

MATHS

BOOKS - ARIHANT MATHS (HINGLISH)

INDEFINITE INTEGRAL

Examples

1. If $\frac{d}{dx} [x^{n+1} + c] = (n + 1)x^n$, then find $\int x^n dx$.

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2. If $\frac{d}{dx} (\sin x + c) = \cos x$, then find $\int \cos x dx$.

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3. Evaluate

$$\int \frac{x^2 + 5x - 1}{\sqrt{x}} dx$$



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4. Evaluate

$$\int (x^2 + 5)^3 dx$$



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5. Evaluate

$$\int \tan^2 x dx$$



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6. Evaluate

$$\int \frac{dx}{\sin^2 x \cos^2 x}$$



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7. Evaluate

$$\int \frac{\sin^6 x + \cos^6 x}{\sin^2 x \cos^2 x} dx$$



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8. Evaluate

$$\int \frac{\cos x - \cos 2x}{1 - \cos x} dx$$



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9. Evaluate

$$\int \frac{x^3}{x+2} dx$$



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10. Evaluate

$$\int \frac{x^2}{x^2 + 5} dx$$

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11. Evaluate

$$\int 5^{\log_e x} dx$$

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12. Evaluate

$$\int 2^{\log_4 x} dx$$

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13.
$$\int \frac{(\sqrt{x} + 1)(x^2 - \sqrt{x})}{x\sqrt{x} + x + \sqrt{x}} dx$$

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14. Evaluate

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

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15. Evaluate

$$\int \frac{x^6 - 1}{(x^2 + 1)} dx$$

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16.
$$\int \left(\frac{1 - x^{-2}}{x^{1/2} - x^{-1/2}} - \frac{2}{x^{3/2}} + \frac{x^{-2} - x}{x^{1/2} - x^{-1/2}} \right) dx$$

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17.
$$\int \left(\frac{x^{-6} - 64}{4 + 2x^{-1} + x^{-2}} \cdot \frac{x^2}{4 - 4x^{-1} + x^{-2}} - \frac{4x^2(2x + 1)}{1 - 2x} \right) dx$$



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18. Evaluate: $\int \frac{1}{\sin(x - a)\cos(x - b)} dx$

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19. Evaluate: $\int \frac{1}{\cos(x - a)\cos(x - b)} dx$

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20. Evaluate $\int \frac{\sin(x + a)}{\sin(x + b)} dx$.

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21. If $f'(x) = \frac{x}{2} + \frac{2}{x}$ and $f(1) = \frac{5}{4}$, then find $f(x)$.

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22. The gradient of the curve is given by $\frac{dy}{dx} = 2x - \frac{3}{x^2}$.

The curve passes through (1, 2) find its equation.

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23. By substitution: Theorem: If $\int (ax + b)^n dx = \frac{(ax + b)^{n+1}}{a} (n + 1)$

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24. Evaluate: $\int \frac{1}{\sqrt{3x + 4} - \sqrt{3x + 1}} dx$.

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25. Evaluate: $\int \frac{8x + 13}{\sqrt{4x + 7}} dx$

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

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27. Evaluate $\int \frac{2 + 3x^2}{x^2(1 + x^2)} dx$.

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28. Evaluate $\int \frac{\sin(\log x)}{x} dx$

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29. Evaluate $\int \left(\frac{3 \sin x + 4 \cos x}{4 \sin x - 3 \cos x} \right) dx$

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30. Evaluate $\int \frac{e^{m \tan^{-1} x}}{1 + x^2} dx$

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31. Evaluate $\int x \sin(4x^2 + 7) dx$

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32. Evaluate $\int \cos 4x \cos 7 dx$

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33. Evaluate $\int \cos x \cos 2x \cos 5x dx$

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34. Evaluate $\int \sin x \cos x \cdot \cos 2x \cdot \cos 4x dx$



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35. $\int \frac{1 - \tan^2 x}{1 + \tan^2 x} dx$



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36. Evaluate $\int \frac{1 + \cos^2 x}{1 + \cos 2x} dx$



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37. $\int \frac{\cos 2x}{\sin^2 x \cos^2 x} dx = ?$



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38. Evaluate $\int \frac{\sec 2x - 1}{\sec 2x + 1} dx$



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39. $\int \left[\frac{\cot^2 2x - 1}{2 \cot 2x} - \cos 8x \cot 4x \right] dx$

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40. Evaluate: $\int \frac{1}{x^2 - x + 1} dx$

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41. Evaluate: $\int \frac{1}{2x^2 + x - 1} dx$

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42. Evaluate $\int \frac{1}{\sqrt{x^2 - 2x + 3}} dx$

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43. Evaluate: $\int \sqrt{2x^2 + 3x + 4} dx$

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44. Evaluate: $\int \frac{1}{\sqrt{1 - e^{2x}}} dx$

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45. $\int \frac{2x}{\sqrt{1 - x^2 - x^4}} dx =$

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46. Evaluate $\int \frac{a^x}{\sqrt{1 - a^{2x}}} dx$

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47. Evaluate: $\int \sqrt{\frac{x}{a^3 - x^3}} dx$

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48. Evaluate: $\int \frac{\cos x}{\sqrt{\sin^2 x - 2 \sin x - 3}} dx$

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49. $\int \sqrt{\frac{\sin(x - \alpha)}{\sin(x + \alpha)}} dx$

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50. Evaluate $\int \frac{2 \sin 2x - \cos x}{6 - \cos^2 x - 4 \sin x} dx.$

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51. Evaluate $\int \sqrt{\frac{a - x}{a + x}} dx$

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52. Evaluate $\int x \sqrt{\frac{a^2 - x^2}{a^2 + x^2}} dx$

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53. Evaluate: $\int x \sqrt{1 + x - x^2} dx$

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54. Evaluate: $\int (x + 1) \sqrt{1 - x - x^2} dx$

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55. Evaluate $\int \frac{x^2 + x + 3}{x^2 - x - 2} dx$.

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56. Evaluate $\int \frac{2x^2 + 5x + 4}{\sqrt{x^2 + x + 1}} dx$.

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57. Evaluate $\int \frac{1}{4\sin^2 x + 9\cos^2 x} dx$

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58. Evaluate $\int \frac{\sin x}{\sin 3x} dx$

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59. Evaluate: $\int \frac{1}{2 + \sin x + \cos x} dx$

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60. Evaluate: $\int \frac{1}{\sqrt{3}\sin x + \cos x} dx$



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61. Evaluate: $\int \frac{1}{\sqrt{3} \sin x + \cos x} dx$



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62. Evaluate $\int \frac{3 \cos x + 2}{\sin x + 2 \cos x + 3} dx$



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63. The value of $\int \{1 + \tan x \cdot \tan(x + A)\} dx$ is

A. $\cot A \cdot \log \left| \frac{\sec x}{\sec(x + A)} \right| + C$

B. $\tan A \cdot \log |\sec(x + A)| + C$

C. $\cot A \cdot \log \left| \frac{\sec(x + A)}{\sec(x)} \right| + C$

D. None of these

Answer: C

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64. Integrate :

$$\int \frac{\sqrt{\cos 2x}}{\sin x} dx$$

A. $\log \left| \cot x + \sqrt{\cot^2 x - 1} \right| + \sqrt{2} \log \left| \cos x + \sqrt{\cos^2 x - 1/2} \right| + C$

B.

$$-\log \left| \cot x + \sqrt{\cot^2 x - 1} \right| + \sqrt{2} \log \left| \cos x + \sqrt{\cos^2 x - 1/2} \right| + C$$

C. $\log \left| \cot x + \sqrt{\cot^2 x - 1} \right| + 2 \log \left| \cos x + \sqrt{\cos^2 x - 1/2} \right| + C$

D. $-\log \left| \cot x + \sqrt{\cot^2 x - 1} \right| + 2 \log \left| \cos x + \sqrt{\cos^2 x - 1/2} \right| + C$

Answer: B

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65. Evaluate $\int \sin^{-1} x dx.$

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66. $\int \log_e x dx = \int \frac{1}{\log_x e} dx =$

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67. Evaluate $\int x \cos x dx$.

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68. Evaluate $\int x^2 \cos x dx$

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69. Evaluate: $\int \frac{\sin^{-1} \sqrt{x} - \cos^{-1} \sqrt{x}}{\sin^{-1} \sqrt{x} + \cos^{-1} \sqrt{x}} dx$

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70. Evaluate $\int e^x \left(\frac{1 + \sin x \cos x}{\cos^2 x} \right) dx$

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71. Evaluate $\int e^{2x} \left(\frac{1 + \sin 2x}{1 + \cos 2x} \right) dx$

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72. Evaluate: $\int e^x \frac{(1-x)^2}{(1+x^2)^2} dx$

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73. Evaluate $\int e^x \cos^2 x dx$

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74. Evaluate: $\int \sin(\log x) dx$

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75. $\int \frac{x^2 dx}{(x \sin x + \cos x)^2}$

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76. Evaluate $\int \sqrt{\frac{3-x}{3+x}} \cdot \sin^{-1}\left(\frac{1}{\sqrt{6}}\sqrt{3-x}\right) dx$

A. $\frac{1}{4} \left\{ -3 \left(\cos^{-1}\left(\frac{x}{3}\right) \right)^2 + 2\sqrt{9-x^2} \cdot \cos^{-1}\left(\frac{x}{3}\right) + 2x \right\} + C$

B. $\frac{1}{4} \left\{ -3 \left(\cos^{-1}\left(\frac{x}{3}\right) \right)^2 + 2\sqrt{9-x^2} \sin^{-1}\left(\frac{x}{3}\right) + 2x \right\} + C$

C. $\frac{1}{4} \left\{ -3 \left(\sin^{-1}\left(\frac{x}{3}\right) \right)^2 + 2\sqrt{9-x^2} \sin^{-1}\left(\frac{x}{3}\right) + 2x \right\} + C$

D. None of the above

Answer: A

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77. The value of $\int \frac{\sec x(2 + \sec x)}{(1 + 2 \sec x)^2} dx$, is equal to

A. $\frac{\sin x}{2 + \cos x} + C$

B. $\frac{\cos x}{2 + \cos x} + C$

C. $\frac{-\sin x}{2 + \sin x} + C$

D. $\frac{\cos x}{2 + \sin x} + C$

Answer: A

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78. The value of $\int \log(\sqrt{1-x} + \sqrt{1+x}) dx$, is equal to

A. $x \log(\sqrt{1-x} + \sqrt{1+x}) + \frac{1}{2}x - \frac{1}{2}\sin^{-1}(x) + C$

B. $x \log(\sqrt{1-x} + \sqrt{1+x}) + \frac{1}{2}x + \frac{1}{2}\sin^{-1}(x) + C$

C. $x \log(\sqrt{1-x} + \sqrt{1+x}) - \frac{1}{2}x + \frac{1}{2}\sin^{-1}(x) + C$

D. None of the above

Answer: C



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79. the value of $\int e^x \left(\frac{x^4 + 2}{(1 + x^2)^{\frac{5}{2}}} \right) dx,$

A. $\frac{e^x(x + 1)}{(1 + x^2)^{3/2}}$

B. $\frac{e^x(1 - x + x^2)}{(1 + x^2)^{3/2}}$

C. $\frac{e^x(1 + x)}{(1 + x^2)^{3/2}}$

D. None of these

Answer: D



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80. If $\int (\sin 3\theta + \sin \theta) \cos \theta e^{\sin \theta} d\theta = (A \sin^3 \theta + B \cos^2 \theta + C \sin \theta + D \cos \theta + E) e^{\sin \theta} + F$, then

A. $A = -4, B = 12$

B. $A = -4, B = -12$

C. $A = 4, B = 12$

D. $A = 4, B = -12$

Answer: B

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81. $\int e^{x \sin x + \cos x} \left(\frac{x^4 \cos^3 x - x \sin x + \cos x}{x^2 \cos^2 x} \right) dx =$

A. $e^{(x \sin x + \cos x)} \cdot \left(x + \frac{1}{x \cos x} \right) + C$

B. $e^{(x \sin x + \cos x)} \cdot \left(x \cos x \frac{1}{x} \right) + C$

C. $e^{(x \sin x + \cos x)} \cdot \left(x - \frac{1}{x \cos x} \right) + C$

D. None of the above

Answer: C

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82. Evaluate: $\int \sin^{-1} \left(\frac{2x + 2}{\sqrt{4x^2 + 8x + 13}} \right) dx$

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83. $\int \frac{x^2 (x \sec^2 x + \tan x)}{(x \tan x + 1)^2}$

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84. $\frac{2x + 1}{(x + 1)(x - 2)}$ into partial fractions

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85. Resolve $\frac{1}{(x-1)(x+2)(2x+3)}$ into partial fractions.

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86. Resolve $\frac{3x^3 + 2x^2 + x + 1}{(x+1)(x+2)}$ into partial fraction

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87. Expression $\frac{x+5}{(x-2)^2}$ has repeated (twice) linear factors in denominator, so find partial fractions.

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88. Resolve $\frac{3x-2}{(x-1)^2(x+1)(x+2)}$ into partial fractions.

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89. Resolve $\frac{2x + 7}{(x + 1)(x^2 + 4)}$ into partial fractions.

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90. Find the partial fraction

$$\frac{2x + 1}{(3x + 2)(4x^2 + 5x + 6)}.$$

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91. Resolve $\frac{2x^4 + 2x^2 + x + 1}{x(x^2 + 1)^2}$ into partial fractions.

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92. Evaluate : $\int \frac{1 - x^2}{x(1 - 2x)} dx$.

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93. Evaluate $\int \frac{3x - 1}{(x - 2)^2} dx$

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94. Evaluate $\int \frac{x^2 + x + 1}{x^2(x + 2)} dx$

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95. Evaluate $\int \frac{8dx}{(x + 2)(x^2 + 4)}$

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96. Evaluate $\int \frac{1}{\sin x - \sin 2x} dx.$

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97. Evaluate: $\int \frac{(1 - x \sin x) dx}{x(1 - x^3 e^{3 \cos x})}$



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98. Evaluate $\int \sin 4x \cdot e^{\tan^2 x} dx$.



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99. Solve $\int \frac{1 + x \cos x}{x(1 - x^2 e^{2 \sin x})} dx$.



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100. $\int \frac{1}{x} \left\{ \log e^{e^x} \cdot \log e^{e^2 x} \cdot \log e^{e^3 x} \right\} dx$



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101. Find the value of $\int \frac{d(x^2 + 1)}{\sqrt{(x^2 + 2)}}$.

A. $2\sqrt{x^2 + 2} + C$

B. $\sqrt{x^2 + 2} + C$

C. $x\sqrt{x^2 + 2} + C$

D. None of these

Answer: A

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102. If $\int \frac{(\sqrt{x})^5}{(\sqrt{x})^7 + x^6} dx = a \log\left(\frac{x^k}{1 + x^k}\right) + c$ then a and k are

A. $2/5, 5/2$

B. $1/5, 2/5$

C. $5/2, 1/2$

D. $2/5, 1/2$

Answer: A

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103. $\int \frac{5x^4 + 4x^5}{(x^5 + x + 1)^2} dx$

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104. For any natural number m , evaluate,

$$\int (x^{3m} + x^{2m} + x^m)(2x^{2m} + 3x^m) + 6^{t/m} dx, x > 0$$
$$\int \frac{x^2 - 1}{x^3 \sqrt{2x^4 - 2x^2 + 1}} dx \text{ is equal to:}$$

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105. $\int \frac{x}{\sqrt{1 + x^2} + \sqrt{(1 + x^2)^3}} dx$ is equal to

A. $\frac{1}{2} \ln(1 + \sqrt{1 + x^2}) + C$

B. $2\sqrt{1 + \sqrt{1 + x^2}} + C$

C. $2(1 + \sqrt{1 + x^2}) + C$

D. None of these

Answer: B



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$$106. \int \frac{(2x + 1)}{(x^2 + 4x + 1)^{3/2}} dx$$

$$A. \frac{x^3}{(x^2 + 4x + 1)^{1/2}} + C$$

$$B. \frac{x}{(x^2 + 4x + 1)^{1/2}} + C$$

$$C. \frac{x^2}{(x^2 + 4x + 1)^{1/2}} + C$$

$$D. \frac{1}{(x^2 + 4x + 1)^{1/2}} + C$$

Answer: B



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$$107. \int \frac{px^{p+2q-1} - qx^{q-1}}{x^{2p+2q} + 2x^{p+q} + 1} dx$$

$$A. -\frac{x^p}{x^{p+q} + 1} + C$$

$$\text{B. } \frac{x^q}{x^{p+q} + 1} + C$$

$$\text{C. } -\frac{x^q}{x^{p+q} + 1} + C$$

$$\text{D. } \frac{x^p}{x^{p+q} + 1} + C$$

Answer: C



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108. $\int \frac{x^2(1 - \ln x)}{(\ln^4 x - x^4)} dx$ is equal to



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109. $\int \frac{x^2 - 1}{x^3 \sqrt{2x^4 - 2x^2 + 1}} dx$ is equal to

$$\text{A. } \frac{\sqrt{2x^4 - 2x^2 + 1}}{x^2} + C$$

$$\text{B. } \frac{\sqrt{2x^4 - 2x^2 + 1}}{x^3} + C$$

$$\text{C. } \frac{\sqrt{2x^4 - 2x^2 + 1}}{x} + C$$

$$D. \frac{\sqrt{2x^4 - 2x^2 + 1}}{2x^2} + C$$

Answer: D



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110. Let $f(x) = \frac{x}{(1+x^n)^{1/n}}$ for $n \geq 2$ and $g(x) = \underbrace{fofo\dots of(x)}_{n \text{ times}}$, then

$\int x^{n-2} g(x) dx$ equals to

A. $\frac{1}{n(n-1)}(1+nx^n)^{1-\frac{1}{n}} + C$

B. $\frac{1}{n-1}(1+nx^n)^{1-\frac{1}{n}} + C$

C. $\frac{1}{n(n+1)}(1+nx^n)^{1+\frac{1}{n}} + C$

D. $\frac{1}{n+1}(1+nx^n)^{1+\frac{1}{n}} + C$

Answer: A



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$$111. \int \frac{5}{1+x^4} dx$$

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$$112. \int \frac{1}{x^4 + 5x^2 + 1} dx$$

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$$113. \int \sqrt{\tan x} \cdot dx$$

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$$114. \text{Evaluate: } \int \frac{1}{\sin^4 x + \cos^4 x} dx$$

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115. The value of $\int \frac{(ax^2 - b)dx}{x\sqrt{c^2x^2 - (ax^2 + b)^2}}$ is equal to

A. $\frac{1}{c} \sin^{-1} \left(ax \frac{b}{x} \right) + k$

B. $c \sin^{-1} \left(ax + \frac{b}{x} \right) + k$

C. $\sin^{-1} \left[\frac{ax + b/x}{c} \right] + k$

D. None of these

Answer: C



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116. $\int \frac{x^x (x^{2x} + 1)(\ln x + 1)}{x^{4x} + 1} dx$



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117. Evaluate: $\int \frac{x^2 - 1}{(x^4 + 3x^2 + 1)\tan^{-1} \left(x + \frac{1}{x} \right)} dx$



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118. Evaluate:
$$\int \frac{x^{-\frac{7}{6}} - x^{\frac{5}{6}}}{x^{\frac{1}{3}}(x^2 + x + 1)^{\frac{1}{2}} - x^{\frac{1}{2}}(x^2 + x + 1)^{\frac{1}{3}}} dx$$

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119. The value of $\int(\{[x]\})dx$ where $\{.\}$ and $[.]$ denotes the fractional part of x and greatest integer function equals

- A. 0
- B. 1
- C. 2
- D. -1

Answer: A

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120. Evaluate $\int \frac{1}{(x+1)\sqrt{x-2}} dx$.

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121. Evaluate $\int \frac{x+2}{(x^2+3x+3)\sqrt{x+1}} + C$

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122. Evaluate $\int \frac{dx}{(x-1)\sqrt{x^2+x+1}}$.

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123. Evaluate: $\int \frac{dx}{(1+x^2)\sqrt{1-x^2}}$

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124. Evaluate: $\int \frac{(x-1)\sqrt{x^4+2x^3-x^2+2x+1}}{x^2(x+1)} dx$



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125. Evaluate $\int \frac{dx}{(x-3)^3 \sqrt{x^2-6x+10}}$.



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126. $\int \frac{(2x^2 + 5x + 9) dx}{(x+1)\sqrt{x^2+x+1}}$



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127. Evaluate: (i) $\int \sin^3 x \cos^5 x dx$ (ii) $\int \frac{1}{\sin^4 x \cos^2 x} dx$



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128. $\int (\sin x)^{-\frac{11}{3}} (\cos x)^{-\frac{1}{3}} dx$



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129. Evaluate $\int \frac{dx}{2 \sin x + \sec x}$.

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130. Evaluate $\int x^{1/3} (2 + x^{1/2})^2 dx$.

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131. Evaluate $\int x^{-2/3} (1 + x^{2/3})^{-1} dx$.

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132. Evaluate $\int x^{-2/3} (1 + x^{1/3})^{1/2} dx$.

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133. Evaluate $\int \sqrt{x} (1 + x^{1/3})^4 dx$.



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134. $\int x^5 (1 + x^3)^{\frac{2}{3}} dx$



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135. If $I = \int x^{-11} (1 + x^4)^{-1/2} dx$



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136. $\int \frac{dx}{\sqrt[3]{x} + \sqrt[4]{x}}$



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137. Evaluate $\int \frac{x}{(7x - 10 - x^2)^{\frac{3}{2}}} dx$



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138. Evaluate: $\int \frac{1}{x + \sqrt{x^2 - x + 1}} dx$

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139. Evaluate $I_n = \int \frac{dx}{(x^2 + a^2)^n}$.

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140. Derive reduction formula for

$$I_{(n,m)} = \int \frac{\sin^n x}{\cos^m x} dx.$$

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141. Evaluate $\int \frac{dx}{(5 + 4 \cos x)^2}$.

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142. Evaluate $\int \frac{dx}{(16 + 9 \sin x)^2}$.

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143. Evaluate $\int \frac{dx}{(\sin x + a \sec x)^2}$ when $|a| > \frac{1}{2}$.

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144. Evaluate: $\int \frac{1}{\cos^6 x + \sin^6 x} dx$

A. $\tan^{-1}(2 \cot 2x) + C$

B. $\tan^{-1}(\cot 2x) + C$

C. $\tan^{-1}\left(\frac{1}{2} \cot 2x\right)$

D. $\tan^{-1}(-2 \cot 2x) + C$

Answer: D

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145.

Evaluate:

$$\int \frac{e^{\tan^{-1} x} \cdot ((-1)x)}{(1+x^2)} \left[\left(\sec^{-1} \sqrt{1+x^2} + \cos^{-1} \left(\frac{1-x^2}{1+x^2} \right) \right) \right] dx \quad (x > 0).$$

A. $e^{\tan^{-1} x} \cdot \tan^{-1} x + C$

B. $\frac{e^{\tan^{-1} x} \cdot (\tan^{-1} x)^2}{2} + C$

C. $e^{\tan^{-1} x} \cdot \left(\sec^{-1} \left(\sqrt{1+x^2} \right) \right)^2 + C$

D. $e^{\tan^{-1} x} \cdot \left(\cos^{-1} \left(\sqrt{1+x^2} \right) \right)^2 + C$

Answer: C


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146. If $I = \int \frac{e^x}{e^{4x} + e^{2x} + 1} dx$. $J = \int \frac{e^{-x}}{e^{-4x} + e^{-2x} + 1} dx$. Then for an arbitrary constant c , the value of $J - I$ equal to

A. $\frac{1}{2} \log \left(\frac{e^{4x} - e^{2x} + 1}{e^{4x} + e^{2x} + 1} \right) + C$

B. $\frac{1}{2} \log \left(\frac{e^{2x} + e^x + 1}{e^{2x} - e^x + 1} \right) + C$

$$C. \frac{1}{2} \log \left(\frac{e^{2x} - e^x + 1}{e^{2x} + e^x + 1} \right) + C$$

$$D. \frac{1}{2} \log \left(\frac{e^{4x} + e^{2x} + 1}{e^{4x} - e^{2x} + 1} \right) + C$$

Answer: C



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147. Integral of $\sqrt{1 + 2 \cot x (\cot x + \cos ecx)}$ w.r.t. x , is

A. $2 \ln \cos. \frac{x}{2} + C$

B. $2 \ln \sin. \frac{x}{2} + C$

C. $\frac{1}{2} \ln \cos. \frac{x}{2} + C$

D. $\ln \sin x - \ln(\cos ecx - \cot x) + C$

Answer: B



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148. If $I_n = \int \cot^n x dx$, then $I_0 + I_1 + 2(I_2 + I_3 + \dots + I_8) + I_9 + I_{10}$ equals to (where $u = \cot x$)

A. $u + \frac{u^2}{2} + \dots + \frac{u^9}{9}$

B. $-\left(u + \frac{u^2}{2} + \dots + \frac{u^9}{9}\right)$

C. $-\left(u + \frac{u^2}{2!} + \dots + \frac{u^9}{9!}\right)$

D. $\frac{u}{2} + \frac{2u^2}{3} + \dots + \frac{9u^9}{10}$

Answer: B



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149. Let $f(x) = x + \sin x$. Suppose g denotes the inverse function of f .

The value of $g' \left(\frac{\pi}{4} + \frac{1}{\sqrt{2}} \right)$ has the value equal to

A. $\sqrt{2} - 1$

B. $\frac{\sqrt{2} + 1}{\sqrt{2}}$

C. $2 - \sqrt{2}$

D. $\sqrt{2} + 1$

Answer: C

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150. $\int \frac{dx}{\sqrt{(x-a)(b-x)}}$

A. $2 \sin^{-1} \sqrt{\frac{x-a}{b-a}} + C$

B. $2 \sin^{-1} \sqrt{\frac{x-b}{b-a}} + C$

C. $\sin^{-1} \sqrt{\frac{x-a}{b-a}} + C$

D. None of these

Answer: A

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151. $\int \frac{x-1}{x+1} \cdot \frac{1}{\sqrt{x^3+x^2+x}} dx$

A. $2 \tan^{-1} \sqrt{\frac{x+1}{x}} + C$

B. $\tan^{-1} \sqrt{\frac{x^2+x+1}{x}} + C$

C. $2 \tan^{-1} \sqrt{\frac{x^2+x+1}{x}} + C$

D. None of these

Answer: C



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152. Evaluate: $\int \frac{1+x^2}{(1-x^2)\sqrt{1+x^2+x^4}} dx$

A. $-\frac{1}{2\sqrt{3}} \log \left| \frac{\sqrt{x^4+x^2+1} - \sqrt{3}x}{\sqrt{x^4+x^2+1} + \sqrt{3}x} \right| + C$

B. $\frac{1}{2\sqrt{3}} \log \left| \frac{\sqrt{x^4+x^2+1} + \sqrt{2}x}{\sqrt{x^4+x^2+1} - \sqrt{2}x} \right| + C$

C. $\frac{1}{2\sqrt{3}} \log \left| \frac{\sqrt{x^4-x^2+1} - \sqrt{3}x}{\sqrt{x^4+x^2+1} + \sqrt{3}x} \right| + C$

D. None of the above

Answer: A

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$$153. I = \int \frac{dx}{(a + dx^2)\sqrt{b - ax^2}}$$

A. $\frac{1}{\sqrt{a(a^2 + b^2)}} \tan^{-1} \left(\frac{x\sqrt{a^2 + b^2}}{a\sqrt{b - ax^2}} \right) + C$

B. $\frac{1}{\sqrt{(a^2 + b^2)}} \tan^{-1} \left(\frac{x\sqrt{a^2 + b^2}}{a\sqrt{b - ax^2}} \right) + C$

C. $\frac{1}{\sqrt{a(a^2 + b^2)}} \tan^{-1} \left(\frac{x\sqrt{a^2 + b^2}}{a} \right) + C$

D. None of the above

Answer: A

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154. The value of

$$I = \int \frac{dx}{2x\sqrt{1-x}\sqrt{(2-x)+\sqrt{1-x}}} = -\frac{1}{2} \left\{ \log \left(z + \frac{3}{2} + \sqrt{z^2 + 3z + \dots} \right) \right.$$

and $s - z = \frac{k}{x}$, then value of k, is

A. 1

B. 2

C. 3

D. 4

Answer: B



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155. If $\int \frac{dx}{(x^2 + a^2)^2} = \frac{1}{ka^2} \left\{ \frac{x}{x^2 + a^2} + \frac{1}{a} \tan^{-1} \frac{x}{a} \right\} + C$. Then the

value of k, is

A. 1

B. 2

C. 3

D. 4

Answer: B



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156. If

$$\int \frac{dx}{(x^2 + a^2)^3} = \frac{x}{4a^2(x^2 + a^2)} + \frac{m}{na^2} \left\{ \frac{x}{2a^2(x^2 + a^2)} + \frac{1}{2a^3} \tan^{-1} \left(\frac{x}{a} \right) \right\}$$

. Then $|m - n|$ is equal to

A. 4

B. 3

C. 2

D. 1

Answer: D



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157. If $y(x - y)^2 = x$, then $\int \frac{1}{x - 3y} dx$ is equal to (A) $\frac{1}{3} \log\{(x - y)^2 + 1\}$ (B) $\frac{1}{4} \log\{(x - y)^2 - 1\}$ (C) $\frac{1}{2} \log\{(x - y)^2 - 1\}$ (D) $\frac{1}{6} \log\{x^2 - y^2 - 1\}$

A. 1

B. 3

C. 5

D. 7

Answer: C



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158. If $\int (x + \sqrt{1 + x^2})^n dx$.

$$= \frac{1}{a(n+1)} \{x + \sqrt{1+x^2}\}^{n+1} + \frac{1}{-b(n-1)} \{x + \sqrt{1+x^2}\}^{n-1} + C$$

Then $(a + b)$ is equal to

A. 2

B. 3

C. 4

D. 5

Answer: C



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159. If $\int \frac{f(x)}{x^3 - 1} dx$, where $f(x)$ is a polynomial of degree 2 in x such that

$$f(0) = f(1) = 3f(2) = -3 \quad \text{and}$$

$$\int \frac{f(x)}{x^3 - 1} dx = -\log|x - 1| + \log|x^2 + x + 1| + \frac{m}{\sqrt{n}} \tan^{-1}\left(\frac{2x + 1}{\sqrt{3}}\right) +$$

. Then $(2m + n)$ is

A. 3

B. 5

C. 7

D. 9

Answer: C

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160. The value of $\int \frac{(1+x)}{x(1+xe^x)^2} dx$, is equal to

A. $\log \left| \frac{x}{1+xe^x} \right| + \frac{1}{(1+xe^x)} + C$

B. $\log \left| \frac{xe^x}{1+xe^x} \right| + \frac{1}{1+xe^x} + C$

C. $\log \left| \frac{xe^x}{1+e^x} \right| + \frac{1}{1+xe^x} + C$

D. None of the above

Answer: B

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161. The value of $\int \frac{dx}{x + \sqrt{a^2 - x^2}}$, is equal to

A. $\frac{1}{2} \sin^{-1} \left(\frac{x}{a} \right) + \frac{1}{2} \log \left| x + \sqrt{a^2 - x^2} \right| + C_1$

$$B. \frac{1}{2} \sin^{-1} \left(\frac{x}{a} \right) - \frac{1}{2} \log \left| x + \sqrt{a^2 - x^2} \right| + C_1$$

$$C. \frac{1}{2} \sin^{-1} \left(\frac{x}{a} \right) - \log \left| x + \sqrt{a^2 - x^2} \right| + C_1$$

$$D. \frac{1}{2} \cos^{-1} \left(\frac{x}{a} \right) + \frac{1}{2} \log \left| x + \sqrt{a^2 - x^2} \right| + C_1$$

Answer: A

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162. $\int \frac{x^2 - 1}{(x^2 + 1)\sqrt{x^4 + 1}} dx$ is equal to -

$$A. \frac{1}{\sqrt{2}} \sec^{-1} \left(\frac{x^2 + 1}{\sqrt{2}x} \right) + C$$

$$B. \sqrt{2} \sec^{-1} \left(\frac{x^2 + 1}{\sqrt{2}x} \right) + C$$

$$C. \frac{1}{\sqrt{2}} \operatorname{cosec}^{-1} \left(\frac{x^2 + 1}{\sqrt{2}x} \right) + C$$

$$D. \sqrt{2} \operatorname{cosec}^{-1} \left(\frac{x^2 + 1}{\sqrt{2}x} \right) + C$$

Answer: A

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163. $\int \frac{\sqrt{4+x^2}}{x^6} dx = \frac{A(4+x^2)^{3/2}(Bx^2-6)}{x^5} + C$, then

A. $A = \frac{1}{120}$

B. $B = 1$

C. $A = -\frac{1}{120}$

D. $B = -1$

Answer: A::B



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164. The value of the integral $\int e^{\sin^2 x} (\cos x + \cos^3 x) \sin x dx$ is

A. $\frac{1}{2} e^{\sin^2 x} (3 - \sin^2 x) + C$

B. $e^{\sin^2 x} \left(1 + \frac{1}{2} \cos^2 x \right) + C$

C. $e^{\sin^2 x} (3 \cos^2 x + 2 \sin^2 x) + C$

D. $e^{\sin^2 x} (2 \cos^2 x + 3 \sin^2 x) + C$

Answer: A::B

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165. Find $\int [\sqrt{\cot x} + \sqrt{\tan x}] dx$

A. $\sqrt{2} \sin^{-1}(\sin x - \cos x)$

B. $\frac{\pi}{\sqrt{2}} - \sqrt{2} \cos^{-1}(\sin x - \cos x)$

C. $\sqrt{2} \tan^{-1} \left(\frac{\tan x - 1}{\sqrt{2}\sqrt{\tan x}} \right)$

D. None of these

Answer: A::B::C

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166. For integral $\int f\left(x - \frac{a}{x}\right) \cdot \left(1 + \frac{a}{x^2}\right) dx$, put $x - \frac{a}{x} = t$

For integral $\int f\left(x + \frac{a}{x}\right) \cdot \left(1 - \frac{a}{x^2}\right) dx$, put $x + \frac{a}{x} = t$

For integral $\int f\left(x^2 - \frac{a}{x^2}\right) \cdot \left(x + \frac{a}{x^3}\right) dx$, put $x^2 - \frac{a}{x^2} = t$

For integral $\int f\left(x^2 + \frac{a}{x^2}\right) \cdot \left(x - \frac{a}{x^3}\right) dx$, put $x^2 + \frac{a}{x^2} = t$

many integrands can be brought into above forms by suitable reductions or transformations .

$$\int \frac{x^4 - 2}{x^2 \sqrt{x^4 + x^2 + 2}} dx$$

A. $\sqrt{x^2 + 1 + \frac{1}{x^2}} + C$

B. $\sqrt{x^2 + 1 + \frac{2}{x^2}} + C$

C. $\sqrt{x^2 + \frac{1}{x^2}} + C$

D. $\sqrt{x^2 + \frac{2}{x^2}} + C$

Answer: B



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167. For integral $\int f\left(x - \frac{a}{x}\right) \cdot \left(1 + \frac{a}{x^2}\right) dx$, put $x - \frac{a}{x} = t$

For integral $\int f\left(x + \frac{a}{x}\right) \cdot \left(1 - \frac{a}{x^2}\right) dx$, put $x + \frac{a}{x} = t$

For integral $\int f\left(x^2 - \frac{a}{x^2}\right) \cdot \left(x + \frac{a}{x^3}\right) dx$, put $x^2 - \frac{a}{x^2} = t$

For integral $\int f\left(x^2 + \frac{a}{x^2}\right) \cdot \left(x - \frac{a}{x^3}\right) dx$, put $x^2 + \frac{a}{x^2} = t$

many integrands can be brought into above forms by suitable reductions or transformations .

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

A. $\tan^{-1}\left(x + \frac{1}{x} + 1\right) + C$

B. $\tan^{-1}\sqrt{x + \frac{1}{x} + 1} + C$

C. $2 \tan^{-1}\sqrt{x + \frac{1}{x} + 1} + C$

D. None of these

Answer: C



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168. For integral $\int f\left(x - \frac{a}{x}\right) \cdot \left(1 + \frac{a}{x^2}\right) dx$, put $x - \frac{a}{x} = t$

For integral $\int f\left(x + \frac{a}{x}\right) \cdot \left(1 - \frac{a}{x^2}\right) dx$, put $x + \frac{a}{x} = t$

For integral $\int f\left(x^2 - \frac{a}{x^2}\right) \cdot \left(x + \frac{a}{x^3}\right) dx$, put $x^2 - \frac{a}{x^2} = t$

For integral $\int f\left(x^2 + \frac{a}{x^2}\right) \cdot \left(x - \frac{a}{x^3}\right) dx$, put $x^2 + \frac{a}{x^2} = t$

many integrands can be brought into above forms by suitable reductions

or transformations .

$$\int \frac{5x^4 + 4x^5}{(x^5 + x + 1)^2} dx$$

A. $x^5 + x + 1 + C$

B. $\frac{x^5}{x^5 + x + 1} + C$

C. $x^{-4} + x^{-5} + C$

D. $\frac{x^5}{x^5 + x + 1} + C$

Answer: D



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169. If the primitive of the function $f(x) = \frac{x^{2009}}{(1+x^2)^{1006}}$ w.r.t. x is equal to $\frac{1}{n} \left(\frac{x^2}{1+x^2} \right)^m + C$, then $\frac{n}{m}$ is equal to

A.

B.

C.

D.

Answer: 2



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170. Suppose $\begin{vmatrix} f'(x) & f(x) \\ f''(x) & f'(x) \end{vmatrix} = 0$ where $f(x)$ is continuous differentiable function with $f'(x) \neq 0$ and satisfies $f(0) = 1$ and $f'(0) = 2$, then $f(x) = e^{\lambda x} + k$, then $\lambda + k$ is equal to

A.

B.

C.

D.

Answer: 2



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171. $\int \sin(101x) \sin^{99} x dx = \frac{\sin(100x)(\sin x)^\lambda}{\mu}$ then $\frac{\lambda}{\mu}$

A.

B.

C.

D.

Answer: 1



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172. If $I_n = \int z^n e^{1/z} dz$, then show that

$$(n + 1)! I_n = I_0 + e^{1/z} (1! z^2 + 2! z^3 + \dots + n! z^{n+1}).$$

A.

B.

C.

D.

Answer:



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173. If $I_n = \int x^n \sqrt{a^2 - x^2} dx$, prove that

$$I_n = -\frac{x^{n-1}(a^2 - x^2)^{\frac{3}{2}}}{(n+2)} + \frac{(n+1)}{(n+2)}a^2 I_{n-2}$$

A.

B.

C.

D.

Answer:



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174. If $I_m = \int (\sin x + \cos x)^m dx$, then show that

$$m I_m = (\sin x + \cos x)^{m-1} \cdot (\sin x - \cos x) + 2(m-1)I_{m-2}$$

A.

B.

C.

D.

Answer:



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175. If $I_{m,n} = \int \cos^m x \cdot \cos nx dx$, show that

$$(m + n)I_{m,n} = \cos^m x \cdot \sin nx + mI_{(m-1,n-1)}$$

A.

B.

C.

D.

Answer: $(m + n)I_{m,n} = \cos^m x \cdot \sin nx + mI_{m-1, n-1}$

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176.
$$\int \frac{\tan\left(\frac{\pi}{4} - x\right)}{\cos^2 x \sqrt{\tan^3 x + \tan^2 x + \tan x}} dx$$

- A.
- B.
- C.
- D.

Answer: $-2 \tan^{-1}\left(\sqrt{\tan x + 1 + \frac{1}{\tan x}}\right) + C$

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177. Evaluate
$$\int \frac{x^2 + n(n-1)}{(x \sin x + n \cos x)^2} dx.$$

- A.
- B.

C.

D.

Answer:



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178. If $\cos \theta > \sin \theta > 0$, then evaluate :

$$\int \left\{ \log \left(\frac{1 + \sin 2\theta}{1 - \sin 2\theta} \right)^{\cos^2 \theta} + \log \left(\frac{\cos 2\theta}{1 + \sin 2\theta} \right) \right\} d\theta$$

A.

B.

C.

D.

Answer: $\frac{\sin 2\theta}{2} \log \left(\frac{\cos \theta + \sin \theta}{\cos \theta - \sin \theta} \right) + \frac{1}{2} \log |\cos 2\theta| + C$



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179. Evaluate $\int \frac{\tan^{-1} x}{x^4} dx$.

A.

B.

C.

D.

Answer: $-\frac{\tan^{-1} x}{3x^3} - \frac{1}{6} \log \left| \frac{x^2 + 1}{x^2} \right| - \frac{1}{6x^2} + C$



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180. Evaluate $\int x^2 \log(1 - x^2) dx$, and hence prove that

$$\frac{1}{1.5} + \frac{1}{2.7} + \frac{1}{3.9} + \dots = \frac{2}{3} \log 2 - \frac{8}{9}.$$

A.

B.

C.

D.

Answer: $\frac{2}{3}\log(2) - \frac{8}{9}$



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181. $\int \frac{a + b \sin x}{(b + a \sin x)^2} dx$

A.

B.

C.

D.

Answer: $-\left(\frac{\cos x}{b + a \sin x}\right) + C$



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182. Evaluate: $\int \frac{1}{(x-1)^3(x+2)^5} dx$.

A.

B.

C.

D.

Answer: $\frac{4}{3} \left(\frac{x-1}{x+2} \right)^{1/4} + C$



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Exercise For Session 1

1. Evaluate the following integration

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



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2. Evaluate the following integration

$$\int \frac{x^2 + 3}{x^6(x^2 + 1)} dx$$



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3. Evaluate the following integration

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



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4. Evaluate the following integration

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



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5. Evaluate the following integration

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



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6. Evaluate the following integration

$$\int \frac{(x^2 + \sin^2 x) \sec^2 x}{(1 + x^2)} dx$$



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7. Evaluate: $\int \frac{x^2}{(a + bx)^2} dx$



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8. Evaluate the following integration

$$\int 2^x \cdot e^x \cdot dx$$



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9. Evaluate :

$$\int \frac{e^{5x} + e^{3x}}{e^x + e^{-x}} dx$$

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10. $\int (e^{x \log a} + e^{a \log x}) dx$

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11. Evaluate: $\int \frac{1 + \cos 4x}{\cot x - \tan x} dx$

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12. Evaluate $\int \tan x \tan 2x \tan 3x dx$.

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13. Evaluate the following integration

$$\int \frac{\sin 4x}{\sin x} dx$$



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14. Evaluate the following integration

$$\int \cos^3 x dx$$



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15. Evaluate the following integration

$$\int \sin^3 x \cos^3 x dx$$



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Exercise For Session 2

1. Solve the following integration

$$\int \frac{dx}{1 + \sin x}$$

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2. Solve the following integration

$$\int \frac{\cos x - \sin x}{\cos x + \sin x} \cdot (2 + 2 \sin 2x) dx$$

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3. $\int (3 \sin x \cos^2 x - \sin^3 x) dx$

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4. Solve the following integration

$$\int \cos x^\circ dx$$

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5. Solve the following integration

$$\int \frac{\sin x + \cos x}{\sqrt{1 + \sin 2x}} \cdot dx, \text{ here } (\sin x + \cos x) > 0$$

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6. $\int \frac{\cos 2x - \cos 2\alpha}{\cos x - \cos \alpha} dx$

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7. $\int \frac{\sin^3 x + \cos^3 x}{\sin^2 x \cdot \cos^2 x} dx$

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8. $\int \sec^2 x \operatorname{cosec}^2 x dx$

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9. Solve the following integration

$$\int \sqrt{1 - \sin 2x} dx$$

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10.
$$\int \frac{\sin^6 x + \cos^6 x}{\sin^2 x \cos^2 x} dx$$

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11.
$$\int \left[\sin^2 \left(\frac{9\pi}{8} + \frac{x}{4} \right) - \sin^2 \left(\frac{7\pi}{8} + \frac{x}{4} \right) \right] dx$$

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12.
$$\int \frac{\cos 4x - 1}{\cot x - \tan x} dx$$
 is equal to

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13. $\int \left[\sin \alpha \sin(x - \alpha) + \sin^2 \left(\frac{x}{2} - \alpha \right) \right] dx$

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14. Solve the following integration

$$\int \frac{\sin 2x + \sin 5x - \sin 3x}{\cos x + 1 - 2 \sin^2 2x} dx$$

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15. $\int \frac{\cos^4 x - \sin^4 x}{\sqrt{1 + \cos 4x}} dx, (\cos 2x > 0)$

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Exercise For Session 3

1. Evaluate the following integrals

$$\int \frac{x dx}{9 - 16x^4}$$



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$$2. \int \frac{x^2}{9 + 16x^6} dx$$



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3. Evaluate the following integrals

$$\int \frac{x^3 dx}{16x^8 - 25}$$



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4. Evaluate the following integrals

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



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5. $\int \sqrt{\frac{x^4}{a^6 + x^6}} dx$

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6. $\int \frac{1}{4e^x + 9e^{-x}} dx = \dots$

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7. Evaluate the following integrals

$$\int \frac{2^x}{\sqrt{4^x - 25}} dx$$

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8. Evaluate: $\int \frac{8x - 11}{\sqrt{5 + 2x - x^2}} dx$

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9. निम्नलिखित समाकलों के मान ज्ञात कीजिए-

$$\int \frac{x + 2}{\sqrt{x^2 + 2x + 3}} dx$$

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10. Evaluate the following integrals $\int \frac{x - 3}{\sqrt{3 - 2x - x^2}} dx$

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11. Evaluate the following integrals

$$\int \frac{3x - 1}{4x^2 - 4x + 17} dx$$

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12. $\int \frac{\sqrt{x} dx}{\sqrt{2x + 3}}$

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13. Evaluate the following integrals

$$\int \sqrt{\frac{a-x}{x-b}} dx$$

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14. Evaluate the following integrals

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

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15. Evaluate the following integrals

$$\int \frac{x^2 + 2x + 3}{\sqrt{x^2 + x + 1}} dx$$

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16. Evaluate the following integrals

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



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17. Evaluate: $\int \frac{1}{\sin x + \sqrt{3} \cos x} dx$

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18. Evaluate the following integrals

$$\int \frac{\cos^2 x \sin x}{\sin x - \cos x} dx$$

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19. Evaluate : $\int \frac{e^x}{\sqrt{5 - 4e^x - e^{2x}}} dx$

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20. Evaluate the following integrals

$$\int \sqrt{\frac{\cos x - \cos^3 x}{(1 - \cos^3 x)}} dx$$



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21. Evaluate the following integrals

Evaluate $\int \frac{3 \sin x + 2 \cos x}{3 \cos x + 2 \sin x} dx$



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22. Evaluate the following integrals

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



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23. $\int \frac{(2x^2 + 5x + 9) dx}{(x + 1) \sqrt{x^2 + x + 1}}$



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24. $\int \frac{dx}{\sec x + \operatorname{cosec} x}$

A. $\left\{ (\sin x + \cos x) + \frac{1}{\sqrt{2}} \log \left| \frac{\tan x/2 - 1 - \sqrt{2}}{\tan x/2 - 1 + \sqrt{2}} \right| \right\} + C$

B. $2 \left\{ (\sin x + \cos x) + \frac{1}{\sqrt{2}} \log \left| \frac{\tan x/2 - 1 - \sqrt{2}}{\tan x/2 - 1 + \sqrt{2}} \right| \right\} + C$

C. $\frac{1}{2} \left\{ (\sin x - \cos x) + \frac{1}{\sqrt{2}} \log \left| \frac{\tan x/2 - 1 - \sqrt{2}}{\tan x - 1 + \sqrt{2}} \right| \right\} + C$

D. None of these

Answer: C



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Exercise For Session 4

1. $\int x^2 e^x dx$



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2. $\int x^2 \sin x dx$



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3. ज्ञात करें $\int \log x dx$



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4. Evaluate: $\int (\log x)^2 dx$



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5. $\int (\tan^{-1} x) dx$



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6. $\int \sec^{-1} x dx$



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7. $\int x \tan^{-1} x \, dx$

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8. $\int \frac{\log x}{x^2} dx$

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9. $\int \frac{x - \sin x}{1 - \cos x} dx$

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10. Evaluate: $\int \log(1 + x^2) dx$

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11. Evaluate: $\int e^x (\tan x + \log \sec x) dx$

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12. $\int e^x \frac{1 + \sin x \cos x}{\cos^2 x} dx$ is equal to

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13. Evaluate: $\int \left(\log(\log x) + \frac{1}{(\log x)^2} \right) dx$

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14. $\int e^{2x} \cdot \left\{ \frac{1 + \sin 2x}{1 + \cos 2x} \right\} dx$

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15. Evaluate: $\int e^x \frac{(1-x)^2}{(1+x^2)^2} dx$

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16. Evaluate: $\int \frac{e^x(2-x^2)dx}{(1-x)\sqrt{1-x^2}}$

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17. $\int e^{ax} \cos(bx + c) dx$

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18. Evaluate $\int \sec^3 x dx$.

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19. $\int \sin \sqrt{x} dx$

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$$20. \int (\sin^{-1} x)^2 dx$$



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$$21. \int \cot^{-1}(1 - x + x^2) dx$$



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$$22. \int \sin^{-1} \sqrt{\frac{x}{a+x}} dx$$



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$$23. \int \frac{\sqrt{x^2 + 1}(\log(x^2 + 1) - 2 \log x)}{x^4} dx$$



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24.
$$\int \frac{\cos^2 x + \sin 2x}{(2 \cos x - \sin x)^2} dx$$

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25.
$$\int \frac{e^{\sin x}}{\cos^2 x} (x \cos^3 x - \sin x) dx$$

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Exercise For Session 5

1. Evaluate the following Integrals :

$$\int \frac{x^2}{(x-1)(x-2)(x-3)} dx$$

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2. Evaluate the following Integrals :

$$\int \frac{dx}{1+x^3}$$



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3. Evaluate the following Integrals :

$$\int \frac{dx}{x(x^n + 1)}$$



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4. Evaluate the following Integrals :

$$\int \frac{2x}{(x^2 + 1)(x^2 + 3)}$$



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5. Evaluate the following Integrals :

$$\int \frac{\cos x}{(1 + \sin x)(2 + \sin x)} dx$$



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6. Evaluate the following Integrals :

$$\int \frac{dx}{\sin x(3 + 1 \cos x)} dx$$

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7. $\int \frac{\sec x}{1 + \operatorname{cosec} x} dx$

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8. Evaluate $\int \frac{\tan x + \tan^3 x}{1 + \tan^3 x} dx$

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9. Prove that : $\int \frac{1}{x [6(\log x)^2 + 7 \log x + 2]} dx = \log \left| \frac{1 + \log x^2}{2 + \log x^3} \right| + c$

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10. Evaluate the following Integrals :

$$\int \frac{\tan^{-1} x}{x^2} dx$$

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Exercise For Session 6

1. Evaluate the following Integrals :

$$\int \frac{x^4 - 1}{x^2(x^4 + x^2 + 1)^{1/2}} dx$$

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2. Evaluate the following Integrals :

$$\int \frac{(x + 2) dx}{(x^2 + 3x + 3)\sqrt{x + 1}}$$

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3. Evaluate the following Integrals :

$$\int \frac{dx}{(x+1)^{1/2} + (x+1)^{1/2}}$$

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4.
$$\int \frac{dx}{(x+a)^{\frac{8}{7}}(x-b)^{\frac{6}{7}}} =$$

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5.
$$\int \frac{\sec x}{\sqrt{\sin(2x + \alpha) + \sin \alpha}} dx$$

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6. The value of $\int (\{[x]\}) dx$ where $\{.\}$ and $[.]$ denotes the fractional part of x and greatest integer function equals

A. 0

B. 1

C. 2

D. -1

Answer: A



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7. If $\int f(x) \cos x dx = \frac{1}{2} f^2(x) + C$, then $f(x)$ can be

A. x

B. 1

C. $\cos x$

D. $\sin x$

Answer: D



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8. The value of $\int \frac{\sin x + \cos x}{9 + 16 \sin 2x} dx$ is

A. $\frac{1}{40} \log \left| \frac{5 + 4(\sin x - \cos x)}{5 - 4(\sin x - \cos x)} \right| + C$

B. $\log \left| \frac{5 + 4(\sin x - \cos x)}{5 - 4(\sin x - \cos x)} \right| + C$

C. $\frac{1}{10} \log \left| \frac{5 + 4(\sin x + \cos x)}{5 - 4(\sin x + \cos x)} \right| + C$

D. None of these

Answer: A



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9. The value of $\int \frac{\cos 7x - \cos 8x}{1 + 2 \cos 5x} dx$, is

A. $\frac{\sin 2x}{2} + \frac{\cos 3x}{3} + C$

B. $\sin x - \cos x + C$

C. $\frac{\sin 2x}{2} - \frac{\cos 3x}{3} + C$

D. None of these

Answer: D



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10. The value of $\int \frac{\cos 5x + \cos 4x}{1 - 2 \cos 3x} dx$, is

A. $\sin x + \sin 2x + C$

B. $\sin x - \frac{\sin 2x}{2} + C$

C. $-\sin x - \frac{\sin 2x}{2} + C$

D. None of these

Answer: C



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Exercise Single Option Correct Type Questions

1. Let $f(x) = \int \frac{x^2}{(1+x^2)(1+\sqrt{1+x^2})} dx$ and $f(0) = 0$ then $f(1)$ is

A. $\log_e(1 + \sqrt{2})$

B. $\log_e(1 + \sqrt{2}) - \frac{\pi}{4}$

C. $\log_e(1 + \sqrt{2}) + \frac{\pi}{4}$

D. None of these

Answer: B



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2. If $\int f(x) dx = f(x)$, then $\int \{f(x)\}^2 dx$ is equal to

A. $\frac{1}{2} \{f(x)\}^2$

B. $\{f(x)\}^3$

C. $\frac{\{f(x)\}^3}{3}$

D. $\{f(x)\}^2$

Answer: A



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3. If $\int f(x)dx = F(x)$, then $\int x^3 f(x^2)dx$ is equal to :

A. $\frac{1}{2} \left[x^2 \{F(x)\}^2 dx \right]$

B. $\frac{1}{2} \left[x^2 F(x^2) - \int F(x^2) d(x^2) \right]$

C. $\frac{1}{2} \left[x^2 F(x) - \frac{1}{2} \int \{F(x)\}^2 dx \right]$

D. None of the above

Answer: B



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4. If n is a positive odd integer, then $\int |x^n| dx =$

A. $\left| \frac{x^{n+1}}{n+1} \right| + C$

B. $\frac{x^{n+1}}{n+1} + C$

C. $\frac{|x|^n x}{n+1} + C$

D. None of these

Answer: C



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5. Let $F(x)$ be the primitive of $\frac{3x+2}{\sqrt{x-9}}$ w.r.t. x . If $F(10) = 60$ then the value of $F(13)$

A. 66

B. 132

C. 248

D. 264

Answer: B



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6. $\int (x^x)^x (2x \log_e x + x) dx$ is equal to

A. $x^{(x^x)} + C$

B. $(x^x)^x + C$

C. $x^2 \cdot \log_e x + C$

D. None of these

Answer: B



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7. The value of $\int x \log x (\log x - 1) dx$ is equal to

A. $2(x \log x - x)^2 + C$

B. $\frac{1}{2}(x \log x - x)^2 + C$

C. $(x \log x)^2 + C$

D. $\frac{1}{2}(x \log x)^3 + C$

Answer: B

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8. $\int \frac{x^2 - 1}{x^3 \sqrt{2x^4 - 2x^2 + 1}} dx$ is equal to

A. $\frac{\sqrt{2x^4 - 2x^5 + 1}}{x^2} + C$

B. $\frac{\sqrt{2x^4 - 2x^2 + 1}}{x^3} + C$

C. $\frac{\sqrt{2x^4 + 2x^2 + 1}}{x} + C$

D. $\frac{\sqrt{2x^4 - 2x^2 + 1}}{2x^2} + C$

Answer: D

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9. Let $f(x)$ be a polynomial satisfying $f(0)=2$, $f'(0) = 3$ and $f''(x) = f(x)$ then $f(4)$ equals

A. $\frac{5(e^8 + 1)}{2e^4}$

B. $\frac{5(e^8 - 1)}{2e^4}$

C. $\frac{2e^4}{5(e^8 - 1)}$

D. $\frac{2e^4}{5(e^8 + 1)}$

Answer: B

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10. $\int \frac{e^{(x^2 + 4 \ln x)} - x^3 e^{x^2}}{x - 1} dx$ is equal to

A. $\left(\frac{e^{3 \ln x} - e^{\ln x}}{2x} \right) e^{x^2} + C$

B. $\frac{(x - 1)x e^{x^2}}{2} + C$

C. $\frac{(x^2 - 1)}{2x} - e^{x^2} + C$

D. None of these

Answer: D

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11. $\int \tan^4 x dx = A \tan^3 x + B \tan x + f(x)$, then

A. $A = \frac{1}{3}, B = -1, f(x) = x + C$

B. $A = \frac{2}{3}, B = -1, f(x) = x + C$

C. $A = \frac{1}{3}, B = 1, f(x) = x + C$

D. $A = \frac{2}{3}, B = 1, f(x) = -x + C$

Answer: A



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12. If the anti derivative of $\int \frac{\sin^4 x}{x} dx$ is $f(x)$ then $\int \frac{\sin^4(p+q)x}{x} dx$ in terms of $f(x)$ is

A. $f\{(p+q)x\}$

B. $\frac{f\{(p+q)x\}}{p+q}$

C. $f\{(p + q)x\}(p + q)$

D. None of these

Answer: A

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13. Prove that : $\frac{\sin \theta}{\cos[3\theta]} + \frac{\sin[3\theta]}{\cos[9\theta]} + \frac{\sin[9\theta]}{\cos[27\theta]} = \frac{1}{2} [\tan[27\theta] - \tan[\theta]]$

A. $\frac{1}{2} \log \left| \frac{\sec 27\theta}{\sec \theta} \right| + C$

B. $\frac{1}{2} \log \left| \frac{\sec \theta}{\sec 27\theta} \right| + C$

C. $\frac{1}{2} \log \left| \frac{\sqrt[2]{\sec 27\theta}}{\sec \theta} \right| + C$

D. None of these

Answer: C

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14. If $x^2 \neq n\pi - 1, n \in N$. Then, the value of

$$\int x \sqrt{\frac{2 \sin(x^2 + 1) - \sin 2(x^2 + 1)}{2 \sin(x^2 + 1) + \sin 2(x^2 + 1)}} dx \text{ is equal to:}$$

A. $\log \left| \frac{1}{2} \sec(x^2 + 1) \right| + C$

B. $\log \left| \sec \left(\frac{x^2 + 1}{2} \right) \right| + C$

C. $\frac{1}{2} \log \left| \sec(x^2 + 1) \right| + C$

D. None of these

Answer: B

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15. $\int \frac{dx}{\cos(2x)\cos(4x)} =$

A. $\frac{1}{2\sqrt{2}} \log \left| \frac{1 + \sqrt{2} \sin 2x}{1 - \sqrt{2} \sin 2x} \right| - \frac{1}{2} (\log |\sec 2x - \tan 2x|) + C$

B. $\frac{1}{2\sqrt{2}} \log \left| \frac{1 + \sqrt{2} \sin 2x}{1 + \sqrt{2} \sin x} \right| - \frac{1}{2} (\log |\sec 2x - \tan 2x|) + C$

C. $\frac{1}{\sqrt{2}} \log \left| \frac{1 + \sqrt{2} \sin 2x}{1 - \sqrt{2} \sin 2x} \right| - \frac{1}{2} (\log |\sec 2x - \tan 2x|) + C$

D. None of the above

Answer: A



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16. $\int \frac{1 - 7 \cos^2 x}{\sin^7 x \cos^2 x} dx = \frac{f(x)}{(\sin x)^7} + C$, then $f(x)$ is equal to

A. $\sin x$

B. $\cos x$

C. $\tan x$

D. $\cot x$

Answer: C



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17. Evaluate: $\frac{\sin^3 x dx}{(\cos^4 x + 3 \cos^2 x + 1) \tan^{-1}(\sec x + \cos x)}$

A. $\tan^{-1}(\sec x + \cos x) + C$

B. $\log_e |\tan^{-1}(\sec x + \cos x)| + C$

C. $\frac{1}{(\sec x + \cos x)^2} + C$

D. None of these

Answer: B

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18. The primitive of the function $f(x) = x|\cos x|$, when $\frac{\pi}{2} < x < \pi$ is given by

A. $\cos x + x \sin x + C$

B. $-\cos x - x \sin x + C$

C. $x \sin x - \cos x + C$

D. None of the above

Answer: B



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19. The primitive of the function $f(x) = (2x + 1)|\sin x|$, when $\pi < x < 2\pi$ is

A. $-(2x + 1)\cos x + 2\sin x + C$

B. $(2x + 1)\cos x - 2\sin x + C$

C. $(x^2 + x)\cos x + C$

D. None of the above

Answer: B



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20. If $f(x) = \begin{vmatrix} 0 & x^2 - \sin x & \cos x - 2 \\ \sin x - x^2 & 0 & 1 - 2x \\ 2 - \cos x & 2x - 1 & 0 \end{vmatrix}$, then $\int f(x) dx$ is

equal to

A. $\frac{x^3}{3} - x^2 \sin x + \sin 2x + C$

B. $\frac{x^3}{3} - x^2 \sin x - \cos 2x + C$

C. $\frac{x^3}{3} - x^2 \cos x - \cos 2x + C$

D. None of the above

Answer: D



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Exercise More Than One Correct Option Type Questions

1. $\int \frac{dx}{(x+1)(x-2)} = A \log(x+1) + B \log(x-2) + C$, where

A. $A + B = 0$

B. $AB = 0$

C. $A/B = -1$

D. None of these

Answer: A::C

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2. If $\int \frac{1}{(x^2 + 1)(x^2 + 4)} dx = A \tan^{-1} x + B \tan^{-1} \frac{x}{2} + C$, then

A. $k = \frac{1}{3}$

B. $l = \frac{2}{3}$

C. $k = -\frac{1}{3}$

D. $l = \frac{1}{6}$

Answer: A::D

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3. If $\int x \log(1 + x^2) dx = \phi(x) \log(1 + x^2) + x(\Psi) + C$, then

A. $\phi(x) = \frac{1 + x^2}{2}$

$$\text{B. } \Psi(x) = \frac{1+x^2}{2}$$

$$\text{C. } \Psi(x) = -\frac{1+x^2}{2}$$

$$\text{D. } \phi(x) = -\frac{1+x^2}{2}$$

Answer: A::C



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4. सिद्ध कीजिए कि $\int \frac{4e^x + 6e^{-x}}{9e^x - 4e^{-x}} dx = Ax + B \log_e(9x^{2x} - 4) + C$

A. $A = \frac{3}{2}$

B. $B = \frac{35}{36}$

C. C is indefinite

D. $A + B = -\frac{19}{36}$

Answer: B::C::D



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5. If $\int \tan^5 x \, dx = A \tan^4 x + B \tan^2 x + g(x) + C$, where C is constant of integration and $g(0) = 0$, then

A. $A = \frac{1}{4}, B = -\frac{1}{2}$

B. $g(x) = \ln|\sec x|$

C. $g(x) = \ln|\cos x|$

D. $A = -\frac{1}{4}, B = \frac{1}{3}$

Answer: A::B



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Exercise Statement I And II Type Questions

1. Statement I If y is a function of x such that $y(x - y)^2 = x$, then

$$\int \frac{dx}{x - 3y} = \frac{1}{2} [\log(x - y)^2 - 1]$$

Statement II $\int \frac{dx}{x - 3y} = \log(x - 3y) + C$

- A. Statement I is true, Statement II is also true , Statement II is the correct explanation of Statement I.
- B. Statement I is true, Statement II is also true, Statement II is not the correct explanation of Statement I.
- C. Statement I is true, Statement II is false.
- D. Statement I is false, Statement II is true .

Answer: C



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2. Statement I Integral of an even function is not always an odd function.
Statement II Integral of an odd function is an even function .

- A. Statement I is true, Statement II is also true , Statement II is the correct explanation of Statement I.

B. Statement I is true, Statement II is also true, Statement II is not the correct explanation of Statement I.

C. Statement I is true, Statement II is false.

D. Statement I is false, Statement II is true .

Answer: C

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3. Statement I If $a > 0$ and $b^2 - 4ac < 0$, then the value of the integral

$\int \frac{dx}{ax^2 + bx + c}$ will be of the type

$\mu \tan^{-1} \frac{x + A}{B} + C$, where A, B, C, μ are constants.

Statement II If $a > 0$, $b^2 - 4ac < 0$, then $ax^2 + bx + C$ can be written as sum of two squares .

A. Statement I is true, Statement II is also true , Statement II is the correct explanation of Statement I.

B. Statement I is true, Statement II is also true, Statement II is not the correct explanation of Statement I.

C. Statement I is true, Statement II is false.

D. Statement I is false, Statement II is true .

Answer: A

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4. Statement I $\int \left(\frac{1}{1+x^4} \right) dx = \tan^{-1}(x^2) + C$

Statement II $\int \frac{1}{1+x^2} dx = \tan^{-1} x + C$

A. Statement I is true, Statement II is also true , Statement II is the correct explanation of Statement I.

B. Statement I is true, Statement II is also true, Statement II is not the correct explanation of Statement I.

C. Statement I is true, Statement II is false.

D. Statement I is false, Statement II is true .

Answer: D

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5. Statement I $\int 2^{\tan^{-1} x} d(\cot^{-1} x) = \frac{2^{\tan^{-1} x}}{\ln 2} + C$

Statement II $\frac{d}{dx}(a^x + C) = a^x \ln a$

A. Statement I is true, Statement II is also true , Statement II is the correct explanation of Statement I.

B. Statement I is true, Statement II is also true, Statement II is not the correct explanation of Statement I.

C. Statement I is true, Statement II is false.

D. Statement I is false, Statement II is true .

Answer: D

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Exercise Passage Based Questions

1. Let us consider the integral of the following forms

$$f\left(x_1, \sqrt{mx^2 + nx + p}\right)^{1/2}$$

Case I If $m > 0$, then put $\sqrt{mx^2 + nx + C} = u \pm x\sqrt{m}$

Case II If $p > 0$, then put $\sqrt{mx^2 + nx + C} = ux \pm \sqrt{p}$

Case III If quadratic equation $mx^2 + nx + p = 0$ has real roots α and β

there put $\sqrt{mx^2 + nx + p} = (x - \alpha)u$ or $(x - \beta)u$

$$\int \frac{(x + \sqrt{1 + x^2})^{15}}{\sqrt{1 + x^2}} dx \text{ is equal to}$$

A. $\sqrt{9x^2 + 4x + 6} = u \pm 3x$

B. $\sqrt{9x^2 + 4x + 6} = 3u \pm x$

C. $x = \frac{1}{t}$

D. $9x^2 + 4x + 6 = \frac{1}{t}$

Answer: A

2. Let us consider the integral of the following forms

$$f\left(x_1, \sqrt{mx^2 + nx + p}\right)^{1/2}$$

Case I If $m > 0$, then put $\sqrt{mx^2 + nx + C} = u \pm x\sqrt{m}$

Case II If $p > 0$, then put $\sqrt{mx^2 + nx + C} = ux \pm \sqrt{p}$

Case III If quadratic equation $mx^2 + nx + p = 0$ has real roots α and β

there put $\sqrt{mx^2 + nx + p} = (x - \alpha)u$ or $(x - \beta)u$

$$\int \frac{(x + \sqrt{1 + x^2})^{15}}{\sqrt{1 + x^2}} dx \text{ is equal to}$$

A. $\frac{(x + \sqrt{1 + x^2})^{16}}{10} + C$

B. $\frac{1}{15(\sqrt{1 + x^2} + x)} + C$

C. $\frac{15}{(\sqrt{1 + x^2} - x)} + C$

D. $\frac{(x + \sqrt{1 + x^2})^{15}}{15} + C$

Answer: D

3. Let us consider the integral of the following forms

$$f\left(x_1, \sqrt{mx^2 + nx + p}\right)^{1/2}$$

Case I If $m > 0$, then put $\sqrt{mx^2 + nx + C} = u \pm x\sqrt{m}$

Case II If $p > 0$, then put $\sqrt{mx^2 + nx + C} = ux \pm \sqrt{p}$

Case III If quadratic equation $mx^2 + nx + p = 0$ has real roots α and β

there put $\sqrt{mx^2 + nx + p} = (x - \alpha)u$ or $(x - \beta)u$

To evaluate $\int \frac{dx}{(x-1)\sqrt{-x^2+3x-2}}$ one of the most suitable substitution could be

- A. $\sqrt{-x^2 + 3x - 2} = u$
- B. $\sqrt{-x^2 + 3x - 2} = (ux\sqrt{2})$
- C. $\sqrt{-x^2 + 3x - 2} = u(1 - x)$
- D. $\sqrt{-x^2 + 3x - 2} = u(x + 2)$

Answer: C

4. Let $I_{m,n} = \int \sin^n x \cos^m x dx$. Then, we can relate $I_{n,m}$ with each of the following :

$$(i) I_{n-2,m} \quad (ii) I_{n+2,m}$$

$$(iii) I_{n,m-2} \quad (iv) I_{n,m+2}$$

$$(v) I_{n-2,m+2} \quad I_{n+2,m-2}$$

Suppose we want to establish a relation between $I_{n,m}$ and $I_{n,m-2}$, then we get

$$P(x) = \sin^{n+1} x \cos^{m-1} x \dots(i)$$

In $I_{n,m}$ and $I_{n,m-2}$ the exponent of $\cos x$ is m and $m - 2$ respectively, the minimum of the two is $m - 2$, adding 1 to the minimum we get $m - 2 + 1 = m - 1$. Now, choose the exponent of $\sin x$ for $m - 1$ of $\cos x$ in $P(x)$. Similarly, choose the exponent of $\sin x$ for

$$P(x) = (nH)\sin^n x \cos^m x - (m - 1)\sin^{n+2} x \cos^{m-2} x.$$

Now, differentiating both the sides of Eq. (i), we get

$$\begin{aligned} &= (n + 1)\sin^n x \cos^m x - (m - 1)\sin^n x (1 - \cos^2 x) \cos^{m-2} x \\ &= (n + 1)\sin^n x \cos^m x - (m - 1)\sin^n x \cos^{m-2} x + (m - 1)\sin^n x \cos^n x \\ &= (n + m)\sin^n x \cos^m x - (m - 1)\sin^n x \cos^{m-2} x \end{aligned}$$

Now, integrating both the sides, we get

$$\sin^{n+1} x \cos^{m-1} x = (n + m)I_{n,m} - (m - 1)I_{n,m-2}$$

Similarly, we can establish the other relations.

The relation between $I_{4,2}$ and $I_{2,2}$ is

A. $I_{4,2} = \frac{1}{6} (-\sin^3 x \cos^3 x + 3I_{2,2})$

B. $I_{4,2} = \frac{1}{6} (\sin^3 x \cos^3 x + 3I_{2,2})$

C. $I_{4,2} = \frac{1}{6} (\sin^3 x \cos^3 x - 3I_{2,2})$

D. $I_{4,2} = \frac{1}{4} (-\sin^3 x \cos^3 x + 2I_{2,2})$

Answer: A



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5. Let $I_{m,n} = \int \sin^n x \cos^m x dx$. Then, we can relate $I_{n,m}$ with each of the following :

(i) $I_{n-2,m}$ (ii) $I_{n+2,m}$

(iii) $I_{n,m-2}$ (iv) $I_{n,m+2}$

(v) $I_{n-2,m+2}$ $I_{n+2,m-2}$

Suppose we want to establish a relation between $I_{n,m}$ and $I_{n,m-2}$, then

we get

$$P(x) = \sin^{n+1} x \cos^{m-1} x \dots(i)$$

In $I_{n,m}$ and $I_{n,m-2}$ the exponent of $\cos x$ in m and $m - 2$ respectively, the minimum of the two is $m - 2$, adding 1 to the minimum we get $m - 2 + 1 = m - 1$. Now, choose the exponent of $\sin x$ for $m - 1$ of $\cos x$ in $P(x)$. Similarly, choose the exponent of $\sin x$ for

$$P(x) = (nH)\sin^n x \cos^m x - (m - 1)\sin^{n+2} x \cos^{m-2} x.$$

Now, differentiating both the sides of Eq. (i), we get

$$\begin{aligned} &= (n + 1)\sin^n x \cos^m x - (m - 1)\sin^n x (1 - \cos^2 x) \cos^{m-2} x \\ &= (n + 1)\sin^n x \cos^m x - (m - 1)\sin^n x \cos^{m-2} x + (m - 1)\sin^n x \cos^n x \\ &= (n + m)\sin^n x \cos^m x - (m - 1)\sin^n x \cos^{m-2} x \end{aligned}$$

Now, integrating both the sides, we get

$$\sin^{n+1} x \cos^{m-1} x = (n + m)I_{n,m} - (m - 1)I_{n,m-2}$$

Similarly, we can establish the other relations.

The relation between $I_{4,2}$ and $I_{6,2}$ is

$$A. I_{4,2} = \frac{1}{5} (\sin^3 x \cos^3 x + 8I_{6,2})$$

$$B. I_{4,2} = \frac{1}{5} (-\sin^3 x \cos^3 x + 8I_{6,2})$$

$$C. I_{4,2} = \frac{1}{5} (\sin^3 x \cos^3 x - 8I_{6,2})$$

$$D. I_{4,2} = \frac{1}{6} (\sin^3 x \cos^3 x + 8I_{6,2})$$

Answer: A



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6. Let $I_{m,n} = \int \sin^n x \cos^m x dx$. Then, we can relate $I_{n,m}$ with each of the following :

$$(i) I_{n-2,m} \quad (ii) I_{n+2,m}$$

$$(iii) I_{n,m-2} \quad (iv) I_{n,m+2}$$

$$(v) I_{n-2,m+2} \quad I_{n+2,m-2}$$

Suppose we want to establish a relation between $I_{n,m}$ and $I_{n,m-2}$, then we get

$$P(x) = \sin^{n+1} x \cos^{m-1} x \dots (i)$$

In $I_{n,m}$ and $I_{n,m-2}$ the exponent of $\cos x$ is m and $m - 2$ respectively, the minimum of the two is $m - 2$, adding 1 to the minimum we get $m - 2 + 1 = m - 1$. Now, choose the exponent of $\sin x$ for $m - 1$ of $\cos x$ in $P(x)$. Similarly, choose the exponent of $\sin x$ for

$$P(x) = (nH) \sin^n x \cos^m x - (m - 1) \sin^{n+2} x \cos^{m-2} x.$$

Now, differentiating both the sides of Eq. (i), we get

$$\begin{aligned} &= (n + 1)\sin^n x \cos^m x - (m - 1)\sin^n x (1 - \cos^2 x) \cos^{m-2} x \\ &= (n + 1)\sin^n x \cos^m x - (m - 1)\sin^n x \cos^{m-2} x + (m - 1)\sin^n x \cos^n x \\ &= (n + m)\sin^n x \cos^m x - (m - 1)\sin^n x \cos^{m-2} x \end{aligned}$$

Now, integrating both the sides, we get

$$\sin^{n+1} x \cos^{m-1} x = (n + m)I_{n,m} - (m - 1)I_{n,m-2}$$

Similarly, we can establish the other relations.

The relation $I_{4,2}$ and $I_{4,4}$ is

A. $I_{4,2} = \frac{1}{3}(\sin^5 x \cos^3 x + 8I_{4,4})$

B. $I_{4,2} = \frac{1}{3}(-\sin^5 x \cos^3 x + 8I_{4,4})$

C. $I_{4,2} = \frac{1}{3}(\sin^5 x \cos^3 x - 8I_{4,4})$

D. $I_{4,2} = \frac{1}{3}(\sin^5 x \cos^3 x + 6I_{4,4})$

Answer: B



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7. If $f: \mathbb{R} \rightarrow (0, \infty)$ be a differentiable function $f(x)$ satisfying

$$f(x + y) - f(x - y) = f(x) \cdot \{f(y) - f(y) - y\}, \forall x, y \in \mathbb{R}, (f(y) \neq f($$

and $f'(0) = 2010$.

Now, answer the following questions.

Which of the following is true for $f(x)$

- A. $f(x)$ is one-one and into
- B. $\{f(x)\}$ is non-periodic, where $\{ \cdot \}$ denotes fractional part of x .
- C. $f(x) = 4$ has only two solutions.
- D. $f(x) = f^{-1}(x)$ has only one solution .

Answer: B



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8. If $f: \mathbb{R} \rightarrow (0, \infty)$ be a differentiable function $f(x)$ satisfying

$$f(x + y) - f(x - y) = f(x) \cdot \{f(y) - f(y) - y\}, \forall x, y \in \mathbb{R}, (f(y) \neq f($$

and $f'(0) = 2010$.

Now, answer the following questions.

let $g(x) = \log_e(\sin x)$, and $\int f(g(x)) \cos x dx = h(x) + c$, (where c is constant of integration), then $h\left(\frac{\pi}{2}\right)$ is equal to

A. 0

B. $\frac{1}{2010}$

C. 1

D. $\frac{1}{2011}$

Answer: D



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9. Let $f: R \rightarrow R$ be a function as

$f(x) = (x - 1)(x + 2)(x - 3)(x - 6) - 100$. If $g(x)$ is a polynomial of degree ≤ 3 such that $\int \frac{g(x)}{f(x)} dx$ does not contain any logarithm function and $g(-2) = 10$. Then

The equation $f(x) = 0$ has

- A. all four distinct roots
- B. three distinct real roots
- C. two real and two imaginary
- D. all four imaginary roots

Answer: C

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10. Let $f: R \rightarrow R$ be a function as

$f(x) = (x - 1)(x + 2)(x - 3)(x - 6) - 100$. If $g(x)$ is a polynomial of degree ≤ 3 such that $\int \frac{g(x)}{f(x)} dx$ does not contain any logarithm function and $g(-2) = 10$. Then

The minimum value of $f(x)$ is

- A. -136
- B. -100
- C. -84

Answer: C[View Text Solution](#)

11. Let $f: R \rightarrow R$ be a function as

$f(x) = (x - 1)(x + 2)(x - 3)(x - 6) - 100$. If $g(x)$ is a polynomial of

degree ≤ 3 such that $\int \frac{g(x)}{f(x)} dx$ does not contain any logarithm

function and $g(-2) = 10$. Then

$\int \frac{g(x)}{f(x)} dx$, equals

A. $\tan^{-1}\left(\frac{x-2}{2}\right) + c$

B. $\tan^{-1}\left(\frac{x-1}{1}\right) + c$

C. $\tan^{-1}(x) + c$

D. None of these

Answer: A[View Text Solution](#)

Exercise Single Integer Answer Type Questions

$$1. \int \frac{(2x + 3)dx}{x(x + 1)(x + 2)(x + 3) + 1} = C - \frac{1}{f(x)}$$

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2. Let $F(x)$ be the primitive of $\frac{3x + 2}{\sqrt{x - 9}}$ w.r.t. x . If $F(10) = 60$ then the value of $F(13)$

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3. Let $u(x)$ and $v(x)$ be differentiable functions such that

$$\frac{u(x)}{v(x)} = 7. \quad \text{if} \quad \frac{u'(x)}{v'(x)} = p \quad \text{and} \quad \left(\frac{u(x)}{v(x)}\right)' = q, \quad \text{then} \quad \frac{p + q}{p - q} \quad \text{has the}$$

value equal to

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4. If $\int \frac{1}{(x^2 - 1)} \ln\left(\frac{x - 1}{x + 1}\right) dx = 6A \left[\ln\left(\frac{x - 1}{x + 1}\right) \right]^2 + C$, then find 24 A.

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5. If $\int \frac{e^x(2 - x^2)}{(1 - x)\sqrt{1 - x^2}} dx = \mu e^x \left(\frac{1 + x}{1 - x}\right)^\lambda + C$, then $2(\lambda + \mu)$ is equal to

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6. If $\int \frac{\cos x - \sin x + 1 - x}{e^x + \sin x + x} dx = \ln\{f(x)\} + g(x) + C$, where C is the constant of integrating and $f(x)$ is positive, then $\frac{f(x) + g(x)}{e^x + \sin x}$ is equal to

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7. Suppose $A = \int \frac{dx}{x^2 + 6x + 25}$ and $B = \int \frac{dx}{x^2 - 6x - 27}$.

If $12(A + B) = \lambda \cdot \tan^{-1}\left(\frac{x+3}{4}\right) + \mu \cdot \ln\left|\frac{x-9}{x+3}\right| + C$, then the value of $(\lambda + \mu)$ is

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8. If $\int \frac{\cos 6x + \cos 9x}{1 - 2 \cos 5x} dx = -\frac{\sin 4x}{k} - \sin x + C$, then the value of k is

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9. The value of

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

Then the value of A is:

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10. $\int \sin^{5/2} x \cos^3 x dx = 2 \sin^{A/2} x \left[\frac{1}{B} - \frac{1}{C} \sin^2 x \right] + C$, then the value of $(A + B) - C$ is equal to

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11. If

$$\int (x^{2020} + x^{804} + x^{402}) (2x^{1608} + 5x^{402} + 10)^{1/402} dx = \frac{1}{10a} (2x^{2010} + 5x^{804} + 10x^{402}) + C$$

. Then $(a - 400)$ is equal to

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12.

If $\int e^{x^3+x^2-1} (3x^4 + 2x^3 + 2x) dx = f(x) + C$, then the value of $f(1) \times$

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1. $\int e^{x \sin x + \cos x} \left(\frac{x^4 \cos^3 x - x \sin x + \cos x}{x^2 \cos^2 x} \right) dx =$

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2. Evaluate : $\int \sqrt{x \sqrt{x^2 + 2}} dx$

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3. Evaluate $\int \frac{dx}{\left(\sqrt{(x - \alpha)^2 - \beta^2} \right) (ax + b)}$.

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4. Evaluate $\int \frac{\sqrt{1 + \sqrt[3]{x}}}{\sqrt[3]{x^2}} dx$.

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5. Evaluate: $\int \frac{\sin^3\left(\frac{\theta}{2}\right)}{\cos\left(\frac{\theta}{2}\right)\sqrt{\cos^3\theta + \cos^2\theta + \cos\theta}} d\theta$

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6. Evaluate $\int \frac{(2\sin\theta + \sin 2\theta)d\theta}{(\cos\theta - 1)\sqrt{\cos\theta + \cos^2\theta + \cos^3\theta}}$.

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7. Connect $\int x^{m-1}(a + bx^n)^p dx$ with $\int x^{m-n-1}(a + bx^n)^p dx$ and evaluate $\int \frac{x^8 dx}{(1 - x^3)^{1/3}}$.

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8. Evaluate $\int \cos e^{c^2 x} \ln(\cos x + \sqrt{\cos 2x}) dx$.

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9. Evaluate $\int \frac{dx}{(\sin x + a \sec x)^2}$ when $|a| > \frac{1}{2}$.

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10. Evaluate $\int \frac{dx}{x - \sqrt{x^2 + 2x + 4}}$.

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11. Evaluate $\int \frac{dx}{1 + \sqrt{x^2 + 2x + 2}}$.

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12. Evaluate: $\int \frac{x^4 + 1}{x^6 + 1} dx$

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13. Evaluate $\int \frac{dx}{(1-x^3)^{1/3}} dx$.

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14. Evaluate: $\int \frac{[\sqrt{1+x^2} + x]^n}{\sqrt{1+x^2}} dx$

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15. If $y^2 = ax^2 + 2bx + c$, and $u_n = \int \frac{x^n}{y} dx$, prove that $(n+1)au_{n+1} + (2n+1)bu_n + (n)cu_{n-1} = x^ny$ and deduce that $au_1 = y - bu_0$, $2a^2u_2 = y(ax - 3b) - (ac - 3b^2)u_0$.

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Exercise Questions Asked In Previous 13 Years Exam

1. The integral $\int \frac{\sec^2 x}{(\sec x + \tan x)^{\frac{9}{2}}} dx$ equals (for some arbitrary constant

K).

$$-\frac{1}{(\sec x + \tan x)^{\frac{11}{2}}} \left\{ \frac{1}{11} - \frac{1}{7}(\sec x + \tan x)^2 \right\} + K$$

$$\frac{1}{(\sec x + \tan x)^{\frac{11}{2}}} \left\{ \frac{1}{11} - \frac{1}{7}(\sec x + \tan x)^2 \right\} + K$$

$$-\frac{1}{(\sec x + \tan x)^{\frac{11}{2}}} \left\{ \frac{1}{11} + \frac{1}{7}(\sec x + \tan x)^2 \right\} + K$$

$$\frac{1}{(\sec x + \tan x)^{\frac{11}{2}}} \left\{ \frac{1}{11} + \frac{1}{7}(\sec x + \tan x)^2 \right\} + K$$

A. $\frac{-1}{(\sec x + \tan x)^{11/2}} \left\{ \frac{1}{11} - \frac{1}{7}(\sec x + \tan x)^2 \right\} + K$

B. $\frac{1}{(\sec x + \tan x)^{11/2}} \left\{ \frac{1}{11} - \frac{1}{7}(\sec x + \tan x)^2 \right\} + K$

C. $\frac{-1}{(\sec x + \tan x)^{11/2}} \left\{ \frac{1}{11} + \frac{1}{7}(\sec x + \tan x)^2 \right\} + K$

D. $\frac{1}{(\sec x + \tan x)^{11/2}} \left\{ \frac{1}{11} + \frac{1}{7}(\sec x + \tan x)^2 \right\} + K$

Answer: C



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2. If $I = \int \frac{e^x}{e^{4x} + e^{2x} + 1} dx$. $J = \int \frac{e^{-x}}{e^{-4x} + e^{-2x} + 1} dx$. Then for an arbitrary constant c , the value of $J - I$ equal to

A. $\frac{1}{2} \log \left| \frac{e^{4x} - e^{2x} + 1}{e^{4x} + e^{2x} + 1} \right| + C$

B. $\frac{1}{2} \log \left| \frac{e^{2x} + e^x + 1}{e^{2x} - e^x + 1} \right| + C$

C. $\frac{1}{2} \log \left| \frac{e^{2x} - e^x + 1}{e^{2x} + e^x + 1} \right| + C$

D. $\frac{1}{2} \log \left| \frac{e^{4x} + e^{2x} + 1}{e^{4x} - e^{2x} + 1} \right| + C$

Answer: C



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3. The integral $\int \frac{2x^{12} + 5x^9}{(x^5 + x^3 + 1)^3} dx$ is equal to (where C is a constant of integration)

A. $\frac{-x^5}{(x^5 + x^3 + 1)^2} + C$

B. $\frac{x^{10}}{2(x^5 + x^3 + 1)^2} + C$

$$C. \frac{x^5}{2(x^5 + x^3 + 1)^2} + C$$

$$D. \frac{-x^{10}}{2(x^5 + x^3 + 1)^2} + C$$

Answer: B



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4. The integral $\int \frac{dx}{x^2(x^4 + 1)^{3/4}}$ equal

$$A. \left(\frac{x^4 + 1}{x^4} \right)^{\frac{1}{4}} + C$$

$$B. (x^4 + 1)^{1/4} + C$$

$$C. -(x^4 + 1)^{\frac{1}{4}} + C$$

$$D. -\left(\frac{x^4 + 1}{x^4} \right)^{\frac{1}{4}} + C$$

Answer: D



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5. The integral $\int \left(1 + x - \frac{1}{x}\right) e^{x + \frac{1}{x}} dx$ is equal to

A. $(x - 1)e^{x + \frac{1}{x}} + C$

B. $xe^{x + \frac{1}{x}} + C$

C. $(x + 1)e^{x + \frac{1}{x}} + C$

D. $-xe^{x + \frac{1}{x}} + C$

Answer: B



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6. If $\int f(x) dx = \psi(x)$, then $\int x^5 f(x^3) dx$

A. $\frac{1}{3} \left[x^3 \Psi(x^3) - \int x^2 \Psi(x^3) dx \right] + C$

B. $\frac{1}{3} x^3 \Psi(x^3) - 3 \int x^3 \Psi(x^3) dx + C$

C. $\frac{1}{2} x^3 \Psi(x^3) - \int x^2 \Psi(x^3) dx + C$

D. $\frac{1}{3} \left[x^3 \Psi(x^3) - \int x^3 \Psi(x^3) dx \right] + C$

Answer: C



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7. If the integral $\int \frac{5 \tan x}{\tan x - 2} dx = x + a \ln |\sin x - 2 \cos x| + k$, then a is equal to:

A. -1

B. -2

C. 1

D. 2

Answer: D



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8. The value of $\sqrt{2} \int \frac{\sin x}{\sin\left(x - \frac{\pi}{4}\right)} dx$, is

A. $x + \log \left| \cos \left(x - \frac{\pi}{4} \right) \right| + C$

B. $x + \log \left| \sin \left(x - \frac{\pi}{4} \right) \right| + C$

C. $x - \log \left| \sin \left(x - \frac{\pi}{4} \right) \right| + C$

D. $x - \log \left| \cos \left(x - \frac{\pi}{4} \right) \right| + C$

Answer: B



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