

MATHS

BOOKS - KC SINHA ENGLISH

PROPERTIES OF DEFINITE INTEGRALS - FOR BOARDS

Solved Examples

1. Evaluate $\int_{-1}^1 f(x)dx$, $f(x) = \begin{cases} 1 & -2x \leq x \leq 0 \\ 1 + 2x & x \geq 0 \end{cases}$



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2. Evaluate $\int_{-1}^1 |x|dx$



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3. Evaluate $\int_1^4 f(x)dx$, where $f(x) = |x - 1| + |x - 2| + |x - 3|$



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4. Find the value of $\int_0^{2\pi} |\sin x|dx$



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5. Evaluate $\int_0^{2\pi} |\cos x|dx$



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6. Evaluate $\int_0^{\frac{3}{2}} |x \cos \pi x|dx$



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7. The integral $\int_0^{1.5} [x^2] dx$, where $[.]$ denotes the greatest integer function, equals



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8. The value of $\int_0^{\pi/2} \frac{\sqrt{\cos x}}{\sqrt{\cos x} + \sqrt{\sin x}} dx$ is $\pi/2$ b. $\pi/4$ c. 0 d. none of these



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9. Evaluate $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{dx}{1 + \sqrt{\tan x}}$



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10. Evaluate : $\int_0^{\frac{\pi}{4}} \log(1 + \tan x) dx$.





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11. Evaluate the following integral: $\int_0^1 \frac{\log(1+x)}{1+x^2} dx$



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12. If k is an integer, evaluate $\int_0^\pi \frac{\sin 2kx}{\sin x} dx$



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13. Evaluate $\int_0^{\pi/2} \frac{\sin x - \cos x}{1 + \sin x \cdot \cos x} dx$



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14. Evaluate: $\int_0^{\pi/2} \frac{x}{\sin x + \cos x} dx$



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15. Evaluate $\int_0^{\frac{\pi}{2}} \log \sin x dx$



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16. Evaluate: $\int_0^{\pi/2} (2 \log \sin x - \log \sin 2x) dx$



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17. Evaluate $\int_0^{\pi/2} \frac{\sin^2 x dx}{\sin x + \cos x}$



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18. Show that $\int_0 a f(x)g(x) dx = 2 \int_0 a f(x) dx$ if f and g defined as
 $f(x) = f(a-x)$ and $g(x) + g(a-x) = 4$



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19. Prove that $\int_0^{\frac{\pi}{2}} \sin 2x \log \tan x dx = 0$



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20. Prove that: $\int_0^{2\pi} \frac{x \sin^{2n} x}{\sin^{2n} x + \cos^{2n} x} dx$



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21. Evaluate: $\int_0^{\pi} \frac{x}{1 + \cos \alpha \sin x} dx$



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22. Evaluate: $\int_0^{\pi} \frac{x}{a^2 \cos^2 x + b^2 \sin^2 x} dx$



23. Find $\int_{-1}^1 x|x|dx$



24. Evaluate: $\int_{-a}^a \sqrt{\frac{a-x}{a+x}} dx$



25. Evaluate: $\int_{\pi/3}^{\pi/4} x^3 \sin^4 x dx$ (ii) $\int_a^a \sqrt{\frac{a-x}{a+x}} dx$



26. Prove that $\int_{-1}^1 \log\left(\frac{2-x}{2+x}\right)^{20} dx = 0$



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27. Choose the correct answer. The value of

$$\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \left(x^3 + x \cos x + \tan^5 x + 1 \right) dx$$

(A) 0 (B) 2 (C) π (D) 1



28. Evaluate: $\int_{\pi/4}^{\pi/4} \frac{x + \pi/4}{2 - \cos 2x} dx$



29. Evaluate $\int_1^3 (2x + 3) dx$ as the limit of a sum.



30. Evaluate $\int_0^1 e^x dx$ as the limit of a sum.



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31. Evaluate: $\int_0^{\pi/2} \sin x \, dx$



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Exercise

1. Evaluate the following: $\int_{-2}^2 |x| \, dx$



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2. Evaluate the following: $\int_1^5 |x - 4| \, dx$



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3. Evaluate the following: $\int_0^2 |x - 3| dx$



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4. Evaluate the following: $\int_{-1}^2 |2x - 1| dx$



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5. Evaluate the following: $\int_{-1}^1 (|x| + |x - 1|) dx$



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6. Evaluate the following integral: $\int_{-4}^4 |x + 2| dx$



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7. Evaluate the following integral: $\int_{-3}^3 |x + 1| dx$



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8. Evaluate the following integral: $\int_0^3 |3x - 1| dx$



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9. Evaluate the following integral: $\int_{-2}^2 |x + 1| dx$



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10. Evaluate the following: $\int_{-2}^2 |2x + 3| dx$



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11. Evaluate the following: $\int_0^8 |x - 5| dx$



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12. Evaluate $\int_1^4 f(x) dx$, where
 $f(x) = |x - 1| + |x - 2| + |x - 3|.$



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13. Evaluate $\int_{-1}^2 |x^3 - x| dx$



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14. Evaluate : $\int_{-5}^0 [|x| + |x + 2| + |x + 5|] dx$



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15. Evaluate the following integral: $\int_{-\pi/4}^{\pi/4} |\tan x| dx$



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16. Evaluate the following: $\int_0^{\frac{\pi}{2}} |\cos x - \sin x| dx$



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17. Evaluate $\int_1^4 f(x) dx$, where $f(x) = \begin{cases} 2x + 8 & 1 \leq x \leq 2 \\ 6x & 2 \leq x \leq 4 \end{cases}$



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18. Evaluate the following integral: $\int_{-\pi/2}^{\pi/2} (\sin|x| + \cos|x|) dx$



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19. Evaluate $\int_{0.2}^{3.5} [x] dx$



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20. Evaluate the following: $\int_0^{\frac{\pi}{2}} \frac{\cos x}{\cos x + \sin x} dx$



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21. Evaluate the following integral: $\int_0^{\pi/2} \frac{1}{1 + \tan x} dx$



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22. Evaluate the following: $\int_0^{\frac{\pi}{2}} \log \tan x dx$



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23. Evaluate the following integral: $\int_0^\pi \frac{x \tan x}{\sec x \cos ec x} dx$



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24. Evaluate the following: $\int_0^{\frac{\pi}{2}} \frac{\sqrt{\tan x}}{1 + \sqrt{\tan x}} dx$



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25. Prove that $\int_0^\pi x \sin^6 x \cos^4 x dx = \frac{\pi}{2} \int_0^\pi \sin^6 x \cos^4 x dx$



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26. Prove that: $\int_0^{\pi/2} \log|\tan x + \cot x| dx = \pi(\log)_e 2$



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27. By using the properties of definite integrals, evaluate the integrals

$$\int_0^{\frac{\pi}{2}} \frac{\cos^5 x dx}{\sin^5 + \cos^5 x}$$


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28.

$$\int_0^{\frac{\pi}{2}} \frac{\sqrt[3]{\cos x}}{\sqrt[3]{\cos x} + \sqrt[3]{\sin x}} dx$$



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29. about to only mathematics



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30.

$$\int_0^{2\pi} (\sin^3 x + 2\ln|\sin x| + \tan^5 x) dx = \pi \ln 2 \quad (2) - \pi \ln 2 \quad (3)$$
$$- 4\pi \ln 2 \quad 4\pi \ln 2 \quad (5) \quad 6\pi \ln 2$$



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31. evaluate: $\int_0^{\frac{\pi}{2}} \frac{\sin^{\frac{3}{2}} x}{\sin^{\frac{3}{2}} x + \cos^{\frac{3}{2}} x} dx$

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32. Evaluate the following integral: $\int_0^{\pi/2} \frac{\sqrt{\cot x}}{\sqrt{\cot x} + \sqrt{\tan x}} dx$

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33. Evaluate the definite integrals $\int_0^{\pi} \frac{x \tan x}{\sec x + \tan x} dx$

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34. Prove that $\int_0^{2a} \frac{f(x)}{f(x) + f(2a - x)} dx = a$

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35. Prove that $\int_0^1 \tan^{-1} \left(\frac{2x - 1}{1 + x - x^2} \right) dx = 0$



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36. Prove that $\int_0^a f(x)g(a - x)dx = \int_0^a g(x)f(a - x)dx.$



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37. f, g, h are continuous in $[0, 1]$, $f(a - x) = f(x)$, $g(a - x) = -g(x)$, $3h(x) - 4h(a - x) = 5$. Then prove that $\int_0^a f(x)g(x)h(x)dx = 0$.



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38. Prove that: $\int_0^\pi \frac{x}{1 - \cos \alpha \sin x} dx = \frac{\pi(\pi - \alpha)}{\sin \alpha}$



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39. Find $\int_{-1}^1 x^5 e^{x^8} dx$



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40. Find $\int_{-\pi}^{\pi} \sin^5 x \cos x dx$



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41. Find $\int_{-1}^1 x e^{-x^2 \tan^2 x} dx$



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42. Prove that $\int_{-a}^a xf(x^4)dx = 0$



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43. Prove that $\int_{-2}^2 f(x^4)dx = 2\int_0^2 f(x^4)dx$



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44. Evaluate $\int_{-1}^1 e^{|x|}dx$



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45. Evaluate $\int -11 \sin^5 x \cos^4 x dx$



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46. Prove that $\int -11x^{17} \cos^4 x dx = 0$



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47. Evaluate : $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \sin^2 x dx$



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48. Evaluate $\int_{-1}^1 \log\left(\frac{3-x}{3+x}\right) dx$



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49. Evaluate the following integral: $\int_{-\pi/2}^{\pi/2} \log\left(\frac{2-\sin x}{2+\sin x}\right) dx$



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50. Evaluate $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \sin^2 x dx$

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51. Evaluate as limit of sums: $\int_0^2 x dx$

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52. Evaluate the following definite integrals as limit of sums.

$$\int_0^5 (x + 1) dx$$

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53. Evaluate the following integrals as limit of sums: $\int_0^2 (x + 4) dx$

(ii) $\int_0^2 (2x + 1) dx$

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54. Evaluate as limit of sums: $\int_2^4 (2x - 1)dx$



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55. Evaluate as limit of sums: $\int_1^3 (2x + 1)dx$



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56. Evaluate the following definite integrals as limit of sums.

$$\int abxdx$$



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57. Evaluate the following integrals as limit of sum: $\int_1^2 x^2 dx$



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58. Evaluate the following definite integrals as limit of sums.

$$\int 23x^2 dx$$



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59. Evaluate the following integrals as limit of sum: $\int_0^2 (x^2 + 1) dx$



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$$60. \int_0^2 (x^2 + 3) dx$$



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61. Evaluate the following integrals as limit of sum: $\int_1^2 (x^2 - 1) dx$



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62. Evaluate as limit of sums: $\int_0^3 (2x^2 + 3x + 5) dx$



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63. Evaluate as limit of sums: $\int_0^2 x^3 dx$



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64. Evaluate the following integrals as limit of sum: $\int_0^2 e^x dx$



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65. Evaluate as limit of sums: $\int_1^3 e^{-x} dx$



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66. Evaluate: $\int_a^b e^x dx$ using limit of sum



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67. Evaluate as limit of sums: $\int_0^1 e^{2-3x} dx$



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68. Evaluate as limit of sums: $\int_2^4 2^x dx$



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69. Evaluate as limit of sums: $\int_a^b e^{mx} dx$



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70. Evaluate the following integrals as limit of sum: $\int_0^{\pi/2} \cos x \, dx$



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