+x^{1/2}}\,dx = x - \frac{6}{5}x^{5/6} + \frac{3}{2}x^{2/3} - 2x^{1/2} + 3x^{1/3} - 6x^{1/6} + 6\ln\left(1+x^{1/6}\right) + C$

20) $\int \frac{x^2+1}{x^4+1}\,dx = \frac{1}{\sqrt{2}}\tan^{-1}\left(\frac{x^2-1}{\sqrt{2}\,x}\right) + C$

21) $\int \frac{x^4+1}{x^2+1}\,dx = \frac{x^3}{3} - x + 2\tan^{-1}x + C$

22) $\int x^5\sqrt{a^3+x^3}\,dx = \frac{2}{15}(a^3+x^3)^{5/2} - \frac{2a^3}{9}(a^3+x^3)^{3/2} + C$

23) $\int \frac{\cos^5 x}{\sin x}\,dx = \ln|\sin x| - \sin^2 x + \frac{\sin^4 x}{4} + C$

24) $\int 2^{2^{2^x}} \cdot 2^{2^x} \cdot 2^x\,dx = \frac{2^{2^{2^x}}}{(\ln 2)^3} + C$

25) $\int \frac{6x+7}{\sqrt{x-5}\sqrt{x-4}}\,dx = 6\sqrt{x^2-9x+20} + 34\ln\left|x - \frac{9}{2} + \sqrt{x^2-9x+20}\right| + C$

26) $\int (3x-2)\sqrt{x^2+x+1}\,dx = (x^2+x+1)^{3/2} - \frac{7(2x+1)}{8}\sqrt{x^2+x+1} - \frac{21}{16}\ln\left|x + \frac{1}{2} + \sqrt{x^2+x+1}\right| + C$

27) $\int \left(\sqrt{\tan x} + \sqrt{\cot x}\right)dx = \sqrt{2}\sin^{-1}(\sin x - \cos x) + C$

28) $\int \sin^{-1}\sqrt{\frac{x}{a+x}}\,dx = (x+a)\tan^{-1}\sqrt{\frac{x}{a}} - \sqrt{ax} + C$

29) $\int \sqrt{\frac{a-x}{a+x}}\,dx = a\sin^{-1}\frac{x}{a} + \sqrt{a^2-x^2} + C$

30) $\int \frac{x^{1/2}}{1+x^{3/4}}\,dx = \frac{4}{3}\left[x^{3/4} - \ln\left(1+x^{3/4}\right)\right] + C$

31) $\int \frac{1-x^2}{x(1-2x)}\,dx = \frac{x}{2} + \ln|x| - \frac{3}{4}\ln|1-2x| + C$

32) $\int \sqrt{\tan x}\,dx = \frac{1}{\sqrt{2}}\left[\sin^{-1}(\sin x - \cos x) - \ln\left|\sin x + \cos x + \sqrt{\sin 2x}\right|\right] + C$

33) $\int \frac{\cos x - \cos 2x}{1-\cos x}\,dx = x + 2\sin x + C$

34) $\int \frac{\cos 5x + \cos 4x}{1-2\cos 3x}\,dx = -\sin x - \frac{\sin 2x}{2} + C$

35) $\int \frac{\sqrt{x}}{\sqrt{a^3-x^3}}\,dx = \frac{2}{3}\sin^{-1}\left(\frac{x}{a}\right)^{3/2} + C$

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36) $\int \sqrt{\sec x - 1}\, dx = -2\ln\left|\sqrt{2}\cos\frac{x}{2} + \sqrt{\cos x}\right| + C$

37) $\int \frac{x^2}{x^4 - x^2 - 12}\, dx = \frac{1}{7}\ln\left|\frac{x-2}{x+2}\right| + \frac{\sqrt{3}}{7}\tan^{-1}\frac{x}{\sqrt{3}} + C$

38) $\int \frac{x^2+1}{(x^2+4)(x^2+25)}\, dx = -\frac{1}{14}\tan^{-1}\frac{x}{2} + \frac{8}{35}\tan^{-1}\frac{x}{5} + C$

39) $\int \frac{1-\cos x}{\cos x\,(1+\cos x)}\, dx = \ln|\sec x + \tan x| - 2\tan\frac{x}{2} + C$

40) $\int \frac{\sin x - x\cos x}{x\,(x+\sin x)}\, dx = \ln\left|\frac{x}{x+\sin x}\right| + C$

41) $\int \sqrt{\frac{1-\sqrt{x}}{1+\sqrt{x}}}\, dx = (\sqrt{x} - 2)\sqrt{1-x} - \sin^{-1}\sqrt{x} + C$

42) $\int \frac{\sqrt{x^2+1}}{x^4}[\ln(x^2+1) - 2\ln x]dx = \frac{1}{9}\left(1 + \frac{1}{x^2}\right)^{3/2}\left[2 - 3\ln\left(1 + \frac{1}{x^2}\right)\right] + C$

43) $\int \frac{(x-4)\,e^x}{(x-2)^3}\, dx = \frac{e^x}{(x-2)^2} + C$

44) $\int \frac{(x^2+1)\,e^x}{(x+1)^2}\, dx = \frac{x-1}{x+1}\, e^x + C$

45) $\int \frac{x+\sin x}{1+\cos x}\, dx = x\tan\frac{x}{2} + C$

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

47) $\int (\sin^{-1}x)^2\, dx = x(\sin^{-1}x)^2 + 2\sqrt{1-x^2}\sin^{-1}x - 2x + C$

48) $\int e^{\tan^{-1}x}\left(\frac{1+x+x^2}{1+x^2}\right)dx = x\, e^{\tan^{-1}x} + C$

49) $\int \frac{dx}{x(x^5+1)} = \frac{1}{5}\ln\left|\frac{x^5}{x^5+1}\right| + C$

50) $\int \frac{\sqrt{x}}{x+1}\, dx = 2\sqrt{x} - 2\tan^{-1}\sqrt{x} + C$

51) $\int \tan^{-1}x\, dx = x\tan^{-1}x - \frac{1}{2}\ln(1+x^2) + C$

52) $\int \frac{dx}{\sin^4 x + \sin^2 x\cos^2 x + \cos^4 x} = \frac{1}{\sqrt{3}}\tan^{-1}\left(\frac{\tan^2 x - 1}{\sqrt{3}\tan x}\right) + C$

53) $\int \frac{dx}{\cos x + \sqrt{3}\sin x} = \frac{1}{2}\ln\left|\sec\left(x - \frac{\pi}{3}\right) + \tan\left(x - \frac{\pi}{3}\right)\right| + C$

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54) $\int \frac{x^3-1}{x^3+x}\,dx = x - \ln|x| + \frac{1}{2}\ln(x^2+1) - \tan^{-1}x + C$

55) $\int \frac{x\,dx}{1+\sin x} = x(\tan x - \sec x) + \ln|1+\sin x| + C$

56) $\int \frac{\sqrt{x}}{x+1}\,dx = 2\sqrt{x} - 2\tan^{-1}\sqrt{x} + C$

57) $\int \frac{dx}{\sin(x-a)\sin(x-b)} = \frac{1}{\sin(a-b)}\ln\left|\frac{\sin(x-a)}{\sin(x-b)}\right| + C$

58) $\int \frac{e^x(1+\sin x)}{1+\cos x}\,dx = e^x\tan\frac{x}{2} + C$

59) $\int \frac{\ln x}{(x+1)^2}\,dx = \frac{x\ln x}{x+1} - \ln|x+1| + C$

60) $\int \frac{dx}{\sec x+\csc x} = \frac{1}{2}(\sin x - \cos x) - \frac{1}{2\sqrt{2}}\ln\left|\tan\left(\frac{x}{2}+\frac{\pi}{8}\right)\right| + C$

61) $(x+3)\sqrt{3-4x-x^2}\,dx = -\frac{1}{3}(3-4x-x^2)^{3/2} + \frac{x+2}{2}\sqrt{3-4x-x^2} + \frac{7}{2}\sin^{-1}\frac{x+2}{\sqrt{7}} + C$

62) $\int \frac{\sin x}{\sin 4x}\,dx = -\frac{1}{8}\ln\left|\frac{1+\sin x}{1-\sin x}\right| + \frac{1}{4\sqrt{2}}\ln\left|\frac{1+\sqrt{2}\sin x}{1-\sqrt{2}\sin x}\right| + C$

63) $\int \frac{1}{x}\sqrt{\frac{1-x}{1+x}}\,dx = -\ln\left|\frac{1+\sqrt{1-x^2}}{x}\right| - \sin^{-1}x + C$

64) $\int \frac{dx}{\sqrt{x}(\sqrt{x}+1)(\sqrt{x}+2)} = 2\ln\left(\frac{\sqrt{x}+1}{\sqrt{x}+2}\right) + C$

65) $\int \frac{\sqrt{1-\sin x}}{1+\cos x}\,e^{-x/2}\,dx = -e^{-x/2}\sec\frac{x}{2} + C$

66) $\int \sec^3 x\tan x\,dx = \frac{\sec^3 x}{3} + C$

67) $\int \frac{1-x^2}{1-2x}\,dx = \frac{x^2}{4} + \frac{x}{4} - \frac{3}{8}\ln|1-2x| + C$

68) $\int \frac{1}{\sqrt{1-e^{2x}}}\,dx = x - \ln\left(1+\sqrt{1-e^{2x}}\right) + C$

69) $\int \frac{dx}{2\sin x - 5\cos x} = \frac{1}{\sqrt{29}}\ln\left|\tan\left(\frac{x-\varphi}{2}\right)\right| + C, \quad \varphi = \tan^{-1}\frac{5}{2}$

70) $\int \frac{2x^2+3}{(x^2-1)(x^2+4)}\,dx = a\ln\left(\frac{x+1}{x-1}\right) + b\tan^{-1}\frac{x}{2}$ where $(a,b) = \left(-\frac{1}{2}, \frac{1}{2}\right)$