MATHS

BOOKS - KC SINHA MATHS (HINGLISH)

PROPERTIES OF DEFINITE INTEGRALS - FOR BOARDS

Solved Examples

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

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

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

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

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

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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 $\int_0^1 \frac{\log(1+x)}{1+x^2}dx$

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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 $\int_0^{\frac{\pi}{2}} \frac{\sin x - \cos x}{1+\sin x \cos x}dx$

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

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

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

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

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18. Show that $\int 0a f(x) g(x) dx = 2 \int 0a f(x) dx$ 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: $\int_0^{2\pi} \frac{x \sin^{2n} x}{\sin^{2n} + \cos^{2n} x} dx$

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21. Evaluate: `int_0^pi(x dx)/(1+cosalphasinx),w h e r e0

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

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

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

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25. Evaluate $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} x^3 \sin^4 x dx$

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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 $\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} (x^3 + x\cos x + \tan^5 x + 1)\,dx$ is (A) 0 (B) 2 (C) p (D) 1

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

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

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30. Evaluate $\int_0^3 (x^2 - 2x + 2)\,dx$ as limit of a sum.

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31. Evaluate $\int_1^3 x^3 dx$ as the limit of a sum.

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

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33. Evaluate $\int_0^{\frac{\pi}{2}} \left(x + e^{2x}\right) dx$ as the limit of a sum.

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34. Integrate from the first principles $\int_0^{\frac{\pi}{2}} \sin x dx$

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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: $\int_{-4}^{4} |x+2|dx$

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

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8. Evaluate the following: $\int_{0}^{3} |3x-1|dx$

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

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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 $\int_{\frac{\pi}{2}}^{\frac{\pi}{2}} (\sin|x| + \cos|x|)dx$

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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: $\int_0^{\frac{\pi}{2}} \frac{dx}{1+\tan x}$

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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: $\int_0^{\pi} \frac{x \tan x}{\sec x \cos ecx} dx$

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

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

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

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

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32. $\int_0^{\frac{\pi}{2}} \frac{\sqrt{\cot x}}{\sqrt{\tan x}+\sqrt{\cot x}} dx =$

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33. $\int_0^{\pi} \frac{x \tan x}{\sec x + \tan x} dx$

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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. DEFINITE INTEGRAL | INTRODUCTION OF DEFINITE INTEGRATION, EVALUATION OF DEFINITE INTEGRALS, DEFINITE INTEGRATION BY TYPICAL SUBSTITUTION, PROPERTIES OF DEFINITE INTEGRALS | Fundamental Theorem of Definite Integration, $\int_a^b f(x)dx = \phi(b) - \phi(a)$, Examples: $\int_2^4 \frac{x}{x^2 + 1} dx$, Definite integration by substitution, Examples: $\int_0^1 \sin^{-1}\left(\frac{2x}{1 + x^2}\right) dx$, Property 1: Integration is independent of the change of variable. $\int_a^b f(x)dx = \int_a^b f(t)dt$, Property 2: If the limits of a definite

integral are interchanged then its value changes. $\int_a^b f(x)dx = -\int_b^a f(x)dx$, Property 3: $\int_a^b f(x)dx = \int_a^c f(x)dx + \int_c^b f(x)dx$, Property 4: If $f(x)$ is a continuous function on $[a, b]$ then $\int_a^b f(x)dx = \int_a^b f(a+b-x)dx$

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

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37. Prove that $\int_0^t f(x)g(t-x)dx = \int_0^t g(x)f(t-x)dx$

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

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

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

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

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42. Find $\int_{-1}^{1} xe^{-x^2 \tan^2 x} dx$

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

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44. Prove that $\int_{-2}^{2} f(x^4)dx = 2\int_{0}^{2} f(x^4)dx$

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

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46. Find $\int_{-1}^{1} \sin^5 x \cos^4 x dx$

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47. $\int_{-1}^{1} x^{17} \cos^4 x dx = 0$

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

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

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50. Evaluate $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \log\left(\frac{2-\sin x}{2+\sin x}\right) dx$

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51. Evaluate $\int \frac{-\pi}{4} \frac{\pi}{4} \sin^2 x dx$

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

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53. Evaluate the following definite integrals as limit of sums. $\int 05(x+1)dx$

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

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56. Evaluate as limit of sums: $\int_{-1}^1 (x+3)dx$

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

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58. Evaluate as limit of sums: $\int_0^2 (2x+1)dx$

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

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60. Evaluate as limit of sums: $\int_a^b xdx$

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61. Evaluate the definite integrals as limit of sums $\int_z^1 x^2 dx$

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62. Evaluate the following definite integrals as limit of sums. $\int 23x^2 dx$

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63. Evaluate as limit of sums: $\int_0^2 (x^2 + 1) dx$

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

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65. Evaluate as limit of sums: $\int_1^3 (2x^2 + 5) dx$

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

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67. Evaluate as limit of sums: $\int_0^2 (x^2 + x)\,dx$

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68. Evaluate as limit of sums: $\int_1^2 (x^2 - 1)\,dx$

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69. Evaluate $\int_0^1 (3x^2 + 2x + 1)\,dx$ as limit of the sum.

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

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

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72. Evaluate as limit of sums: $\int_0^2 e^x\,dx$

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

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

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

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

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

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78. Evaluate as limit of sums: $\int_0^{\frac{\pi}{2}} \cos x$

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