



MATHS

BOOKS - OBJECTIVE RD SHARMA MATHS VOL I (HINGLISH)

DEFINITE INTEGRALS

Illustration

1. The value of $\int_0^1 \sqrt{\frac{1-x}{1+x}} dx$ is

A. $\frac{\pi}{2} + 1$

B. $\frac{\pi}{2} - 1$

C. -1

D. 1

Answer: B



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2. The value of $I = \int_0^{\pi/2} \frac{(\sin x + \cos)^2}{\sqrt{1 + \sin 2x}} dx$ is

A. 3

B. 1

C. 2

D. 0

Answer: C



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3. If $I(m,n) = \int_0^1 t^m(1-t)^n dt$, then the expression for $I(m,n)$ in terms of $I(m+1,n-1)$, is

A. $\frac{2^n}{m+1} - \frac{n}{m+1} I(m+1, n-1)$

B. $\frac{n}{m+1} I(m+1, n-1)$

C. $\frac{2^n}{m+1} - \frac{n}{m+1} I(m+1, n-1)$

D. $\frac{m}{n+1} I(m+1, n-1)$

Answer: B



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4. If a $f(x)+bf\left(\frac{1}{x}\right) = \frac{1}{x} - 5, x \neq 0, a \neq b$, then $\int_1^2 f(x)dx$ equals

A. $\frac{(\ln 2 - 5)a + \frac{13}{2}b}{a^2 - b^2}$

$$\text{B. } \frac{(\ln 2 - 5)a + \frac{7b}{2}}{a^2 - b^2}$$

$$\text{C. } \frac{(5 - \ln 2)a + \frac{7b}{2}}{a^2 - b^2}$$

D. none of these

Answer: B



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$$5. \int_{\pi/4}^{3\pi/4} \frac{1}{1 + \cos x} dx =$$

A. 2

B. 6

C. 5

D. 3

Answer: A



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6. If $\int_0^a \frac{1}{1+4x^2} dx = \frac{\pi}{8}$, then $2a =$

A. 1

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

C. $-\frac{1}{2}$

D. None

Answer: A



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7. The solution for x of the equation

$$\int_{\sqrt{2}}^x \frac{1}{t\sqrt{t^2-1}} dt = \frac{\pi}{2}, \text{ is}$$

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

B. $2\sqrt{2}$

C. 2

D. $-\sqrt{2}$

Answer: D



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8. If $2\int_0^1 \tan^{-1} x dx = \int_2^1 \cot^{-1}(1-x+x^2) dx$. Then

$\int_0^1 \tan^{-1}(1-x+x^2) dx$ is equal to

A. $\log 2$

B. $\frac{\pi}{2} + \log 2$

C. $\log 4$

D. $\frac{\pi}{2} - \log 4$

Answer: A



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9. Let $\frac{d}{dx}(F(x)) = \frac{e^{\sin x}}{x}, x > 0$

If $\int_1^4 \frac{2e^{\sin x^2}}{x} - dx = F(k) - F(1)$, then one of the possible values of k , is

A. 4

B. 8

C. 16

D. 32

Answer: C



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10. The value of the integral $\int_0^{\pi/4} \frac{\sin x + \cos x}{3 + \sin 2x} dx$, is

A. $\log 2$

B. $\log 3$

C. $\frac{1}{4} \log 3$

D. $\frac{1}{8} \log 3$

Answer: C



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11. If $I_1 = \int_e^{e^2} \frac{dx}{\log x}$ and $I_2 = \int_1^2 \frac{e^x}{x} dx$, then

A. $I_1 = I_2$

B. $2I_1 = I_2$

C. $I_1 = 2I_2$

D. none of these

Answer: A



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12. The value of the integral $\int_0^{\log 5} \frac{e^x \sqrt{e^x - 1}}{e^x + 3} dx$, is

A. $3 + 2\pi$

B. $4 - \pi$

C. $2 + \pi$

D. none of these

Answer: B



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13. Given $\int_1^2 e^{x^2} dx = a$, the value of $\int_e^{e^4} \sqrt{\log_e x} dx$, is

A. $e^4 - e$

B. $e^4 - a$

C. $2e^4 - a$

D. $2e^4 - e - a$

Answer: D



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14. If $\int_0^1 \frac{\sin t}{1+t} dt = \alpha$, then the value of the integral

$$\int_{4\pi-2}^{4\pi} \frac{\sin \frac{t}{2}}{4\pi+2-t} dt \text{ in terms of } \alpha \text{ is given by}$$

A. 2α

B. -2α

C. α

D. $-\alpha$

Answer: D



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15. $\int_0^{2\pi} e^{x/2} \sin\left(\frac{x}{2} + \frac{\pi}{4}\right) dx =$

A. 2π

B. e^π

C. 0

D. $2\sqrt{2}$

Answer: C



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16. If $I_n = \int_0^{\pi/4} \tan^n \theta d\theta$, then $I_8 + I_6$ equals

A. $\frac{1}{4}$

B. $\frac{1}{5}$

C. $\frac{1}{6}$

D. $\frac{1}{7}$

Answer: D



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17. $\int_0^2 \frac{x^3}{(x^2 + 1)^{3/2}} dx$ is equal to

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

B. $\frac{(\sqrt{2} - 1)}{\sqrt{2}}$

C. $\frac{\sqrt{2} - 1}{\sqrt{2}}$

D. none of these

Answer: D



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18. The value of the integral $I = \int_0^a \frac{x^4}{(a^2 + x^2)^4} dx$ is

A. $\frac{1}{16a^3} \left(\frac{\pi}{4} - \frac{1}{3} \right)$

B. $\frac{1}{16a^3} \left(\frac{\pi}{4} + \frac{1}{3} \right)$

C. $\frac{a^3}{16} \left(\frac{\pi}{4} - \frac{1}{3} \right)$

D. $\frac{a^3}{16} \left(\frac{\pi}{4} + \frac{1}{3} \right)$

Answer: A



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19. Let $f(x) = 7\tan^8x + 7\tan^6x - 3\tan^4x - 3\tan^4x - 3\tan^2x$ for all

$x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$. Then the correct expression (s) is (are)

$$\int_0^{\frac{\pi}{4}} xf(x)dx = \frac{1}{12} \int_0^{\frac{\pi}{4}} f(x)dx = 0 \int_0^{\frac{\pi}{4}} xf(x) = \frac{1}{6} \quad \text{(d) } \int_0^{\frac{\pi}{4}} f(x)dx = \frac{1}{12}$$

A. $\int_0^{\pi/4} xf(x)dx = \frac{1}{12}$

B. $\int_0^{\pi/4} xf(x)dx = 0$

C. $\int_0^{\pi/4} xf(x)dx = \frac{1}{6}$

D. $\int_0^{\pi/4} f(x)dx = 1$

Answer: A,B



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20. If $\alpha = \int_0^1 e^{3x+3\tan^{-1}x} \left(\frac{12+9x^2}{1+x^2} \right) dx$, where \tan^{-1} takes principal values, then the value of

$$\left(\log_e |1 + \alpha| - \frac{3\pi}{4} \right), \text{ is}$$

A. 9

B. 8

C. 7

D. 6

Answer: A



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21. The value of $\int_0^\pi |\cos x| dx$, is

A. 1

B. 2

C. 0

D. 4

Answer: B



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22. $\int_0^2 |x^2 + 2x - 3| dx$ is equal to

A. 4

B. 6

C. 3

D. 2

Answer: A



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23. $\int_0^3 [x] dx$ is equal to

A. 2

B. 4

C. 3

D. 1

Answer: C



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24. $\int_0^{15} [x^2] dx$ is equal to

A. 2

B. $2 - \sqrt{2}$

C. $2 + \sqrt{2}$

D. $\sqrt{2}$

Answer: B



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25. $\int_0^2 [x^2] dx$ is equal to

A. $5 - \sqrt{2}$

B. $5 - \sqrt{3} - \sqrt{2}$

C. $5 - \sqrt{3}$

D. none of these

Answer: B



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26. Let $f(x) = x - [x]$, for every real number x , where $[x]$ is integral part of x . Then, $\int_{-1}^1 f(x) dx$, is

A. 1

B. 2

C. 0

D. $1/2$

Answer: A



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27. If $\{x\}$ denotes the fractional part of x , then $\int_0^2 x \{x\} dx$ is equal to

A. 1

B. 2

C. $\frac{1}{2}$

D. 4

Answer: A



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28. $\int_0^4 \{\sqrt{x}\} dx$ is equal to, where $\{x\}$ denotes the fraction part of x .

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

B. $\frac{16}{3}$

C. $\frac{5}{3}$

D. $\frac{7}{3}$

Answer: D



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29. For any real number x , the value of $\int_0^x [x] dx$, is

A. $x[x]$

B. $x[x] - [x]([x] + 1)$

C. $x[x] - \frac{1}{2}[x]([x] + 1)$

D. none of these

Answer: C



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30. If $\{x\}$ denotes the fractional part of x , then $\int_0^x \left(\{x\} - \frac{1}{2} \right) dx$ is equal to

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

B. $\frac{1}{2} \{x\} (\{x\} - 1)$

C. $\{x\} (\{x\} - 1)$

D. $\{x\} (\{x\} + 1)$

Answer: B



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31. The value of : $\int_{\pi/6}^{5\pi/6} \sqrt{4 - 4\sin^2 t} dt$, is

A. 0

B. 2

C. 1

D. none of these

Answer: B



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32. If for a real number y , $[y]$ is the greatest integer less than or equal to y , then the value of the integral $\int_{\pi/2}^{3\pi/2} [2\sin x] dx$, is

A. $-\pi$

B. 0

C. $-\pi/2$

D. $\pi/2$

Answer: C



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33. If $[.]$ stands for the greatest integer function, then $\int_1^2 [3x] dx$ is equal to

A. 3

B. 4

C. 5

D. 6

Answer: B



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34. The value of the integral $\int_0^{0.9} [x - 2[x]]dx$, where $[.]$ denotes the greatest integer function, is

A. 0.9

B. 0

C. 1.8

D. -0.9

Answer: B



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35. Let $[.]$ denote the greatest integer function, then the value of $\int_0^{1.5} x[x^2] dx$, is

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

B. $\frac{3}{4}$

C. $\frac{5}{4}$

D. 0

Answer: B



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36. The integral $\int_0^{\pi} \sqrt{1 + 4\sin^2 \frac{x}{2} - 4\sin \frac{x}{2}} dx$ equals ,

A. $4\sqrt{3} - 4$

B. $4\sqrt{3} - 4 - \frac{\pi}{3}$

C. $\pi - 4$

D. $\frac{2\pi}{3} - 4 - 4\sqrt{3}$

Answer: B



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37. The value of $\int_0^1 4x^3 \left\{ \frac{d^2}{dx^2} (1 - x^2)^5 \right\} dx$ is

A. 1

B. 2

C. 8

D. 4

Answer: B



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38. Let $f: R \rightarrow R$ be a function defined by $f(x) \begin{cases} [x], & x \leq 2 \\ 0, & x > 2 \end{cases}$

where $[x]$ is the greatest integer less than or equal to x . If

$$I = \int_{-1}^2 \frac{xf(x^2)}{2 + f(x+1)} dx, \text{ then the value, is}$$

A. $\frac{1}{4}$

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

C. 8

D. $-\frac{1}{4}$

Answer: A



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39. The value $\int_1^a [x] f(x) dx$, $a > 1$, where $[x]$ denotes the greatest integer not exceeding x , is

- A. $af(a) - \{f(1) + f(2) + \dots + f([a])\}$
- B. $[a]f(a) - \{f(1) + f(2) + \dots + f([a])\}$
- C. $[a]f([a]) - \{f(1) + f(2) + \dots + f(a)\}$
- D. $af([a]) - \{f(1) + f(2) + \dots + f(a)\}$

Answer: B



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40. If $m, n \in N$, then

$$\int_0^{\pi/2} \frac{(\sin^m x)^{\frac{1}{n}}}{(\sin^m x)^{\frac{1}{n}} + (\cos^m x)^{\frac{1}{n}}} dx \text{ is equal to}$$

A. $\frac{\pi}{2}$

B. $\frac{\pi}{4}$

C. $\frac{\pi}{2n}$

D. $\frac{\pi}{4n}$

Answer: B



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41. The value of $\int_0^{\pi/2} \log \tan x dx$, is

A. $\frac{\pi}{4}$

B. $\frac{\pi}{2}$

C. 0

D. none of these

Answer: C



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42. The value of $\int_0^{\infty} \frac{\log x}{1+x^2} dx$, is

A. $\frac{\pi}{4}$

B. $\frac{\pi}{2}$

C. 0

D. none of these

Answer: C



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43. If $I = \int_0^{\pi/4} \log(1 + \tan x) dx$, then $I =$

A. $\frac{\pi}{8} \log_e 2$

B. $\frac{\pi}{4} \log_e 2$

C. $-\frac{\pi}{8} \log_e 2$

D. $-\frac{\pi}{4} \log_e 2$

Answer: A



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44. The value of integral $\int_0^1 \frac{\log(1+x)}{1+x^2} dx$, is

A. $\frac{\pi}{8} \log_e 2$

B. $\frac{\pi}{4} \log_e 2$

C. $-\frac{\pi}{8} \log_e 2$

D. $-\frac{\pi}{4} \log_e 2$

Answer: A



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45. The value of the integral $\int_0^a \frac{1}{x + \sqrt{a^2 - x^2}} dx$, is

A. π

B. $\frac{\pi}{2}$

C. $\frac{\pi}{4}$

D. none of these

Answer: C

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46. The value of $\int_0^{\pi/2} (2\log\sin x - \log\sin 2x)dx$, is

A. $\frac{\pi}{2}\log 2$

B. $-\frac{\pi}{2}\log 2$

C. $\pi\log 2$

D. $-\pi\log 2$

Answer: B

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47. The value of $\int_0^{\pi/2n} \frac{1}{1 + \cos nx} dx$, is

A. 0

B. $\frac{\pi}{4n}$

C. $\frac{\pi}{2n}$

D. $\frac{\pi}{2}$

Answer: B



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48. $\int_0^{\pi/2} \sin 2x \log \tan x dx$ is equal to

A. π

B. $\frac{\pi}{2}$

C. 0

D. 1

Answer: C



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49. The value of the integral $\int_0^{\pi} \frac{1}{e^{\cos x} + 1} dx$, is

A. π

B. 0

C. 2π

D. $\frac{\pi}{2}$

Answer: D



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50. The value of the integral $\int_0^{\pi} \frac{x \sin x}{1 + \cos^2 x} dx$, is

A. $\frac{\pi^2}{2}$

B. $\frac{\pi^2}{4}$

C. $\frac{\pi^2}{8}$

D. $\frac{\pi^2}{16}$

Answer: B



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51. The integral $\int_0^{\pi} x f(\sin x) dx$ is equal to

A. $\frac{\pi}{2} \int_0^{\pi} f(\sin x) dx$

B. $\frac{\pi}{4} \int_0^{\pi} f(\sin x) dx$

C. $\frac{\pi}{2} \int_0^{\pi/2} f(\sin x) dx$

D. $\frac{\pi}{2} \int_0^{\pi/2} f(\cos x) dx$

Answer: A



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52. $\int_0^{\pi} [\cot x] dx$, $[.]$ denotes the greatest integer function, is equal to

A. $\frac{\pi}{2}$

B. 1

C. -1

D. $-\frac{\pi}{2}$

Answer: B



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53. The value of the integral

$$\int_{-1/2}^{1/2} \cos x \log \left(\frac{1+x}{1-x} \right) dx, \text{ is}$$

A. 0

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

C. $-\frac{1}{2}$

D. none of these

Answer: A



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54. The value of $\int_{-1}^1 \left\{ \sqrt{1+x+x^2} - \sqrt{1-x+x^2} \right\} dx$, is

A. 0

B. 1

C. -1

D. none of these

Answer: A



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55. The value of $\frac{\left\{ \int_{-1/2}^{1/2} \cos 2x \cdot \log \left(\frac{1+x}{1-x} \right) dx \right\}}{\left\{ \int_0^{1/2} \cos 2x \cdot \log \left(\frac{1+x}{1-x} \right) dx \right\}}$ is

- A. 0
- B. 4
- C. 2
- D. 8

Answer: A



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56. The value of $\int_{-2}^2 (ax^3 + bx + c) dx$ depends on

- A. B

B. C

C. A

D. none of these

Answer: B



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57. The value of the integral

$$\int_{-1}^1 \log(x + \sqrt{x^2 + 1}) dx \text{ is}$$

A. 0

B. $\log 2$

C. $\log 1/2$

D. none of these

Answer: A



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58. $\int_{-3\pi/2}^{-\pi/2} \left\{ (x + \pi)^3 + \cos^2(x + 3\pi) \right\} dx$, is

A. $\frac{\pi^4}{32}$

B. $\frac{\pi^4}{32} + \frac{\pi}{2}$

C. $\frac{\pi}{2}$

D. $\frac{\pi}{4} - 1$

Answer: C



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59. The value of

$$I = \int_{-2}^0 \left\{ x^3 + 3x^2 + 3x + 3 + (x + 1)\cos(x + 1)\cos(x + 1) \right\} dx, \text{ is}$$

A. 0

B. 3

C. 4

D. 1

Answer: C



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60. $\int_{-\pi/2}^{\pi/2} \frac{1}{e^{\sin x} + 1} dx$ is equal to

A. 0

B. 1

C. $-\frac{\pi}{2}$

D. $\frac{\pi}{2}$

Answer: D



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61. The value of $\int_{\pi/4}^{\pi/4} \frac{e^x \sec^2 x}{e^{2x} - 1} dx$, is

A. 0

B. 2

C. E

D. none of these

Answer: A



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62. The value of $\int_{-\pi/2}^{\pi/2} \frac{\cos x}{1 + e^x} dx$, is

A. 0

B. -1

C. 1

D. none of these

Answer: C



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63. The value of $\int_{-\pi/2}^{\pi/2} \frac{x^2 \cos x}{1 + e^x} dx$ is equal to

A. $\frac{\pi^2}{4} - 2$

B. $\frac{\pi^2}{4} + 2$

C. $\pi^2 + e^{\pi/2}$

D. 0

Answer: A



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64. The value of $\int_{-\pi}^{\pi} \frac{\cos^2 x}{1 + a^2} dx$, $a > 0$, is

A. π

B. π

C. $\pi/2$

D. 2π

Answer: C



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65. If $I = \int_{-\pi}^{\pi} \frac{e^{\sin x}}{e^{\sin x} + e^{-\sin x}} dx$, then I equals

A. $\frac{\pi}{2}$

B. 2π

C. π

D. $\frac{\pi}{4}$

Answer: C



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66. The value of $\int_{-2}^2 \frac{3x^2}{1+e^x} dx$, is

A. 8

B. 2

C. 4

D. 0

Answer: A



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67. The value of $\int_0^{2\pi} \cos^5 x dx$, is

A. 0

B. π

C. 2π

D. $\pi/2$

Answer: A



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68. If $\int_0^{\pi} x f(\sin x) dx = A \int_0^{\pi/2} f(\sin x) dx$, then A is

A. 2π

B. π

C. $\pi/4$

D. 0

Answer: B



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69. The value of $\int_0^\pi \cos^{11} x dx$, is

A. π

B. 11π

C. 0

D. -11π

Answer: C



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70. $I = \int_0^{2\pi} \frac{1}{1 + e^{\sin x}} dx$ is equal to

A. π

B. 2π

C. $\frac{\pi}{2}$

D. none of these

Answer: A



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71. $\int_0^{2\pi} \frac{x \sin^{2n} x}{\sin^{2n} x + \cos^{2n} x} dx, n > 0$, is equal to

A. π

B. 2π

C. π^2

D. $\frac{1}{2}\pi^2$

Answer: C



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72. If $[x]$ stands for the greatest integer function, the value of

$$\int_4^{10} \frac{[x^2]}{[x^2 - 28x + 196] + [x^2]} dx, \text{ is}$$

A. 0

B. 1

C. 3

D. none of these

Answer: C



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73. The value of $\int \frac{\sqrt{\ln 3}}{\sqrt{\ln 2}} \frac{x \sin x^2}{\sin x^2 + \sin(\ln 6 - x^2)} dx$, is

A. $\frac{1}{4} \ln \frac{3}{2}$

B. $\frac{1}{2} \ln \frac{3}{2}$

C. $\ln \frac{3}{2}$

D. $\frac{1}{6} \ln \frac{3}{2}$

Answer: A



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74. The integral

$$\int_2^4 \frac{\log x^2}{\log x^2 + \log(36 - 12x + x^2)} dx \text{ is equal to}$$

A. 1

B. 6

C. 2

D. 4

Answer: A



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75. The integral $\int_{\pi/4}^{3\pi/4} \frac{1}{1 + \cos x} dx$, is equal to

A. 4

B. -1

C. -2

D. 2

Answer: D



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76. If $f(x) = \frac{e^2}{1 + e^x}$, $I_1 = \int_{f(-a)}^{f(a)} xg\{x(1-x)\}dx$ and $I_2 = \int_{f(-a)}^{-f(-a)} g\{x(1-x)\}dx$, where g is not identify function. Then the value of I_2/I_1 , is

A. -1

B. 1/2

C. 2

D. 1

Answer: C



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77. If $f(x)=f(a+b-x)$, then $\int_a^b xf(x)dx$ is equal to

A. $(a + b) \int_a^b af(x)dx$

B. $\frac{1}{2}(a + b) \int_a^b af(x)dx$

C. $(b - a) \int_a^b af(x)dx$

D. $\frac{1}{2}(b - a) \int_a^b af(x)dx$

Answer: B



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78. The value of the integral $\int_{\pi/6}^{\pi/3} \frac{1}{1 + \sqrt{\tan x}} dx$ is

A. $\frac{\pi}{3}$

B. $\frac{\pi}{6}$

C. $\frac{\pi}{12}$

D. 0

Answer: C



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79. $I = \int_{\pi/5}^{3\pi/10} \frac{\sin x}{\sin x + \cos x} dx$ is equal to

A. (π)

B. $\frac{\pi}{2}$

C. $\frac{\pi}{4}$

D. none of these

Answer: D



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80. The value of the integral $\int_3^6 \frac{\sqrt{x}}{\sqrt{9-x+\sqrt{x}}} dx$ is

A. $\frac{1}{2}$

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

C. 2

D. 1

Answer: B



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81. Evaluate $\int_{-4}^{-5} e^{(x+5^2)} dx + 3 \int_{1/3}^{2/3} e^{9\left(x-\frac{2}{3}\right)^2} dx$

A. 1

B. 0

C. -1

D. none of these

Answer: B



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82. The value of the integral

$\int_0^{400\pi} \sqrt{1 - \cos 2x} dx$, is $A\sqrt{2}$. then find the value of A.



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83. If $n \in \mathbb{N}$, then $\int_0^n (x[x]) dx$ is equal to

A. n

B. $n/2$

C. $2n$

D. none of these

Answer: B



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84. The value of $\int_0^{100} e^{x-[x]} dx$, is

A. $100e$

B. $100(e-1)$

C. $100(e+1)$

D. none of these

Answer: B



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85. The value of $\int_0^{32\pi/3} \sqrt{1 + \cos 2x} dx$ is

A. $\frac{44 + \sqrt{3}}{\sqrt{2}}$

B. $\frac{44 - \sqrt{3}}{\sqrt{2}}$

C. $\frac{22 - \sqrt{3}}{\sqrt{2}}$

D. $\frac{22 + \sqrt{3}}{\sqrt{2}}$

Answer: B



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86. The value of $\int_{[x]}^0 (-x - [x])dx$, is

A. $[x]$

B. $2[x]$

C. $(1/2)[x]$

D. none of these

Answer: C



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87. $\frac{d}{dx} \int_{x^2}^{x^3} \left(\frac{1}{\log t} dt \right)$ is equal to

A. $x^2 - x$

B. $(x^2 - x)\log x$

C. $\frac{x^2 - x}{\log x}$

D. $\frac{x - 1^2}{\log x}$

Answer: C



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88. If $g(x) = \int_{\sin x}^{\sin 2x} \sin^{-1}(t) dt$, then

A. $g' \left(\frac{\pi}{2} \right) = -2\pi$

B. $g' \left(-\frac{\pi}{2} \right) = 2\pi$

C. $g' \left(\frac{\pi}{2} \right) = 0$

$$D. g' \left(-\frac{\pi}{2} \right) = 0$$

Answer: C::D



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89. If $\phi(x) = \int_{1/x}^{\sqrt{x}} \sin(t^2) dt$ then $\phi'(1)$ is equal to

A. $\sin 1$

B. $2 \sin 1$

C. $(3/2)\sin 1$

D. none of these

Answer: C



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90. $\lim_{x \rightarrow \infty} \frac{\int_0^{2x} te^{t^2} dt}{e^{4x^2}}$ equals

A. 0

B. 2

C. $\frac{1}{2}$

D. ∞

Answer: C



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91. Let $f: R \rightarrow R$ be a differentiable function having $f(2)=6, f'(2)$

$= \frac{1}{12}$. Then, $\lim_{x \rightarrow 2} \int_6^{f(x)} \frac{4t^3}{x-2} dt$, equals

A. 18

B. 12

C. 36

D. 24

Answer: A



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92. $\lim_{x \rightarrow \pi/4} \frac{\int_2^{\sec^2 x} f(t) dt}{x^2 - \frac{\pi^2}{16}}$ equals

A. $\frac{8}{\pi} f(2)$

B. $\frac{2}{\pi} f(2)$

C. $\frac{2}{\pi} f\left(\frac{1}{2}\right)$

D. $4f(2)$

Answer: A



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93. If $\int_{\sin x}^1 t^2 f(t) dt = 1 - \sin x$ for all $x \in \left[0, \frac{\pi}{2}\right]$, then $f\left(\frac{1}{\sqrt{3}}\right) =$

A. 3

B. $\sqrt{3}$

C. $\frac{1}{3}$

D. none of these

Answer: A



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94. If $y = \int_0^x f(t) \sin\{k(x-t)\} dt$, then $\frac{d^2y}{dx^2} + k^2y =$

A. $f(x)$

B. $k f(x)$

C. $k^2 f(x)$

D. none of these

Answer: B



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95. The value of

$$\int_0^{\sin^2} \sin^{-1} \sqrt{t} dt + \int_0^{\cos^2 x} \cos^{-1} \sqrt{t} dt, \text{ is}$$

A. π

B. $\frac{\pi}{2}$

C. $\frac{\pi}{4}$

D. none of these

Answer: C



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96. Let $f: (0, \infty) \rightarrow \mathbb{R}$ be given

$$f(x) = \int_{1/x}^x e^{-\left(t + \frac{1}{t}\right)} \frac{1}{t} dt, \text{ then}$$

A. $f(x)$ is monotonically increasing on $[1, \infty]$

B. $f(x)$ is monotonically increasing on $(0,1)$

C. $f(x)$ is monotonically decreasing on $(0,1)$

D. $f(2^x)$ is an odd function of x on \mathbb{R}

Answer: A::C::D



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97. Let $I = \int_0^1 \frac{\sin x}{\sqrt{x}} dx$ and $J = \int_0^1 \frac{\cos x}{\sqrt{x}} dx$.

Then , which one of the following is true?

A. $I > \frac{2}{3}$ and $J > 2$

B. $I < \frac{2}{3}$ and $J < 2$

C. $I < \frac{2}{3}$ and $J > 2$

D. $I > \frac{2}{3}$ and $J < 2$

Answer: B



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98. The value of the integral $\int_0^1 e^{x^2} dx$ lies in the interval

- A. (0,1)
- B. (-1,0)
- C. (1, e)
- D. none of these

Answer: C



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99. The smallest interval $[a,b]$ such that

$\int_0^1 (1+\sqrt{1+x^4}) dx \in [a, b]$ is given by

- A. $[1/\sqrt{2}, 1]$
- B. $[0,1]$

C. $[1/2, 1]$

D. $[3/4, 1]$

Answer: A



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100. If $I = \int_0^1 \frac{1}{1+x^{\pi/2}} dx$ then

A. $\ln 2 < I < \frac{\pi}{4}$

B. $I < \ln 2$

C. $\ln 2 > \frac{\pi}{4}$

D. none of these

Answer: A



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101. Let $f(a) > 0$, and let $f(x)$ be a non-decreasing continuous function in $[a, b]$. Then, $\frac{1}{b-a} \int_a^b f(x) dx$ has the

- A. maximum value $f(b)$ and minimum value $f(a)$
- B. maximum value $b f(b)$ and minimum value $a f(a)$
- C. maximum value $f(a)$ and minimum value $f(b)$
- D. none of these

Answer: A



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102. If $I = \sum_{k=1}^{98} \int_k^{k+1} \frac{k+1}{x(x+1)} dx$, then

A. $I > \log_e 99$

B. $I < \log_e 99$

C. $I < \frac{49}{50}$

D. $I > \frac{49}{50}$

Answer: B::D



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103. Let $f: \left[\frac{1}{2}, 1 \right] \in R$ (the set of all real numbers) be a positive, non-constant and differentiable function such that $f'(x) < 2f(x')$ and $f\left(\frac{1}{2}\right) = 1$. Then the value of $\int_{1/2}^1 f(x) dx$ lies in the interval

A. $(2e-1, 2e)$

B. $e^{-1}, 2e^{-1}$)

C. $\left(\frac{e-1}{2}, e-1\right)$

D. $\left(0, \frac{e-1}{2}\right)$

Answer: D



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104. Let $f(x) = \frac{192x^3}{2 + \sin^4 \pi x}$ for all $x \in \mathbb{R}$ with $f\left(\frac{1}{2}\right) = 0$. If

$m \leq \int_{1/2}^1 f(x) dx \leq M$, then the possible values of m and M are

A. $m=13, M=24$

B. $m = \frac{1}{4}, M = \frac{1}{2}$

C. $m=-11, M=0$

D. $m=1, M=12$

Answer: D



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105. Let $f: R \rightarrow R$ be a function which satisfies

$f(x) = \int_0^x f(t) dt$. Then the value of $f(\ln 5)$, is

A. 5

B. 0

C. 1

D. -5

Answer: B



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106. The least value of the function

$$\phi(x) = \int_{5\pi/4}^x (3\sin t + 4\cos t) dt$$

on the interval $[5\pi/4, 4\pi/3]$, is

A. $\sqrt{3} + \frac{3}{2}$

B. $-2\sqrt{3} + \frac{3}{2} + \frac{1}{\sqrt{2}}$

C. $\frac{3}{2} + \frac{1}{\sqrt{2}}$

D. none of these

Answer: B



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107. $\lim_{n \rightarrow \infty} \sum_{r=1}^n \frac{1}{n} e^{r/n}$ is

A. $e+1$

B. e-1

C. 1-e

D. e

Answer: B



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108. $\lim_{n \rightarrow \infty} \sum_{r=2n+1}^{3n} \frac{n}{r^2 - n^2}$ is equal to

A. $\ln \sqrt{\frac{2}{3}}$

B. $\ln \sqrt{\frac{3}{2}}$

C. $\ln \frac{2}{3}$

D. $\ln \frac{3}{2}$

Answer: B



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109. $\lim_{n \rightarrow \infty} \frac{1}{2} \sum_{r=+1}^{2n} \frac{r}{\sqrt{n^2 + r^2}}$ equals

A. $1 + \sqrt{5}$

B. $-1 + \sqrt{5}$

C. $-1 + \sqrt{2}$

D. $1\sqrt{2}$

Answer: B



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110. $\lim_{n \rightarrow \infty} \left\{ \frac{1}{n+1} + \frac{1}{n+2} + \frac{1}{n+3} + \dots + \frac{1}{n+n} \right\}$ is, equal to

A. $\log_e 3$

B. 0

C. $\log_e 2$

D. 1

Answer: C



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111. $\lim_{n \rightarrow \infty} \left\{ \frac{n}{n^2 + 1^2} + \frac{n}{n^2 + 2^2} + \dots + \frac{n}{n^2 + n^2} \right\}$ is equal to

A. 1

B. 0

C. $\frac{\pi}{4}$

D. $\frac{\pi}{2}$

Answer: C



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112. $\lim_{n \rightarrow \infty} \left\{ \frac{1^m + 2^m + 3^m + \dots + n^m}{n^{m+1}} \right\}$ equals

A. $\frac{1}{m+1}$

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

C. $\frac{1}{m}$

D. none of these

Answer: A



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113. $\lim_{n \rightarrow \infty} \frac{(n!)^{1/n}}{n}$ equals

A. e

B. e^{-1}

C. 1

D. none of these

Answer: B



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114. $\lim_{n \rightarrow \infty} \left\{ \frac{1}{n} + \frac{1}{n+1} + \frac{1}{n+2} + \dots + \frac{1}{3n} \right\} =$

A. $\log 2$

B. $\log 3$

C. $\log 5$

D. 0

Answer: B



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115. $\lim_{n \rightarrow \infty} \left\{ \frac{1}{n^2} \sec^2 \frac{1}{n^2} + \frac{2}{n^2} + \sec^2 \frac{4}{n^2} + \dots + \frac{1}{n} \sec^2 1 \right\}$

equals

A. $\frac{1}{2}\tan 1$

B. $\tan 1$

C. $\frac{1}{2}\operatorname{cosec} 1$

D. $\frac{1}{2}\sec 1$

Answer: A



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116. $\lim_{n \rightarrow \infty} \left\{ \frac{(n+1)(n+2)(n+3) \dots 3n}{n^{2n}} \right\}^{\frac{1}{n}}$ is equal to

A. $\frac{18}{e^4}$

B. $\frac{27}{e^2}$

C. $\frac{9}{e^2}$

D. $3\log 3 - 2$

Answer: C



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117. For $a \in \mathbb{R} - \{-1\}$, if

$$\lim_{n \rightarrow \infty} \frac{(1^a + 2^a + 3^a + \dots + n^a)}{(n+1)^{a-1} \{(na+1) + (na+2) + \dots + (na+n)\}} = \frac{1}{60}$$

then, $a =$

A. 5,7

B. $7, \frac{17}{2}$

C. $-\frac{15}{2}, -\frac{17}{2}$

D. $7, \frac{15}{2}$

Answer: B



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118. Let $S_n = \sum_{k=1}^n \frac{n}{n^2 + nk + k^2}$ and $T_n = \sum_{k=0}^{n-1} \frac{n}{n^2 + nk + k^2}$ for $n = 1, 2, 3, \dots$, then

A. $S_n < \frac{\pi}{3\sqrt{3}}, T_n > \frac{\pi}{3\sqrt{3}}$

B. $S_n \geq \frac{\pi}{3\sqrt{3}}, T_n < \frac{\pi}{3\sqrt{3}}$

C. $S_n > \frac{\pi}{3\sqrt{3}}, T_n > \frac{\pi}{3\sqrt{3}}$

D. $S_n < \frac{\pi}{3\sqrt{3}}, T_n < \frac{\pi}{3\sqrt{3}}$

Answer: A



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119. The value of $\int_{-1}^1 x d|x|$, is,

A. 0

B. 1

C. -1

D. 1/2

Answer: B



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120. The value of $\int_0^x d[t]$, is

A. x

B. $x^2/2$

C. $-x$

D. $[x]$

Answer: D



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121. The value of $\int_0^2 x d([x] - x)$, is

A. $1/2$

B. 1

C. -1

D. 0

Answer: B



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122. The value of the integral $\int_0^3 (x^2 + 1) d[x]$ is, where $[*]$ is the greatest integer function

A. 12

B. 15

C. 17

D. 19

Answer: C



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Section I - Solved Mcqs

1. $\int_0^{10} |x(x-1)(x-2)| dx$ is equal to

A. 160.05

B. 1600.5

C. 16.005

D. none of these

Answer: B



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2. If $\int_0^x f(t) dt = x + \int_x^1 t f(t) dt$, then the value of $f(1)$, is

A. $1/2$

B. 0

C. 1

D. $-1/2$

Answer: A



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3. Let f be a positive function. Let

$$I_1 = \int_{1-k}^k x f\{x(1-x)\} dx, I_2 = \int_{1-k}^k f\{x(1-x)\} dx$$

where $2k - 1 > 0$. Then, $\frac{I_1}{I_2}$ is

A. 2

B. k

C. $1/2$

D. 1

Answer: C



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4. If $g(x) = \int_0^x \cos^4 t dt$, then $g(x + \pi)$ equals

A. $g(x) + g(\pi)$

B. $g(x) - g(\pi)$

C. $g(x)g(\pi)$

D. $g(x)/g(\pi)$

Answer: A



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5. If $I_n = \int_0^{\pi/4} \tan^n x dx$, $n \in \mathbb{N}$ then $I_{n+2} + I_n$ equals

A. $\frac{1}{n}$

B. $\frac{1}{n-1}$

C. $\frac{1}{n+1}$

D. $\frac{1}{n+2}$

Answer: C



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6. If $\Rightarrow I_n = \int_0^{\pi/4} \tan^n x dx$, then for any positive integer, n , the value of $(I_{n+1} - I_{n-1})$ is,

A. 1

B. 2

C. $\pi/4$

D. π

Answer: A



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7. The value of $\int_{-1}^1 \frac{d}{dx} \left(\tan^{-1} \frac{1}{x} \right) dx$ is

A. $\pi/2$

B. $-\pi/4$

C. $-\pi/2$

D. none of these

Answer: A



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8. The value of the integral

$$\int_{-1}^3 \left(\tan^{-1} \frac{x}{x^2 + 1} + \tan^{-1} \frac{x^2 + 1}{x} \right) dx \text{ is equal to}$$

A. π

B. 2π

C. 4π

D. none of these

Answer: B



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9. If $I_n = \int_1^e (\log x)^n dx$, then $I_n + nI_{n-1}$ is equal to

A. $1/e$

B. e

C. $e - 1$

D. none of these

Answer: B



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10. If $I_n = \int_0^1 x^n e^{-x} dx$ for $n \in \mathbb{N}$, then $I_n - nI_{n-1} =$

A. e

B. $1/e$

C. $-1/e$

D. none of these

Answer: C



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11. The value of $\int_{1/n}^{(an-1)/n} \frac{\sqrt{x}}{\sqrt{a-x} + \sqrt{x}} dx$, is

A. $\frac{a}{2}$

B. $\frac{1}{2n}(na + 2)$

C. $\frac{na + 2}{2n}$

D. none of these

Answer: C

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12. The value of the integral $\int_0^{\pi/2} \log|\tan x \cot x| dx$ is

A. $\pi \log 2$

B. $-\pi \log 2$

C. $\frac{\pi}{2} \log 2$

D. none of these

Answer: D

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13. If $I_1 = \int_x^1 \frac{1}{1+t^2} dt$ and $I_2 = \int_1^{1/x} dt$ for $x > 0$ then,

A. $I_1 = I_2$

B. $I_1 > I_2$

C. $I_2 = I_1$

D. none of these

Answer: A



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14. For all values of x , $\int_{1/e}^{\tan x} \frac{t}{1+t^2} dt + \int_{1/e}^{\tan x} \frac{dt}{t(t+t^2)}$ has the value

A. 0

B. 1

C. e

D. none of these

Answer: B



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15. The absolute value of $\int_{10}^{19} \frac{\cos x}{1+x^8} dx$, is

A. less than 10^{-7}

B. more than 10^{-7}

C. less than 10^{-8}

D. none of these

Answer: A



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16. If $f(x)$ is an odd periodic function defined on the interval $[-T/2, T/2]$, where T is the period of $f(x)$. Then $\phi(x) = \int_a^x f(t) dt$, is

- A. periodic with period T
- B. non-periodic
- C. periodic with period $2T$
- D. periodic with period aT

Answer: A



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17. If $\int_{\pi/2}^{\theta} \sin x dx = \sin 2\theta$ then the value of θ satisfying $0 < \theta < \pi$, is

- A. $3\pi/2$

B. $\pi/6$

C. $5\pi/6$

D. $\pi/2$

Answer: D



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18. If $f(x)$ is periodic function with period, T , then

$$\text{A. } \int_a^b af(x)dx = \int_a^{b+T} af(x)dx$$

$$\text{B. } \int_a^b af(x)dx = \int_{a+T}^b af(x)dx$$

$$\text{C. } \int_a^b af(x)dx = \int_a^{b+T} a+Tf(x)dx$$

$$\text{D. } \int_a^b af(x)dx = \int_a^{b+2T} a+Tf(x)dx$$

Answer: C



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19. If $f(n) = \frac{1}{n} \{(n+1)(n+2)(n+3)\dots(n+n)\}^{1/n}$ then

$\lim_{n \rightarrow \infty} f(n)$ equals

A. e

B. $1/e$

C. $2/e$

D. $4/e$

Answer: D



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20. The points of extremum of $\phi(x) = \int_1^x e^{-t^2/2} (1 - t^2) dt$ are

A. $x = 1, -1$

B. $x = -1, 2$

C. $x = 2, 1$

D. $x = -2, 1$

Answer: A



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21. $\int_{-2}^2 \min(x - [x], -x - [x]) dx$ equals, where $[x]$ represents greatest integer less than or equal to x .

A. 2

B. 1

C. 4

D. 0

Answer: B



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22. The integral $\int_0^a \frac{g(x)}{f(x) + f(a-x)} dx$ vanishes, if

A. $g(x)$ is odd

B. $f(x) = f(a-x)$

C. $g(x) = -g(a-x)$

D. $f(a-x)g = g(x)$

Answer: C



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23. If $\frac{1}{\sqrt{a}} \int_1^a \left(\frac{3}{2} \sqrt{x} + 1 - \frac{1}{\sqrt{x}} \right) dx < 4$ then 'a' may take values :

A. 0

B. 4

C. 9

D. none of these

Answer: D



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24. The expression $\frac{\int_0^n [x] dx}{\int_0^n \{x\} dx}$ where $[x]$ and $\{x\}$ are integral and fractional parts of x and $n \in \mathbb{N}$ is equal to

fractional parts of x and $n \in \mathbb{N}$ is equal to

A. $\frac{1}{n-1}$

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

C. n

D. $n-1$

Answer: D



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25. If $f(x) = \text{Min} \{|x-1|, |x|, |x+1|\}$ then $\int_{-1}^1 f(x) dx$ equals

A. 1

B. 2

C. 0

D. none of these

Answer: D



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26. The value of $\int_0^{100} [\tan^{-1}x] dx$ is

A. 100

B. $100 - \tan^{-1}1$

C. $100 - \tan 1$

D. none of these

Answer: C



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27. $\int_{-1}^{10} \text{sgn}(x - [x]) dx$ equals

A. 10

B. 11

C. 9

D. 11/2

Answer: B



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28. If $n \in \mathbb{N}$, then $\int_{-n}^n (-1)^{[x]} dx$ equals

A. 2n

B. n

C. n^2

D. none of these

Answer: D



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29. The value of $\therefore \int_0^{[x]} \frac{2^x}{2^{[x]}} dx$ is

A. $\log 2$

B. $\frac{[x]}{\log 2}$

C. $\frac{1}{2} \frac{[x]}{\log 2}$

D. none of these

Answer: B



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30. If $f(x) \Rightarrow \int_{\sin\theta}^{\operatorname{cosec}\theta} f(x)dx$ equals

A. $\sin\theta + \operatorname{cosec}\theta$

B. $\sin^2\theta$

C. $\operatorname{cosec}^2\theta$

D. none of these

Answer: D



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31. If $f(x) = \begin{cases} e^{\cos x} \sin x & \text{for } |x| \leq 2 \\ 2 & \text{otherwise} \end{cases}$ then $\int_{-2}^3 f(x)dx =$

A. 0

B. 1

C. 2

D. 3

Answer: C



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32. The value of the integral $\int_{e^{-1}}^{e^2} \left| \frac{\log_e x}{x} \right| dx$ is

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

B. $\frac{5}{2}$

C. 3

D. 5

Answer: B



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33. Let $g(x) = \int_0^x f(t)dt$, where f is such that $\frac{1}{2} \leq f(t) \leq 1$ for $t \in [0, 1]$ and $0 \leq f(t) \leq \frac{1}{2}$ for $t \in [1, 2]$ then, $g(2)$ satisfies the inequality,

A. $-\frac{3}{2} \leq g(2) < \frac{1}{2}$

B. $0 \leq g(2) \leq 2$

C. $\frac{3}{2} \leq g(2) \leq \frac{5}{2}$

D. $2 < g(2) < 4$

Answer: B



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34. Let $f: (0, \infty) \in \mathbb{R}$ and $F(x) = \int_0^x f(t) dt$. If $F(x^2) = x^2(1+x)$ then $f(4)$ equals

A. $5/4$

B. 7

C. 4

D. 2

Answer: C



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35. The integral $\int_{-1/2}^{1/2} \left\{ [x] + \in \left(\frac{1+x}{1-x} \right) \right\} dx$ equals

A. $-\frac{1}{2}$

B. 0

C. 1

D. $2\ln\left(\frac{1}{2}\right)$

Answer: A



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36. Let $T > 0$ be a fixed real number. Suppose f is a continuous function such that $f(x + T) = f(x)$ for all $x \in \mathbb{R}$. If $I = \int_0^T f(x) dx$, then the value of $\int_3^{3+3T} f(2x) dx$ is

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

B. $2I$

C. 3l

D. 6l

Answer: C



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37. Let $f(x) = \int_1^x \sqrt{2 - t^2} dt$. Then the real roots of the equation $x^2 - f(x) = 0$ are

A. ± 1

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

C. $\pm \frac{1}{2}$

D. 0 and 1

Answer: A



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38. If $f\left(\frac{1}{x}\right) + x^2 f(x) = 0, x > 0$ and $I = \int_{1/x}^x f(t) dt, \frac{1}{2} \leq x \leq 2x,$

then I is equal to

A. $f(2) - f\left(\frac{1}{2}\right)$

B. $f\left(\frac{1}{2}\right) - f(2)$

C. 0

D. none of these

Answer: C



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39. If $\left| \int_a^b f(x) dx \right| = \int_a^b |f(x)| dx$, $a < b$, then $f(x) = 0$ has

- A. exactly one root in (a,b)
- B. at least one root in (a,b)
- C. no root in (a,b)
- D. none of these

Answer: C



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40. Let $f(x)$ be an odd continuous function which is periodic with period 2. if $g(x) = \int_0^x f(t) dt$, then

- A. $g(x)$ is an odd function

B. $g(n) = 0$ for all $n \in N$

C. $g(2n) = 0$ for all $n \in N$

D. $g(x)$ is non periodic

Answer: C



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41. All the values of 'a' for which

$$\int_1^2 \{a^2 + (4 - 4a)x + 4x^3\} dx \leq 12 \text{ are given by}$$

A. $a=3$

B. $a \leq 4$

C. $0 \leq a \leq 3$

D. none of these

Answer: A



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42. Let $f(x)$ be a function defined by

$$f(x) = \int_0^x t(t^2 - 3t + 2) dt, \quad 1 \leq x \leq 3.$$

Then, the range of $f(x)$ is

A. $[0,2]$

B. $[-1/4,4]$

C. $[-1/4,2]$

D. none of these

Answer: C



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43. If $\int_0^x \{t\} dt = \int_0^{\{x\}} t dt$ (where $x > 0 \notin \mathbb{Z}$ and $\{\cdot\}$ represents fractional part function), then

A. $x \in (0, 1)$

B. $[x] = 1$

C. $x \in (1, 6) - I$

D. none of these

Answer: A



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44. Let $f(x) = \max \{x + |x|, x - [x]\}$, where $[x]$ denotes the greatest integer less than or equal to x , then $\int_{-2}^2 f(x)$ is equal to

A. 3

B. 5

C. 1

D. none of these

Answer: B



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45. $\Rightarrow \int_0^{\infty} \left[\frac{2}{e^x} \right] dx$ (where $[*]$ denotes the greatest integer function) equals

A. $\log_e 2$

B. e^2

C. 0

D. $2/e$

Answer: A



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46. If $\Rightarrow \int_0^1 \frac{e^{-t}}{t+1} dt = a$, then $\int_{b-1}^b \frac{e^{-t}}{t-b-1} dt$ is equal to

A. ae^{-b}

B. $-ae^{-b}$

C. be^b

D. none of these

Answer: B



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47. If $\Rightarrow \int_{-1}^{-4} f(x) dx = 4$ and $\int_2^{-4} (3 - f(x)) dx = 7$, then the value of $\Rightarrow \int_{-2}^1 f(-x) dx$ is

A. 2

B. -3

C. 5

D. none of these

Answer: D



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48. For $x \in R$ and a continuous function $f(x)$, let

$I_1 \int_{\sin^2 t}^{1 + \cos^2 t} x f(x(2-x)) dx$ and $I_2 \int_{\sin^2 t}^{1 + \cos^2 t} f(x(2-x)) dx$. Then, $\frac{I_1}{I_2} =$

A. 0

B. 1

C. 2

D. 3

Answer: B



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49. $\int_1^4 \log_e[x] dx$ equals

A. $\log_e 6$

B. $\log_e 3$

C. $\log_e 2$

D. none of these

Answer: A



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50. If $[*]$ denotes the greatest integer function then the value of

the integral $\int_{-\pi/2}^{\pi/2} \left(\left[\frac{x}{\pi} \right] + 0.5 \right) dx$, is

A. π

B. $\pi/2$

C. 0

D. $-\pi/2$

Answer: C



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51. The value of $\int_0^{100\pi} \sum_{r=1}^{10} \tan rx dx$ is equal to

A. 100π

B. -100π

C. 1

D. none of these

Answer: D



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52.

If

$$I_1 = \int_0^{\pi/2} \cos(\sin x) dx, I_2 = \int_0^{\pi/2} \sin(\cos x) dx \text{ and } I_3 = \int_0^{\pi/2} \cos x dx$$

then

A. $I_1 > I_3 > I_2$

B. $I_3 > I_1 > I_2$

C. $I_1 > I_2 > I_3$

D. $I_3 > I_2 > I_1$

Answer: A



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53. For any $n \in N$, the value of the intergral $\int_0^{\pi} \frac{\sin 2nx}{\sin x} dx$ is,

A. π

B. 2π

C. $-\pi$

D. none of these

Answer: D



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54. For any $n \in N$, $\int_0^\pi \frac{\sin^2 nx}{\sin^2 x} dx$ is equal to

A. π

B. $n\pi$

C. 0

D. none of these

Answer: B



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55. For any $n \in \mathbb{N}$, $\int_0^\pi \frac{\sin(2n+1)x}{\sin x} dx$ is equal to

A. π

B. 0

C. $n\pi$

D. $(2n+1)\pi$

Answer: A



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56. If $I_n = \int_{-\pi}^{\pi} \frac{\sin nx}{(1 + \pi^x) \sin x} dx$, $n = 0, 1, 2, \dots$ then which one of the

following is not true?

A. $I_n = I_{n+2}$

$$B. \sum_{m=1}^{10} I_{2m+1} = 10\pi$$

$$C. \sum_{m=1}^{10} I_{2m} = 0$$

$$D. I_n = I_{n+1}$$

Answer: D



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57. If $I_n = \int_0^{\pi/4} \tan^n x dx$, then

$\frac{1}{I_2 + I_4}, \frac{1}{I_3 + I_5}, \frac{1}{I_4 + I_6}, \dots$ form\

A. an A.P.

B. a G.P.

C. a H.P.

D. none of these

Answer: A



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58. Let $f(x)$ be a function defined on \mathbb{R} satisfying $f(x) = f(1 - x)$ for

all $x \in \mathbb{R}$. Then $\int_{-1/2}^{1/2} f\left(x + \frac{1}{2}\right) \sin x dx$ equals

A. $\int_{-1/2}^{1/2} f\left(x + \frac{1}{2}\right) \sin x dx$

B. $2 \int_{-1/2}^{1/2} f\left(x + \frac{1}{2}\right) \sin x dx$

C. $f(x) \sin x dx$

D. none of these

Answer: D



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59. The value of $\frac{(5050)\int_0^1(1-x^{50})^{100}dx}{\int_0^1(1-x^{50})^{100}dx}$, is

A. 5049

B. 5051

C. 5050

D. none of these

Answer: B



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60. If f and g are continuous functions on $[0, \pi]$ satisfying

$f(x) + f(\pi - x) = 1 = g(x) + g(\pi - x)$ then $\int_0^\pi \{f(x) + g(x)\} dx$ is equal

to

A. π

B. 2π

C. $\frac{\pi}{2}$

D. $\frac{3\pi}{2}$

Answer: A



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61. If $f(x)$ and $g(x)$ are two continuous functions defined on $[-$

$a, a]$ then the the value of $\int_{-a}^a \{f(x)f + (-x)\} \{g(x) - g(-x)\} dx$ is,

A. $2a$

B. $f(a) g(a)$

C. a

D. none of these

Answer: D



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62. Let $f(x)$ be a continuous function defined on $[0, a]$ such that $f(a-x) = f(x)$ for all $x \in [0, a]$. If $\int_0^{a/2} f(x) dx = \alpha$, then $\int_0^a f(x) dx$ is equal to

A. α

B. 2α

C. 0

D. none of these

Answer: B



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63. The value of the integral $\int_0^{a/2} \sin 2nx \cot x dx$, where n is a positive integer, is

A. $\frac{\pi}{2}$

B. $-\pi$

C. π

D. none of these

Answer: A



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64. The value of the integral $\Rightarrow \int_1^{e^6} \left[\frac{\log x}{3} \right] dx$, where $[*]$ denotes the greatest integral function, is

A. 0

B. $e^6 - e^3$

C. $e^6 + e^3$

D. $e^3 - e^6$

Answer: B



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65. For any natural number n , the value of $\Rightarrow \int_0^{n^2} [\sqrt{x}] dx$, is

A. $\frac{n(n+1)(4n+1)}{6}$

B. $\frac{n(n-1)(4n+1)}{6}$

C. $\frac{n(n-1)(4n-1)}{6}$

D. none of these

Answer: B



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66. The value of the integral $\int_a^{a+\pi/2} (|\sin x| + |\cos x|) dx$ is

A. $a\pi$

B. $2a\pi$

C. $\frac{a\pi}{2}$

D. independent of a

Answer: D



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67. If $\Rightarrow I_n = \int_a^{a+\pi/2} \frac{\cos^2 nx}{\sin x} dx$, then $I_2 - I_1, I_3 - I_2, I_4 - I_3$ are in

A. G.P.

B. A.P.

C. H.P.

D. none of these

Answer: C



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68. Let $f(x)$ be a polynomial of degree 2 satisfying $f(0) = 1, f(1) = -2$ and $f'(0) = 6$, then $\int_{-1}^2 f(x)$ is equal to

A. 6

B. 2

C. 9

D. none of these

Answer: C



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69. The value of $\int_{-2}^2 \frac{\sin^2 x}{\left[\frac{x}{\pi} \right] + \frac{1}{2}} dx$ where $[*]$ denotes the greatest

integer function, is

A. 1

B. 2

C. $4 - \sin 4$

D. none of these

Answer: B



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70. If $\int_0^x f(t) dt = x + \int_x^1 t f(t) dt$, then the value of $f(1)$, is

A. $1/2$

B. 0

C. 1

D. $-1/2$

Answer: A



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71. If $f(x) = \int_0^{\sin x} \cos^{-1} t dt + \int_0^{\cos x} \sin^{-1} t dt$, $0 < x < \frac{\pi}{2}$ then $f(\pi/4)$ is equal to

A. $\frac{\pi}{\sqrt{2}}$

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

C. 1

D. none of these

Answer: B



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72. Let $f(x)$ be a continuous function such that

$\int_n^{n+1} f(x) dx = n^3$, $n \in Z$. Then the value of the integral $\int_{-3}^3 f(x)$

dx , is

A. 9

B. -27

C. -9

D. none of these

Answer: B



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73. Let $f(x) = \frac{e^x + 1}{e^{-x} - 1}$ and $\int_0^1 x^3 \frac{e^x + 1}{e^x - 1} dx = \alpha$ then, $\int_{-1}^1 t^3 f(t) dt$ is equal to

A. 0

B. α

C. 2α

D. none of these

Answer: C



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74. If $\int_0^1 xe^{x^2} dx = \alpha \int_0^1 e^{x^2} dx$, then

A. $\alpha \in (0, 1)$

B. $(1, 2)$

C. $(-\infty, 0)$

D. $(0, \infty)$

Answer: A



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75. If $I = \int_0^1 (1 + e^{-x^2}) dx$ then, s

A. $I \in (1, 2)$

B. $I \in (0, 1)$

C. $I \in \left(1 + \frac{1}{e}, 2\right]$

D. none of these

Answer: C



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76. If $I = \int_0^1 \frac{x}{8 + x^3} dx$ then the smallest interval is which I less is

A. $(0, 1/8)$

B. (0,1/9)

C. (0,1/10)

D. (0,1/7)

Answer: B



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77. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a continuous function given by

$$f(x + y) = f(x) + f(y) \text{ for all } x, y \in \mathbb{R}.$$

If $\int_0^2 f(x) dx = \alpha$, then $\int_2^4 f(x) dx$ is equal to

A. 2α

B. α

C. 0

D. none of these

Answer: C



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78. Let the be an integrable function defined on $[0,a]$ if

$$I_1 = \int_{\pi/2}^{\pi/2} \cos\theta f(\sin\theta\cos^2\theta) d\theta \text{ and } I_2 = \int_0^{\pi/2} \sin 2\theta f(\sin\theta\cos^2\theta) d\theta$$

then

A. $I_1 = I_2$

B. $I_1 = -I_2$

C. $I_1 = 2I_2$

D. $I_1 = 2I_2$

Answer: A



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79. $\lim_{x \rightarrow 0} \frac{2 \int_0^{\cos x} \cos^{-1} t dt}{2x - \sin 2x}$ is equal to

A. 0

B. 1/2

C. -1/2

D. 2/3

Answer: C



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80. If $I_1 = \int_1^{\sin\theta} \frac{x}{1+x^2} dx$ and $I_2 = \int_1^{\operatorname{cosec}\theta} \frac{1}{x(x^2+1)} dx$ then the value

of $\begin{vmatrix} I_1 & I_1^2 & I_2 \\ e^{I_1+I_2} & I_2^2 & -1 \\ 1 & I_1^2 + I_2^2 & -1 \end{vmatrix}$, is

A. $\sin\theta$

B. $\operatorname{cosec}\theta$

C. 0

D. 1

Answer: C



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81. If $f(x) = \int_1^x \frac{\log t}{1+t} dt$ then $f(x) + f\left(\frac{1}{x}\right)$ is equal to

A. $(\log_e x)^2$

B. $\frac{2}{3} \log_e x$

C. $\frac{1}{2} \log_e x$

D. $\frac{1}{2} (\log_e x)^2$

Answer: D



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82. Let $F(x) = f(x) + f\left(\frac{1}{x}\right)$, where $f(x) = \int_1^x \frac{\log t}{1+t} dt$ Then $F(e)$

equals

A. 1

B. 2

C. 1/2

D. 0

Answer: C



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83. If $\int_0^x \frac{bt\cos 4t - a\sin 4t}{t^2} dt = \frac{a\sin 4x}{x}$ for all $x \neq 0$, then a and b are given by

A. $a = \frac{1}{4}, b = 1$

B. $a = 2, b = 2$

C. $a = -1, b = 4$

D. $a = 2, b = 4$

Answer: A



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84. Let $f: R \rightarrow R$ be given by

$$f(x) = \begin{cases} |x - [x]| & \text{when } [x] \text{ is odd} \\ |x - [x] - 1| & \text{when } [x] \text{ is even} \end{cases} \quad \text{where } [*] \text{ denotes the}$$

greatest integer function, then $\int_{-2}^4 f(x) dx$ is equal to

A. $\frac{5}{2}$

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

C. 5

D. 3

Answer: D



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85. If $f(x) = \sin x + \cos x$ and $g(x) = \begin{cases} \frac{|x|}{x} & ,x \neq 0 \\ 2 & ,x = 0 \end{cases}$ then the value

of $\int_{-\pi/4}^{2\pi} g \circ f(x) dx$ is equal to

A. $3\pi/4$

B. $\pi/4$

C. π

D. none of these

Answer: B



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86. If $x \in \left[(4n + 1)\frac{\pi}{2}, (4n + 3)\frac{\pi}{2} \right]$ and $n \in \mathbb{N}$, then the value of

$\int_0^x [\cos t] dt$, is

A. $(2n - 1)\frac{\pi}{2} - x$

B. $(2n - 1)\frac{\pi}{\pi} / (2) - x$

C. $(2n + 1)\frac{\pi}{2} - x$

D. $(2n + 1)\frac{\pi}{2} + x$

Answer: C



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87. If $f: \mathbb{R} \rightarrow \mathbb{R}$ is continuous and differentiable function such that

$\int_{-1}^x f(t)dt + f''(3)\int_x^1 dt = \int_1^x t^3 dt - f(1)\int_0^x t^2 dt + f(2)\int_x^3 rdt$, then the value of $f'(4)$, is

A. $48 - 8f(1) + f(2)$

B. $48 - 8f(1) - f'(2)$

C. $48 + 8f(1) - f(2)$

D. none of these

Answer: B



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88. Let $I_1 = \int_0^1 \frac{e^x}{1+x} dx$ and $I_2 = \int_0^1 \frac{x^2}{e^{x^3}(2-x^3)} dx$.

Then, $\frac{I_1}{I_2}$ is equal to

A. $\frac{3}{e}$

B. $\frac{e}{3}$

C. $3e$

D. $\frac{1}{3e}$

Answer: C



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89. Let $f(x) = \begin{cases} 1 - |x|, & |x| \leq 1 \\ 0, & |x| > 1 \end{cases}$ and, $g(x) = f(x-1) + f(x+1)$ for all $x \in \mathbb{R}$.

Then, the value of $\int_{-3}^3 g(x) dx$, is

A. 2

B. 3

C. 4

D. 5

Answer: A



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90. If $f(x) = \frac{x-1}{x+1}$ and $f^k(x) = f(f^{k-1}(x))$, $f^2(x) = f(f(x))$, , $f^{k+1}(x) = f(f^k(x))$

, $k=1,2,3,\dots$ and $g(x) = f^{1998}(x)$ then $\int_{1/e}^1 g(x) dx$ is equal to

A. 0

B. 1

C. -1

D. e

Answer: C



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91. If $f: R \in R$ be such that

$$f(x) = \sqrt{\sin(\cos x)} + \ln(-2\cos^2 x + 3\cos x - 1), \quad \text{then}$$

$$\int_{x_1}^{x_2} \left[\cos x - \frac{1}{2} \right] dx \text{ is equal to, where } x_1, x_2 \in D \text{ and } [.] \text{ denotes}$$

the greatest integer function,

A. 0

B. $\frac{1}{2}(x_2 - x_1)$

C. $x_1 - x_2$

D. $\frac{1}{2}(x_1 - x_2)$

Answer: A



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92. If $\int_e^x tf(t)dt = \sin x - x\cos x - \frac{x^2}{2}$ for all $x \in R - \{0\}$, then the value of $f\left(\frac{\pi}{6}\right)$ will be equal to

A. 0

B. 1

C. $-\frac{1}{2}$

D. none of these

Answer: C



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93. If $f(x) = \int_0^x \{f(t)\}^{-1} dt$, and $\int_0^1 \{f(t)\}^{-1} dt = \sqrt{2}$, then $f(x) =$

A. $\sqrt{2x}$

B. $\sqrt{2\log_e x}$

C. $\sqrt{3x - 1}$

D. none of these

Answer: A



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94. If $f(x)$ is differentiable and $\int_0^{t^2} xf(x)dx = \frac{2}{5}t^5$, then $ff\left(\frac{4}{25}\right)$ equals

A. $2/5$

B. $-5/2$

C. 1

D. $5/2$

Answer: A



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95. The value of $\int_{-2}^3 |1 - x^2| dx$ is

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

B. $\frac{14}{3}$

C. $\frac{7}{3}$

D. $(28)/(3)$

Answer: D



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96. $\int_0^\pi x f(\sin x) dx$ is equal to

A. $\pi \int_0^\pi f(\cos x) dx$

B. $\pi \int_0^\pi f(\sin x) dx$

C. $\frac{\pi}{2} \int_0^{\pi/2} f(\sin x) dx$

D. $\pi \int_0^{\pi/2} f(\cos x) dx$

Answer: D



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97. If $f(x) \frac{e^x}{1+e^x}, I_1 = \int_{f(-a)}^{f(a)} x g\{x(1-x)\} dx$ and

$I_2 = \int_{f(-a)}^{f(a)} g\{x(1-x)\} dx$, then the value of $\frac{I_2}{I_1}$ is

A. 1

B. -3

C. -1

D. 2

Answer: D



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98. $\int_{-2}^2 |[x]| dx =$

A. 1

B. 2

C. 3

D. 4

Answer: D



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99. The value

$$\int_{-2}^2 \left\{ p \ln\left(\frac{1+x}{1-x}\right) + q \ln\left(\frac{1-x}{1+x}\right) - 2 + r \right\} dx$$

depends on the value of

A. p

B. q

C. r

D. p and q

Answer: C



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100. $7 \left(\int_0^1 \frac{x^4(1-x)^4 dx}{1+x^2} + \pi \right)$ is equal to

A. $\frac{22}{7} - \pi$

B. $\frac{2}{105}$

C. 0

D. $\frac{71}{15} - \frac{3\pi}{2}$

Answer: A



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101. The value of $\lim_{x \rightarrow 0} \frac{1}{x^3} \int_0^x \frac{t \ln(1+t)}{t^4+4} dt$ is

A. 0

B. $1/12$

C. $1/24$

D. $1/24$

Answer: B



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102. Let f be the function defined on $[-\pi, \pi]$ given by $f(0) = 9$

and $f(x) = \frac{\sin\left(\frac{9x}{2}\right)}{\sin\left(\frac{x}{2}\right)}$ for $x \neq 0$. The value of $\frac{2}{\pi} \int_{-\pi}^{\pi} f(x) dx$ is (asked

as Match the following question)

A. 0

B. 2

C. 4

D. 6

Answer: C



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103. Let f be a real-valued function defined on the interval $(-1, 1)$ such that $e^{-x}f(x)^2 + \int_0^x \sqrt{t^4 + 1} dt$ for all $x \in (-1, 1)$ and let f^{-1} be the inverse function of f . Then, $(f^{-1})'(2)$ is equal to

A. 1

B. $1/3$

C. $1/2$

D. $1/e$

Answer: B



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104. For any real number x , let $[x]$ denote the largest integer less than or equal to x . Let f be a real valued, function defined on the interval $[-10,10]$ by

$$f(x) = \begin{cases} x - [x], & \text{if } [x] \text{ is odd} \\ 1 + [x] - x, & \text{if } [x] \text{ is even} \end{cases}$$

Then the value of $\frac{\pi^2}{10} \int_{-10}^{10} f(x) \cos \pi x dx$, is

A. 3

B. 4

C. 6

D. 9

Answer: B



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105. Let f be a real-valued function defined on the interval $(0, \infty)$ by $f(x) = \ln x + \int_0^x \sqrt{1 + \sin t} dt$. Then which of the following statement(s) is(are) true?

A. $f''(x)$ exists for all $x \in (0, \infty)$

B. $f'(x)$ exists for all $x \in (0, \infty)$ and $f'(x)$ is continuous on $(0, \infty)$ but not differentiable on $(0, \infty)$

C. there exists $\alpha > 1$ such that $|f'(x)| < f(x)$ for all $x \in (\alpha, \infty)$

D. there exists $\beta > 0$ such that $|f'(x)| + f(x) \leq \beta$ for all $x \in (0, \infty)$

Answer: C



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106. Let $p(x)$ be a function defined on \mathbb{R} such that $p'(x)=p'$ for all $x \in [0, 1]$, $p(0) = 1$ and $p(1)=41$. Then, $\int_0^1 p(x)dx$ equals

A. 41

B. 42

C. $\sqrt{41}$

D. 21

Answer: D



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107. If $\int_a^b \{f(x) - 3x\} dx = a^2 - b^2$, then the value of $f\left(\frac{\pi}{6}\right)$, is

A. $\frac{\pi}{6}$

B. $\frac{2\pi}{3}$

C. $\frac{\pi}{2}$

D. $\frac{\pi}{2}$

Answer: A



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108. The value of $\frac{\pi^2}{\ln 3} \int_{7/6}^{5/6} \sec(\pi x) dx$ is

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

B. $\frac{\pi}{2}$

C. π

D. $\frac{4\pi}{3}$

Answer: C



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109. The value of the integral

$$\int_{-\pi/2}^{\pi/2} \left\{ x^2 + \log \left(\frac{\pi + x}{\pi - x} \right) \right\} \cos x dx \text{ is}$$

A. 0

B. $\frac{\pi^2}{2} - 4$

C. $\frac{\pi^2}{2} - 6$

D. $\frac{\pi^2}{2}$

Answer: B



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110. Let $f: (0, 1) \rightarrow (0, 1)$ be a differentiable function such that

$f(x) \neq 0$ for all $x \in (0, 1)$ and $f\left(\frac{1}{2}\right) = \frac{\sqrt{3}}{2}$. Suppose for all x ,

$$\lim_{x \rightarrow x} \frac{\int_0^1 \sqrt{1+(f(s))^2} dx \int_0^x \sqrt{1+(f(s))^2} ds}{f(x) - f(x)} = f(x)$$

Then, the value of $f\left(\frac{1}{4}\right)$ belongs to

A. $\{(\sqrt{7}, \sqrt{15})\}$

B. $\left\{\frac{\sqrt{7}}{2}, \frac{\sqrt{15}}{2}\right\}$

C. $\left\{\frac{\sqrt{7}}{3}, \frac{\sqrt{15}}{3}\right\}$

D. $\left\{\frac{\sqrt{7}}{4}, \frac{\sqrt{15}}{4}\right\}$

Answer: D



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111. The value of the integral $\int_0^2 \frac{\log(x^2 + 2)}{(x + 2)^2} dx$ is

A. $\frac{\sqrt{2}}{3} \tan^{-1} \sqrt{2} + \frac{5}{12} \log 2 - \frac{1}{4} \log 3$

B. $\frac{\sqrt{2}}{3} \tan^{-1} \sqrt{2} - \frac{5}{12} \log 2 - \frac{1}{12} \log 3$

C. $\frac{\sqrt{2}}{3} \tan^{-1} \sqrt{2} + \frac{5}{12} \log 2 + \frac{1}{4} \log 3$

D. $\frac{\sqrt{2}}{3} \tan^{-1} \sqrt{2} - \frac{5}{12} \log 2 + \frac{1}{12} \log 3$

Answer: D



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112. The integral $\int_{\pi/4}^{\pi/2} (2\operatorname{cosec}x)^{17} dx$ is equal to

A. $\int_0^{\log(1+\sqrt{2})} 2(e^u + e^{-u})^{16} du$

B. $\int_0^{\log(1+\sqrt{2})} (e^u + e^{-u})^{17} du$

C. $\int_0^{\log(1+\sqrt{2})} (e^u - e^{-u})^{17} du$

D. $\int_0^{\log(1+\sqrt{2})} 2(e^u - e^{-u})^{16} du$

Answer: A



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113. Let $f: [0, 2] \rightarrow \mathbb{R}$ be a function which is continuous on $[0, 2]$ and is differentiable on $(0, 2)$ with $f(0)=1$. Let $F(x) = \int_0^{x^2} f(\sqrt{t}) dt$ for $x \in [0, 2]$. If $F'(x)=f'(x)$ for all x in $(0, 2)$, then $F(2)$ equals

A. $e^2 - 1$

B. $e^4 - 1$

C. $e - 1$

D. e^4

Answer: B



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114. Given that for each $a \in (0, 1)$ $\lim_{h \rightarrow 0^+} \int_h^{1-h} t^{-a}(1-t)^{a-1} dt$

exists. If this limit be $g(a)$, then the value $g\left(\frac{1}{2}\right)$, is

A. π

B. 2π

C. $\frac{\pi}{2}$

D. $\frac{\pi}{4}$

Answer: A

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115. Given that for each $a \in (0, 1)$ $\lim_{x \rightarrow 0} \int_h^{-h} t^{-a}(1-t)^{a-1} dt$ exists and is equal to $g(a)$. If $g(a)$ is differentiable in $(0, 1)$, then the value of $g'(\frac{1}{2})$, is

A. $\pi/2$

B. π

C. $-\pi/2$

D. 0

Answer: D



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116. The options (s) with the values of a and L that satisfy the following equation is (are)

$$\frac{\int_0^{4\pi} e^t (\sin^6 at + \cos^4 at) dt}{\int_0^{\pi} e^t (\sin^6 at + \cos^4 at) dt} = L?$$

A. $a = 2, L = \frac{e^{4\pi} - 1}{e^{\pi} - 1}$

B. $a = 2, L = \frac{e^{4\pi} + 1}{e^{\pi} + 1}$

C. $a = 4, L = \frac{e^{4\pi} - 1}{e^{\pi} - 1}$

D. $a = 4, L = \frac{e^{4\pi} + 1}{e^{\pi} + 1}$

Answer: A::C



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117. Let $f: R \rightarrow R$ be a continuous odd function, which vanishes exactly at one point and $f(1) = \frac{1}{2}$. Suppose that $F(x) = \int_{-1}^x f(t) dt$ for all $x \in [-1, 2]$ and $G(x) = \int_{-1}^x t|f(f(t))| dt$ for all $x \in [-1, 2]$. If

$$\lim_{x \rightarrow x} \frac{F(x)}{G(x)} = \frac{1}{14}, \text{ then the value of } f\left(\frac{1}{2}\right), \text{ is}$$

A. 7

B. 8

C. 9

D. 6

Answer: A



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118. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a thrice differentiable function. Suppose that $F(1)=0, F(3)=-4$ and $F'(x) < 0$ for all x in $(1/2, 3)$. Let $f(x) = xF(x)$ for all x in \mathbb{R} . If $\int_1^3 x^2 F'(x) dx = -12$ and $\int_1^3 F''(x) dx = 40$, then which of the following is (are) correct?

A. $9f(3) + f(1) - 32 = 0$

B. $\int_1^3 f(x) dx = 12$

C. $9f(3) - f(1) + 32 = 0$

D. $\int_1^3 f(x) dx = -12$

Answer: C::D



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119. Let $f: (0, \infty) \rightarrow \mathbb{R}$ be continuous function such that

$$F(x) = \int_0^x t f(t) dt. \text{ If } F(x^2) = x^4 + x^5, \text{ then } \sum_{r=1}^{12} f(r^2) \text{ is equal to}$$

A. 216

B. 219

C. 222

D. 225

Answer: B



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120. If $f: [0, 1] \rightarrow [0, \infty)$ is differentiable function with decreasing first derivative such that $f(0)=0$ and $f'(x) > 0$, then

$$\text{A. } \int_0^1 \frac{1}{f^2(x) + 1} dx > \frac{f(1)}{f'(1)}$$

$$\text{B. } \int_0^1 \frac{1}{f^2(x) + 1} dx < \frac{f(1)}{f'(1)}$$

$$\text{C. } \int_0^1 \frac{1}{f^2(x) + 1} dx < \frac{\tan^{-1}(f(1))}{f'(1)}$$

$$\text{D. } \int_0^1 \frac{1}{f^2(x) + 1} dx = \frac{f(1)}{f'(1)}$$

Answer: C



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121. If $f(x)$ is differentiable function and $f(x) = x^2 + \int_0^x e^{-t}(x-t)dt$

, then $f'(x)$ equals to

$$\text{A. } \frac{-2}{3}$$

$$\text{B. } \frac{2}{3}$$

$$\text{C. } \frac{1}{3}$$

D. $-\frac{1}{3}$

Answer: B



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122. If $f(x)$ is a continuous function such that $f(x) > 0$ for all $x > 0$ and $(f(x))^{2020} = 1 + \int_0^x f(t)dt$, then the value of $\{f(2020)\}^{2019}$ is equal to

A. 2019

B. 2020

C. 2021

D. 2018

Answer: B



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123. If a function $y=f(x)$ such that $f'(x)$ is continuous function and satisfies

$$(f(x))^2 = k + \int_0^x [\{f(t)\}^2 + \{f'(t)\}^2] dt, k \in R^+, \text{ then}$$

- A. $f(x)$ is an increasing function for all $x \in R$
- B. $f(x)$ is a bounded function
- C. $f(x)$ is neither even nor odd function
- D. If $k=100$, then $f(0)=10$.

Answer: A::C



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124. The maximum value of $f(x) = \int_0^1 t \sin(x + \pi t) dt$ is

A. $\frac{1}{\pi} \sqrt{\pi^2 + 4}$

B. $\frac{1}{\pi^2} \sqrt{\pi^2 + 4}$

C. $\sqrt{\pi^2 + 4}$

D. $\frac{1}{2\pi^2} \sqrt{\pi^2 + 4}$

Answer: B



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125. If $I_n = \int_0^\pi e^x \sin^n x \, dx$ then $\frac{I_3}{I_1}$ is equal to

A. $\frac{3}{5}$

B. $\frac{1}{5}$

C. 1

D. $\frac{2}{5}$

Answer: A



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126. If $k = \int_0^1 \frac{e^t}{1+t} dt$, then $\int_0^1 e^t \log_e(1+t) dt$ is equal to

A. k

B. 2k

C. $e \ln 2 - k$

D. none of these

Answer: C



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127. If $k \in N$ and $I_k = \int_{-2k\pi}^{2k\pi} |\sin x| [\sin x] dx$, where $[.]$ denotes the greatest integer function, then $\sum_{k=1}^{100} I_k$ equal to

- A. -10100
- B. -40400
- C. -20200
- D. none of these

Answer: C



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128. The value of

$$\int_{-1}^1 \frac{\left(\log x + \sqrt{1+x^2}\right)}{x + \log\left(x + \sqrt{1+x^2}\right)} f(x) dx - \int_{-1}^1 \frac{\log\left(x\sqrt{1+x^2}\right)}{x + \log\left(x + \log\sqrt{1+x^2}\right)} f(-x) dx$$

,

A. 0

B. $2 \int_0^1 \frac{\log\left(x + \sqrt{1+x^2}\right)}{x + \log\left(x + \sqrt{1+x^2}\right)} \{f(x) - f(-x)\} dx$

C. $2f(x)$

D. none of these

Answer: A



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129. If $\int_0^1 \alpha e^{\beta x^2} \sin(x+k) dx = 0$ for some $\alpha, \beta \in R, \alpha \neq 0$, then the value of k can belong to the interval

A. $\left[\frac{\pi}{3}, \frac{5\pi}{12} \right]$

B. $\left[\frac{\pi}{3}, \frac{\pi}{2} \right]$

C. $\left[\frac{3\pi}{4}, \frac{5\pi}{6} \right]$

D. $\left[-\frac{\pi}{2}, -\frac{\pi}{3} \right]$

Answer: C



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130. $\int_0^{[x]/3} \frac{8^x}{2^{[3x]}} dx$ where $[.]$ denotes the greatest integer function, is equal to

A. $\frac{[x]}{\ln 2}$

B. $\frac{[x]}{\ln 2}$

C. $\frac{2[x]}{\ln 2}$

D. $\frac{[x]}{\ln 8}$

Answer: D



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131. Let $f(x) = \ln \left[\cos|x| + \frac{1}{2} \right]$ where $[.]$ denotes the greatest

integer function, then $\int_{x_1}^{x_2} \lim_{n \rightarrow \infty} \left(\frac{\{f(x)\}^n}{x^2 + \tan^2 x} \right) dx$ is equal to,

where $x_1, x_2 \in \left[\frac{-\pi}{6}, \frac{\pi}{6} \right]$

A. 1

B. 2

C. -1

D. 0

Answer: D



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132. $\lim_{x \rightarrow 0} \left(\frac{\int_0^x x e^{t^2} dt}{1 + x - e^x} \right)$ is equal to

A. 1

B. -1

C. 2

D. -2

Answer: D



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133. If $\int_{2x^2}^{x^3} (\ln x) f(t) dt = x^2 - 2x + 5$, then $f(8) =$

A. $\frac{1}{\ln 2}$

B. $\frac{1}{2\ln 2}$

C. $\frac{1}{3\ln 2}$

D. $\frac{1}{4\ln 2}$

Answer: B



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134. $\lim_{x \rightarrow 0} \frac{\int_{-x}^x f(t) dt}{\int_0^{2x} f(t+4) dt}$ is equal to

A. $f(0)$

B. 0

C. $\frac{f(4)}{f(0)}$

D. $\frac{f(0)}{f(4)}$

Answer: D



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135. If $f(x+f(y))=f(x)+y$ for all $x, y \in \mathbb{R}$ and $f(0)=1$, then

$\int_0^{10} f(10-x) dx$ is equal to

A. 1

B. 10

C. $\int_0^1 f(x) dx$

D. $10 \int_0^1 f(x) dx$

Answer: D



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136. If $\alpha, \beta (\beta > \alpha)$ are the roots of $f(x) = -ax^2 + bx + c = 0$ and $f(x)$ is an even function, then

$$\int_{\alpha}^{\beta} \frac{e^{f\left(\frac{f(x)}{x-\alpha}\right)}}{e^{f\left(\frac{f(x)}{x-a}\right)} + e^{f\left(\frac{f(x)}{x-b}\right)}} dx \text{ is equal to}$$

A. $\left| \frac{b}{a} \right|$

B. $\left| \frac{b}{2a} \right|$

$$\sqrt{b^2 - 4ac}$$

C. $\frac{\quad}{|2a|}$

D. none of these

Answer: C



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137. The value of the constant $a > 0$ such that

$$\int_0^a [\tan^{-1} \sqrt{x}] dx = \int_0^a [\cot^{-1} \sqrt{x}] dx, \text{ where } [.] \text{ denotes the greatest}$$

integer function, is

A. $\frac{2(3 + \cos 4)}{1 - \cos 4}$

B. $\frac{2(3 - \cos 4)}{1 + \cos 4}$

C. $\frac{2(3 - \cos 4)}{1 - \cos 4}$

D. $\frac{2(3 + \cos 4)}{1 + \cos 4}$

Answer: A



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138. If $f(x)$ is a continuous function in $[0, \pi]$ such that $f(0)=f(\pi)=0$, then the value of

$\int_0^{\pi/2} \{f(2x) - f'(2x)\} \sin x \cos x dx$ is equal to

A. π

B. 2π

C. 3π

D. 0

Answer: D



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139. Let $f: R \rightarrow R$ be continuous function such that $f(x)=f(2x)$ for all $x \in R$. If $f(t)=3$, then the value of $\int_{-1}^1 f(f(x))dx$, is

A. $3f(0)$

B. 0

C. $3f(3)$

D. 6

Answer: D



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140. The value of

$$\int_0^{\pi/4} (\tan^n x + \tan^{n-2} x) d\left(x - \frac{[x]}{1!} + \frac{[x]^2}{2!} - \frac{[x]^3}{3!} + \dots\right)$$

where $[x]$ is greatest function, is

A. $\frac{1}{n}$

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

C. $\frac{1}{n-1}$

D. $\frac{1}{n-2}$

Answer: C



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141. The value of the definite integral

$$\int_{t+2\pi}^{t+5\pi/2} \left\{ \sin^{-1}(\cos x) + \cos^{-1}(\cos x) \right\} dx \text{ is equal to}$$

A. $\frac{\pi^2}{2}$

B. $\frac{\pi^2}{8}$

C. $\frac{\pi^2}{4}$

D. none of these

Answer: C



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142. If $f(x)$ is an integrable function on $\left[\frac{\pi}{6}, \frac{\pi}{3}\right]$ and

$$I_1 = \int_{\pi/6}^{\pi/3} \sec^2 \theta f(2\sin 2\theta) d\theta \quad \text{and} \quad I_2 = \int_{\pi/6}^{\pi/3} \operatorname{cosec}^2 \theta f(2\sin 2\theta) d\theta, \text{ then}$$

A. $I_1 = 2I_2$

B. $I_1 = 3I_2$

C. $2I_1 = I_2$

D. none of these

Answer: D



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143. Let

$$f(x) = \lim_{n \rightarrow \infty} \left\{ \frac{n^n (x+n) \left(x + \frac{n}{2}\right) \dots \left(x + \frac{n}{2}\right)}{n! \left(x^2 + n^2\right) \left(x^2 + \frac{n^2}{4}\right) \dots \left(x^2 + \frac{n^2}{n^2}\right)} \right\}^{x/n} \quad \text{for all}$$

$x > 0$. Then,

A. $f\left(\frac{1}{2}\right) \geq f(1)$

B. $f\left(\frac{1}{3}\right) \leq f\left(\frac{2}{3}\right)$

C. $f'(2) \leq 0$

D. $\frac{f'(3)}{f(3)} \geq \frac{f'(2)}{f(2)}$

Answer: B::C



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144. The total number of distinct $x \in [0, 1]$ for which

$$\int_0^x \frac{t^2}{1+t^4} dt = 2x - 1, \text{ is}$$

A. 1

B. 2

C. 3

D. infinitely many

Answer: A



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145. For $x \in R, x \neq 0$, if $y(x)$ is differentiable function such that $\xi nt_1^x y(t)dt = (x + 1) \int_1^x ty(t)dt$, then $y(x)$ equals (where C is a constant).

A. $Cx^3 e^{1/x}$

B. $\frac{C}{x^2} e^{-1/x}$

C. $\frac{C}{x^2} e^{-1/x}$

D. $\frac{C}{x^3} e^{-1/x}$

Answer: D



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Section II - Assertion Reason Type

1. Statement-1: $\int_0^{\pi/2} x \cot x dx = \frac{\pi}{2} \log 2$

Statement-2: $\int_0^{\pi/2} \log \sin x dx = -\frac{\pi}{2} \log 2$

- A. Statement-1 is true, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.
- B. Statement-1 is True, Statement-2 is not a correct explanation for Statement-1.
- C. Statement-1 is True, Statement-2 is False.
- D. Statement-1 is False, Statement-2 is True.

Answer: A



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2. Statement-1: $\int_0^{n\pi+v} |\sin x| dx = 2n + 1 - \cos v$ where $n \in N$ and $0 \leq v < \pi$.

Statement-2: If $f(x)$ is a periodic function with period T , then

(i) $\int_0^{nT} f(x) dx = n \int_0^T f(x) dx$, where $n \in N$

and (ii) $\int_{nT}^{nT+a} f(x) dx = \int_0^a f(x) dx$, where $n \in N$

A. Statement-1 is true, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is True, Statement-2 is not a correct explanation for Statement-1.

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: A



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3. Let $I_n = \int_0^{\pi/4} \tan^n x dx$.

Statement-1: $\frac{1}{n+1} < 2I_n < \frac{1}{n-1}$ for all $n=2,3,4,\dots$

Statement-2: $I_n + I_{n-2} = \frac{1}{n-1}, n=3,4,5,\dots$

- A. Statement-1 is true, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.
- B. Statement-1 is True, Statement-2 is not a correct explanation for Statement-1.
- C. Statement-1 is True, Statement-2 is False.
- D. Statement-1 is False, Statement-2 is True.

Answer: A



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4. Statement-1: If $f(x) = \int_1^x \frac{\log_e t}{1+t+t^2} dt$, then

$$f(x) = f\left(\frac{1}{x}\right) \text{ for all } x > 0.$$

Statement-2: If $f(x) = \int_1^x \frac{\log_e t}{1+t} dt$, then $f(x) + f\left(\frac{1}{x}\right) = \frac{(\log_e x)^2}{2}$

- A. Statement-1 is true, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.
- B. Statement-1 is True, Statement-2 is not a correct explanation for Statement-1.
- C. Statement-1 is True, Statement-2 is False.
- D. Statement-1 is False, Statement-2 is True.

Answer: B



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5. Let $n \in \mathbb{N}$ such that $n > 1$.

$$\text{Statement-1: } \int_0^{\infty} \frac{1}{1+x^n} dx = \int_0^1 \frac{1}{(1-x^n)^{1/n}} dx$$

$$\text{Statement-2: } \int_a^b f(x) dx = \int_a^b f(a+b-x) dx$$

- A. Statement-1 is true, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.
- B. Statement-1 is True, Statement-2 is not a correct explanation for Statement-1.
- C. Statement-1 is True, Statement-2 is False.
- D. Statement-1 is False, Statement-2 is True.

Answer: B



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6. Statement-1: For any $n \in \mathbb{N}$, we have

$$\int_0^{n\pi} \left| \frac{\sin x}{x} \right| dx \geq \frac{2}{\pi} \left(1 + \frac{1}{2} + \frac{1}{3} + \dots + \frac{1}{n} \right)$$

Statement-2: $\frac{\sin x}{x} \geq \frac{2}{\pi}$ on $\left(0, \frac{\pi}{2} \right)$

- A. Statement-1 is true, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.
- B. Statement-1 is True, Statement-2 is not a correct explanation for Statement-1.
- C. Statement-1 is True, Statement-2 is False.
- D. Statement-1 is False, Statement-2 is True.

Answer: B



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7. Statement-1: $\int_0^1 \frac{\cos x}{1+x^2} dx > \frac{\pi}{4} \cos 1$

Statement-2: If $f(x)$ and $g(x)$ are continuous on $[a,b]$, then

$$\int_a^b f(x)g(x)dx = f(c)\int_a^b g(x) \text{ for some } c \in (a, b).$$

- A. Statement-1 is true, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.
- B. Statement-1 is True, Statement-2 is not a correct explanation for Statement-1.
- C. Statement-1 is True, Statement-2 is False.
- D. Statement-1 is False, Statement-2 is True.

Answer: A



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8. Statement-1:

$$\int_0^{\sin^2 x} \sin^{-1} \sqrt{t} dt + \int_0^{\cos^2 x} \cos^{-1} \sqrt{t} dt = \frac{\pi}{4} \text{ for all } x.$$

Statement-2: $\frac{d}{dx} \int_{\theta(x)}^{\psi(x)} f(t) dt = \psi'(x)f(\psi(x)) - \theta'(x)f(\theta(x))$

- A. Statement-1 is true, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.
- B. Statement-1 is True, Statement-2 is not a correct explanation for Statement-1.
- C. Statement-1 is True, Statement-2 is False.
- D. Statement-1 is False, Statement-2 is True.

Answer: C



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9. Statement-1: $\int_0^{\pi/2} \frac{1}{1 + \tan^3 x} dx = \frac{\pi}{4}$

Statement-2: $\int_0^a f(x) dx = \int_0^a f(a + x) dx$

- A. Statement-1 is true, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.
- B. Statement-1 is True, Statement-2 is not a correct explanation for Statement-1.
- C. Statement-1 is True, Statement-2 is False.
- D. Statement-1 is False, Statement-2 is True.

Answer: C



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10. Let $F(x) = \int_a^{x^2} \cos\sqrt{t} dt$

Statement-1: $F'(x) = \cos x$

Statement-2: If $f(x) = \int_a^x \phi(t) dt$, then $f'(x) = \phi(x)$.

- A. Statement-1 is true, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.
- B. Statement-1 is True, Statement-2 is not a correct explanation for Statement-1.
- C. Statement-1 is True, Statement-2 is False.
- D. Statement-1 is False, Statement-2 is True.

Answer: D



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11. $I_n = \int_0^{\pi/4} \tan^n x dx$, where $n \in \mathbb{N}$

Statement-1: $\int_0^{\pi/4} \tan^4 x dx = \frac{3\pi - 8}{12}$

Statement-2: $I_n + I_{n-2} = \frac{1}{n-1}$

- A. Statement-1 is true, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.
- B. Statement-1 is True, Statement-2 is not a correct explanation for Statement-1.
- C. Statement-1 is True, Statement-2 is False.
- D. Statement-1 is False, Statement-2 is True.

Answer: A



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12. Statement-1: The value of the integral

$$\int_{\pi/6}^{\pi/3} \frac{1}{\sqrt{\tan x}} dx \text{ is equal to } \frac{\pi}{6}$$

$$\text{Statement-2: } \int_a^b f(x) dx = \int_a^b f(a + b - x) dx$$

- A. Statement-1 is true, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.
- B. Statement-1 is True, Statement-2 is not a correct explanation for Statement-1.
- C. Statement-1 is True, Statement-2 is False.
- D. Statement-1 is False, Statement-2 is True.

Answer: D



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1. If $I = \int_{-2}^2 dx$, then I equals

A. 6

B. 8

C. 12

D. 21

Answer: C



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2. The value of the integral $\int_{\alpha}^{\beta} \frac{1}{\sqrt{(x - \alpha)(\beta - x)}} dx$ for $\beta > \alpha$, is

A. $\sin^{-1}(\alpha/\beta)$

B. $\pi/2$

C. $\sin^{-1}(\beta/2\alpha)$

D. π

Answer: D



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3. $\int_{1^{\sqrt[4]{3}}}^{-1} \frac{x+2}{\sqrt{x^2+2x-3}} dx$ equal to

A. $\frac{2\sqrt{3}}{3} - \frac{1}{2}\log 3$

B. $\frac{2\sqrt{3}}{3} + \frac{1}{2}\log 3$

C. $\frac{2\sqrt{3}}{3} - \frac{1}{2}\log(\sqrt{3}+2)$

D. $\frac{2\sqrt{3}}{3} + \frac{1}{2}\log(\sqrt{3}+2)$

Answer: B



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4. $\int_0^{\pi^2/4} \sin\sqrt{x} dx$ equals to

A. 0

B. 1

C. 2

D. 4

Answer: C



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5. $\int_{1/2}^2 |\log_{10} x| dx$ equals to

A. $\log_{10}(8/e)$

B. $\frac{1}{2} \log_{10}(8/e)$

C. $\log_{10}(2/e)$

D. none of these

Answer: B



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6. The value of the integral $\int_{-\pi/2}^{\pi/2} \log \left(\frac{a - \sin \theta}{a + \sin \theta} \right) d\theta$, $a > 0$ is

A. 0

B. 1

C. 2

D. none of these

Answer: A



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7. The value of the integral $\int_{\pi/3}^{\pi/2} \frac{x \sin x}{\cos^2 x} dx$, is

A. $(\pi/3 - \log \tan 3\pi/2)$

B. $2(2\pi/3 - \log \tan 5\pi/12)$

C. $3(\pi/2 - \log \sin \pi/12)$

D. none of these

Answer: B



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8. The value of $\int_1^{7\sqrt{2}} \frac{1}{x(2x^7 + 1)} dx$ is

A. $\log(6/5)$

B. $6\log(6/5)$

C. $(1/7)\log(6/5)$

D. $(1/12)\log(6/5)$

Answer: C



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9. The value of $\int_{-1}^3 (|X_2| + [x]) dx$ is ($[x]$ stands for greatest integer less than or equal to x)

A. 7

B. 5

C. 4

D. 3

Answer: A



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10. If $f(x) = \begin{vmatrix} \sin x + \sin 2x + \sin 3x & x \sin 2 & x \sin 3x \\ 3 + 4 \sin x & 3 & 4 \sin x \\ 1 + \sin x & \sin x & 1 \end{vmatrix}$ then the value

of $\int_0^{\pi/2} f(x) dx$, is

A. 3

B. 2/3

C. 1/3

D. 0

Answer: C



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11. Evaluate: $(\lim)_{x \rightarrow \infty} \frac{\left(\int_0^x e^{x^2} dx\right)^2}{\int_0^x e^{2x^2} dx}$

A. 1

B. 2

C. 3

D. 0

Answer: D



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12. The value of $\int_1^4 e^{\sqrt{x}} dx$, is

A. e^2

B. $2e^2$

C. $4e^2$

D. $3e^2$

Answer: B



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13. The value of $\int_0^{1000} e^{x - [x]} dx$, is

A. $\frac{e^{1000} - 1}{1000}$

B. $\frac{e^{1000} - 1}{e - 1}$

C. $1000(e-1)$

D. $\frac{e - 1}{1000}$

Answer: C



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14. The value of the integral $\int_0^{100} \sin(x - [x])\pi dx$, is

A. $100/\pi$

B. $200/\pi$

C. 100π

D. 200π

Answer: B



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15. The difference between the greatest and least values of the function $\phi(x) = \int_0^x (t + 1) dt$ on $[2,3]$, is\

- A. 3
- B. 2
- C. $7/2$
- D. $11/2$

Answer: C



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16. The value of $\int_0^1 \frac{2^{2x+1} - 5^{2x-1}}{10^x} dx$ is

$$\text{A. } \frac{3}{5} \left\{ \frac{2}{\log_e \left(\frac{2}{5} \right)} + \frac{1}{2 \log_e \left(\frac{5}{2} \right)} \right\}$$

$$\text{B. } -\frac{3}{5} \left\{ \frac{2}{\log_e \left(\frac{2}{5} \right)} + \frac{1}{2 \log_e \left(\frac{5}{2} \right)} \right\}$$

$$\text{C. } \frac{3}{5} \left\{ \frac{2}{\log_e \left(\frac{2}{5} \right)} - \frac{1}{2 \log_e \left(\frac{5}{2} \right)} \right\}$$

D. none of these

Answer: B



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17. The value of $\int_0^{\pi/2} \frac{\cos 3x + 1}{2 \cos x - 1} dx$ is

A. 2

B. 1

C. 1/2

D. 0

Answer: B



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18. The value of $\int_0^{16\pi/3} |\sin x| dx$ is

A. 21

B. 21/2

C. 10

D. 11

Answer: B



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19. If $\int_0^{n\pi} f(\cos^2 x) dx = k \int_0^\pi f(\cos^2 x) dx$, then the value of k , is

A. 1

B. n

C. $n/2$

D. none of these

Answer: B



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20. The value of $\int_{-\pi}^{\pi} \sin x f(\cos x) dx$ is

A. π

B. 2π

C. $2f(1)$

D. none of these

Answer: D



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21. If $a < \int_0^{2\pi} \frac{1}{10 + 3\cos x} dx < b$. Then the ordered pair (a, b) is

A. $\left(\frac{2\pi}{7}, \frac{2\pi}{3}\right)$

B. $\left(\frac{2\pi}{13}, \frac{2\pi}{7}\right)$

C. $\left(\frac{\pi}{10}, \frac{2\pi}{13}\right)$

D. none of these

Answer: B



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22. The value of the integral $\int_0^{\infty} \frac{x \log x}{(1+x^2)} dx$ is

A. 1

B. 0

C. 2

D. none of these

Answer: B



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23. The value of the integral $\int_{-\pi/2}^{\pi/2} \sqrt{\cos - \cos^2 x} dx$ is

A. 0

B. 2/3

C. 4/3

D. none of these

Answer: C



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24. The value of the integral $\int_{-\pi/2}^{\pi/2} \sqrt{\frac{1 + \cos^2 x}{2}} dx$ is

A. -2

B. 2

C. 0

D. -3

Answer: B



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25. Let $I_1 = \int_1^2 \frac{1}{\sqrt{1+x^2}} dx$ and $I_2 = \int_1^2 \frac{1}{x} dx$. Then

A. $I_1 > I_2$

B. $I_2 > I_1$

C. $I_1 = I_2$

D. $I_2 > 2I_1$

Answer: B



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26. $\int_0^{\pi/4} \frac{\sin x + \cos x}{3 + \sin 2x} dx$ is equal to

A. $-\frac{1}{4} \log 3$

B. $\frac{1}{4} \log 3$

C. $-\frac{1}{3} \log 4$

D. none of these

Answer: B



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27. The value of the integral $\int_0^{\pi/4} \frac{\sin\theta + \cos\theta}{9 + 16\sin 2\theta} d\theta$, is

A. $\log 3$

B. $\log 2$

C. $\frac{1}{20} \log 3$

D. $\frac{1}{20} \log 2$

Answer: C



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28. Let $\frac{d}{dx}(f(x)) = \frac{e^{\sin x}}{x}$, $x > 0$. If $\int_1^4 \frac{3}{x} e^{\sin x^3} dx = F(k) - f(1)$, then one of the possible values of k , is

A. 64

B. 15

C. 16

D. 63

Answer: A



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29. If $I = \int_{-1}^1 \left\{ [x^2] + \log \left(\frac{2+x}{2-x} \right) \right\} dx$ where $[x]$ denotes the greatest integer less than or equal to x , the I equals

A. -2

B. -1

C. 0

D. 1

Answer: C



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30. The value of $\int_{-\pi/2}^{\pi/2} (x^2 + x \cos x + \tan^5 x + 1) dx$ is equal to

A. 0

B. 2

C. π

D. none of these

Answer: D



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31. If $\int_{-1}^4 f(x) = 4$ and $\int_2^7 (3 - f(x)) dx = 7$, then the value of $\int_2^{-1} f(x) dx$, is

A. 2

B. -3

C. -5

D. none of these

Answer: C



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32. The value of $I = \int_0^{\pi/2} \frac{1}{1 + \cos x} dx$ is

A. $\frac{\pi}{4}$

B. $\frac{\pi}{2}$

C. 1

D. π

Answer: C



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33. $\int_0^{\pi/2} \frac{\sin^2 x}{\sin x + \cos x} dx$ is equal to

A. $\frac{\pi}{2}$

B. $\sqrt{2} \log(\sqrt{2} + 1)$

C. $\frac{1}{\sqrt{2}} \log(\sqrt{2} + 1)$

D. none of these

Answer: C



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34. The value of the integral $\int_a^b \frac{|x|}{x} dx$, $a < b$ is

A. $|a|-|b|$

B. $|b|-|a|$

C. $|a|-|b|$

D. $|b|-|a|$

Answer: B



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35. The value of the integral

$$\int_0^{2\pi} \frac{\sin 2\theta}{a - b \cos \theta} d\theta \text{ when } a > b > 0, \text{ is}$$

A. 1

B. π

C. $\pi/2$

D. 0

Answer: D



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36. The value of the integral $\int_0^1 x(1-x)^n dx$, is

A. $\frac{1}{n+1} + \frac{1}{n+2}$

$$\text{B. } \frac{1}{(n+1)(n+2)}$$

$$\text{C. } \frac{1}{n+2} - \frac{1}{n+1}$$

$$\text{D. } 2 \left(\frac{1}{n+1} - \frac{1}{n+2} \right)$$

Answer: B



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37. The value of the integral

$$\int_0^{3\alpha} \operatorname{cosec}(x - \alpha) \operatorname{cosec}(x - 2\alpha) dx \text{ is}$$

$$\text{A. } 2 \operatorname{sec} \alpha \log \left(\frac{1}{2} \operatorname{cosec} \alpha \right)$$

$$\text{B. } 2 \operatorname{sec} \alpha \log \left(\frac{1}{2} \sec \alpha \right)$$

$$\text{C. } 2 \operatorname{cosec} \alpha \log(\sec \alpha)$$

$$\text{D. } 2 \operatorname{cosec} \alpha \log \left(\frac{1}{2} \sec \alpha \right)$$

Answer: D



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38. The value of the integral $\int_0^{\pi} \frac{\sin kx}{\sin x} dx$ (k is an even integer) is equal to

A. π

B. $\frac{\pi}{2}$

C. $\frac{k\pi}{2}$

D. 0

Answer: D



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39. The value of the integral $\int_0^1 \frac{1}{x^2 + 2x\cos\alpha + 1} dx$ is equal to

A. $\sin\alpha$

B. $\alpha\sin\alpha$

C. $\frac{\alpha}{2\sin\alpha}$

D. $\frac{\alpha}{2}\sin\alpha$

Answer: C



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40. The greater value of $F(x) = \int_1^x |t| dt$ on the interval $[-1/2, 1/2]$, is

A. $\frac{3}{8}$

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

C. $-\frac{3}{8}$

D. $-\frac{1}{2}$

Answer: C



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41. The value of the integral $\int_0^{\pi/2} |\sin x - \cos x| dx$, is

A. 0

B. $2(\sqrt{2} - 1)$

C. $2\sqrt{2}$

D. $2(\sqrt{2} + 1)$

Answer: B



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42. The value of the integral $\int_0^{\pi/4} \sin^{-4} x dx$, is

A. $-\frac{8}{3}$

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

C. $\frac{8}{3}$

D. none of these

Answer: A



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43. The value of the integral $I = \int_1^{\infty} \frac{x^2 - 2}{x^3 \sqrt{x^2 - 1}} dx$, is

A. 0

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

C. $\frac{4}{3}$

D. none of these

Answer: A



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44. $\int_0^1 |\sin 2\pi x| dx$ is equal to

A. 0

B. $-\frac{1}{\pi}$

C. $\frac{1}{\pi}$

D. $\frac{2}{\pi}$

Answer: D



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45. The value of integral $\int_{-\pi}^{\pi} (\cos ax - \sin bx)^2 dx$, where (a and b are integers), is

A. $-\pi$

B. 0

C. π

D. 2π

Answer: D



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46. The value of the definite integral $\int_0^1 (1 + e^{-x^2}) dx$ is

A. -1

B. 2

C. $1 + e^{-1}$

D. none of these

Answer: D



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47. If $I = \int_{-\pi}^{\pi} \frac{\sin^2}{1 + a^x} dx$, $a > 0$, then I equals

A. π

B. $\frac{\pi}{2}$

C. $a\pi$

D. $a\frac{\pi}{2}$

Answer: B



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48. If n is an odd natural number, then

$$\int_{-\pi/6}^{\pi/6} \frac{\pi + 4x^n}{-\sin\left(pq + \frac{\pi}{6}\right)} dx =$$



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49. If $I_1 = \int_0^x e^{zx} e^{-z^2} dz$ and $I_2 = \int_0^x e^{-z^2/4} dz$, then

A. $I_1 = e^x I_2$

B. $I_1 = e^{x^2} I_2$

C. $I_1 = e^{x^2/2} I_2$

D. none of these

Answer: D



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50. $\int_0^{1/2} |\sin \pi x| dx$ is equal to

A. 0

B. π

C. $-\pi$

D. $1/\pi$

Answer: D



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51. The function $F(x) = \int_0^x \log\left(\frac{1-x}{1+x}\right) dx$, is

- A. an even function
- B. an odd function
- C. a periodic function
- D. none of these

Answer: A



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52. $\int_{1/3}^3 \frac{1}{x} \sin\left(\frac{1}{x} - x\right) dx$ is equal to

- A. $\frac{\sqrt{3}}{2}$

$$\sqrt{3\pi}$$

B. $\frac{\sqrt{3\pi}}{2}$

C. 0

D. none of these

Answer: C



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53. If $F(x) = \int_{x^2}^{x^3} \log t dt (x > 0)$, then $F'(x)$ equals

A. $(9x^2 - 4x) \log x$

B. $(4x - 9x^2) \log x$

C. $(9x^2 + 4x) \log x$

D. none of these

Answer: A



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54. If $F(x)$ and $g(x)$ are two integrable functions defined on

$[a, b]$, then $\left| \int_a^b f(x)g(x)dx \right|$, is

A. less than $\sqrt{\int_a^b f^2(x)dx \int_a^b g^2(x)dx}$

B. less than or equal to $\sqrt{\int_a^b af^2(x)dx \int_a^b ag^2(x)dx}$

C. less than or equal to $\sqrt{\left\{ \int_a^b af^2(x)dx \right\} \left\{ \int_a^b ag^2(x)dx \right\}}$

D. none of these

Answer: C



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55. If $I = \int_0^1 \frac{dx}{\sqrt{1+x^4}}$ then

A. $I > 2$

B. $I \neq \frac{\sqrt{5}}{2}$

C. $I > \frac{\sqrt{7}}{2}$

D. none of these

Answer: C



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56. If $I = \int_0^1 \frac{dx}{1+x^4}$, then

A. $I > 0.78$

B. $I < 0.78$

C. $I > 1$

D. none of these

Answer: A



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57. The value of $\int_{-1}^1 x|x|dx$, is

A. 2

B. 1

C. 0

D. none of these

Answer: C



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58. If $\int_0^{\pi/2} \cos^n x \sin^n x dx = \lambda \int_0^{\pi/2} \sin^n x dx$, then $\lambda =$

A. $\frac{1}{2^{n-1}}$

B. $\frac{1}{2^{n+1}}$

C. $\frac{1}{2^n}$

D. $\frac{1}{2}$

Answer: C



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59. The value of $\int_{1/e}^e \frac{|\log x|}{x^2} dx$, is

A. 2

B. $\frac{2}{e}$

C. $2\left(1 - \frac{1}{e}\right)$

D. 0

Answer: C



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60. Assuming that f is everywhere continuous, $\frac{1}{c} \int_{ac}^{bc} f\left(\frac{x}{c}\right) dx$ is equal to

A. $\frac{1}{c} \int_a^b f(x) dx$

$$b$$
$$\text{B. } \int af(x)dx$$

$$b$$
$$\text{C. } c \int af(x)dx$$

$$bc^2$$
$$\text{D. } c \int ac^2f(x)dx$$

Answer: B



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61. $\frac{d}{dx} \left(\int_{f(x)}^{g(x)} \phi(t)dt \right)$ is equal to

A. $\phi(g(x)) - \phi(f(x))$

B. $\frac{1}{2}[\phi(g(x))]^2 - \frac{1}{2}[\phi(f(x))]^2$

C. $g'(x)\phi(g(x)) - f'(x)\phi(f(x))$

D. $\phi(g(x))g'(x) - \phi'(f(x))f'(x)$

Answer: C



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62. If $f(x) = ae^{2x} + be^x + cx$ satisfies the conditions $f(0)=-1$, $f'(\log 2)=31$, $\int_0^{\log 4} (f(x) - cx)dx = \frac{39}{2}$, then

A. $a=5, b=-6, c=-7$

B. $a=5, b=6, c=7$

C. $a=-5, b=6, c=-7$

D. none of these

Answer: A



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63. The value of $\int_0^2 \left| \cos\left(\frac{\pi x}{2}\right) \right| dx$ is

A. 2π

B. $\pi/2$

C. $3/4\pi$

D. $4/\pi$

Answer: D



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64. If $\int_0^1 \cot^{-1}(1 - x - x^2) dx = k \int_0^1 \tan^{-1} x dx$, then $k =$

A. 1

B. 2

C. π

D. 2π

Answer: B



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65. If $0 < a < 1$, then $\int_{-1}^1 \frac{1}{\sqrt{1 - 2ax + a^2}} dx$ is equal to

A. 1

B. 2π

C. $\pi/2$

D. $3\pi/2$

Answer: D





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66. The value of $\int_0^{\pi/2} \frac{x + \sin x}{1 + \cos x} dx$, is

A. π

B. 2π

C. $\pi/2$

D. $3\pi/2$

Answer: C



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$$67. f(x) = \begin{vmatrix} \sec x & \cos x & \sec^2 x + \operatorname{cosec} x \cot x \\ \cos^2 x & \cos^2 x & \operatorname{cosec}^2 x \\ 1 & \cos^2 x & \cos^2 x \end{vmatrix} \text{ then,}$$

$\int_0^{\pi/2} f(x) dx$ equals

A. 0

B. 1

C. $-\left(\frac{\pi}{4} + \frac{8}{15}\right)$

D. -1

Answer: C



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68. If a is a fixed real number such that $f(a-x)+f(a+x)=0$, then

$$\int_0^{2a} f(x) dx =$$

A. $\frac{a}{2}$

B. 0

C. $-\frac{a}{2}$

D. $2a$

Answer: B



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69. The value of $\int_0^1 \log \left(\frac{4 + 3\sin x}{4 + 3\cos x} \right) dx$, is

A. 2

B. $3/4$

C. 0

D. 1

Answer: C



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70. The value of $\int_0^1 \tan^{-1} \left(\frac{2x - 1}{1 + x - x^2} \right) dx$ is

A. 1

B. 0

C. -1

D. 2

Answer: B



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71. The value of $\int_0^{2\pi} |\cos x - \sin x| dx$ is

A. $\frac{4}{\sqrt{2}}$

B. $2\sqrt{2}$

C. $\frac{2}{\sqrt{2}}$

D. $4\sqrt{2}$

Answer: D



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72. If $I_1 = \int_0^1 2^{x^2} dx$, $I_2 = \int_0^1 2^{x^3} dx$, $I_3 = \int_1^2 2^{x^2} dx$

and $I_4 = \int_1^2 2^{x^2} dx$ then

A. $I_1 > I_2$ and $I_4 > I_3$

B. $I_2 > I_1$ and $I_3 > I_4$

C. $I_1 > I_2$ and $I_3 > I_4$

D. none of these

Answer: A



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73. Consider the integrals

$$I_1 = \int_0^1 e^{-x} \cos^2 x dx, I_2 = \int_0^1 e^{-x^2} \cos^2 x dx, I_3 = \int_0^1 e^{-x^2} dx$$

and $I_4 = \int_0^1 e^{-x^{1/2}} x^2 dx$. The greatest of these integrals, is

A. I_1

B. I_2

C. I_3

D. I_4

Answer: D



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74. If $f(x)=f(a+b-x)$ for all $x \in [a, b]$ and $\int_a^b xf(x)dx = k\int_a^b f(x)dx$,

then the value of k , is

A. $\frac{a+b}{2}$

B. $\frac{a-b}{2}$

C. $\frac{a^2+b^2}{2}$

D. $\frac{a^2 - b^2}{2}$

Answer: A



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75. To find the numerical value of $\int_{-2}^2 (px^3 + qx + 8) dx$ it is necessary to know the values of the constants:

A. p

B. q

C. s

D. p and s

Answer: C



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76. Let $f: R \rightarrow R$ be continuous functions. Then the value of the integral $\int_{-\pi/2}^{\pi/2} [f(x) + f(-x)][g(x) - g(-x)] dx$ is

A. π

B. 1

C. -1

D. 0

Answer: D



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77. The value of $\int_{-1/2}^{1/2} \left| x \cos \left(\frac{\pi x}{2} \right) \right| dx$ is

$$\text{A. } \frac{\pi\sqrt{2} + 4\sqrt{2} - 8}{\pi^2}$$

$$\text{B. } \frac{\sqrt{2} + 4\pi\sqrt{2} - 8}{\pi^2}$$

$$\text{C. } \frac{\pi\sqrt{2} + 4\sqrt{2} + 8}{\pi^2}$$

D. none of these

Answer: A



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78. The value of the integral $\int_0^{\pi/2} \frac{f(x)}{f(x) + f\left(\frac{\pi}{2} - x\right)} dx$ is

A. $\pi/4$

B. $\pi/2$

C. π

D. 0

Answer: A

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79. The value of $\int_{\pi/2}^0 \frac{1}{9\cos x + 12\sin x} dx$ is

A. $\frac{1}{15} \log_{10} 6$

B. $\frac{1}{15} \log_e 6$

C. $\log\left(\frac{6}{15}\right)$

D. $\log\left(\frac{15}{6}\right)$

Answer: B

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80. If $I = \int_3^4 \frac{1}{3\sqrt{\log x}} dx$ then

A. $0.92 < I < 1$

B. $I > 1$

C. $I < 0.92$

D. none of these

Answer: A



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81. If $I = \int_0^{1/2} \frac{1}{\sqrt{1-x^{2n}}} dx$ then which one of the following is not

true ?

A. $I < \frac{\pi}{6}$

B. $I \geq \frac{1}{2}$

C. $I > 0$

D. none of these

Answer: D



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82. If $I = \int_0^{1/2} \frac{\sin^2 nx}{\sin^2 x} dx$ then which one of the following is not

true ?

A. $I_n = \frac{n\pi}{2}$

B. $I_n = 2 \int_0^{\pi/2} \frac{\sin x \cos x 2nx}{\sin x} dx$

C. $I_1, I_2, I_3, \dots, I_n, \dots$ is a A.P.

D. $\sin(I_{15})=0$

Answer: D

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83. For any integer n , the integral $\int_0^{\pi} e^{\cos x} \cos^3(2n+1)x dx$ has the value

A. π

B. 1

C. 0

D. none of these

Answer: C

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84. The value of the integral $\int_0^{2a} \frac{f(x)}{f(x) + f(2a - x)} dx$ is equal to

A. 0

B. 2a

C. a

D. none of these

Answer: C



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85. If $\int_0^{\infty} \frac{\log(1 + x^2)}{1 + x^2} dx = k \int_0^{\infty} \frac{\log(1 + x)}{1 + x^2} dx$, then $k =$

A. 4

B. 8

C. π

D. 2π

Answer: B



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86. If $\int_{\log 2}^x \frac{1}{\sqrt{e^x - 1}} dx = \frac{\pi}{6}$ then x is equal to

A. e^2

B. $1/e$

C. $\log 4$

D. none of these

Answer: C



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87. The value of the integral $\int_0^{\pi} \log(1 + \cos x) dx$ is

A. $\frac{\pi}{2} \log 2$

B. $-\pi \log 2$

C. $\pi \log 2$

D. none of these

Answer: B



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88. The integral $\int_0^{\pi} \frac{1}{a^2 - 2a\cos x + 1} dx$ ($a < 1$) is

A. $\frac{\pi}{1 - a^2}$

B. $\frac{\pi}{a^2 - 1}$

C. $\frac{2\pi}{a^2 - 1}$

D. $\frac{3\pi}{4}$

Answer: A



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89. The integral $\int_0^{\pi/2} f(\sin 2x) \sin x dx$ is equal to

A. $\int_0^{\pi/2} f(\cos 2x) \sin x dx = \sqrt{2} \int_0^{\pi/2} f(\cos 2x) \sin x dx$

B. $\int_0^{\pi/2} f(\sin 2x) \cos x dx = \sqrt{2} \int_0^{\pi/4} f(\cos 2x) \cos x dx$

$$C. \int_0^{\pi/2} f(\cos 2x) \cos x dx = \sqrt{2} \int_0^{\pi/2} f(\cos 2x) \cos x dx$$

$$D. \int_0^{\pi/2} f(\sin 2x) \cos x dx = \sqrt{2} \int_0^{\pi/2} f(\cos 2x) \cos x dx$$

Answer: B

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90. $\int_0^{\pi} k(\pi x - x^2)^{100} \sin 2x \, dx$ is equal to

A. π^{100}

B. $\frac{1}{2}(\pi^{100} - \pi^{97})$

C. $\frac{1}{2}(\pi^{100} + \pi^{97})$

D. 0

Answer: D

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91. The value of the integral $\int_2^4 \frac{\sqrt{x^2 - 4}}{x^4} dx$ is

A. $\sqrt{\frac{3}{32}}$

B. $\frac{\sqrt{3}}{32}$

C. $\frac{32}{\sqrt{3}}$

D. $-\frac{\sqrt{3}}{32}$

Answer: B



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92. The value of the integral $\int_0^\pi \frac{1}{a^2 - 2a \cos x + 1} dx (a > 1)$, is

A. $\frac{\pi}{1 - a^2}$

B. $\frac{\pi}{a^2 - 1}$

C. $\frac{2\pi}{a^2 - 1}$

D. $\frac{2\pi}{1 - a^2}$

Answer: A



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93. If $f(x)$ and $g(x)$ are continuous functions satisfying

$f(x) = f(a - x)$ and $g(x) + g(a - x) = 2$, then $\int_0^a f(x) g(x) dx$

is equal to

A. $\int_0^a g(x) dx$

B. $\int_0^a f(x) dx$

C. 0

D. none of these

Answer: B



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94. $\int_0^{\pi/2} x(\sqrt{\tan x} + \sqrt{\cot x}) dx$ equals

A. $\frac{\pi}{2\sqrt{2}}$

B. $\frac{\pi^2}{2}$

C. $\frac{\pi^2}{2\sqrt{2}}$

D. $\frac{\pi^2}{2\sqrt{3}}$

Answer: C



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95. The value of the integral

$$\int_{1/3}^1 \frac{(x - x^3)^{1/3}}{x^4} dx \text{ is}$$

- A. 6
- B. 0
- C. 3
- D. 4

Answer: A



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96. The value of the integral $\int_0^{100\pi} \sqrt{1 - \cos 2x} \, dx$ is

A. $100\sqrt{2}$

B. $200\sqrt{2}$

C. 0

D. $400\sqrt{2}$

Answer: B



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97. The value of the integral

$$\int_{-1/2}^{1/2} \left\{ \left(\frac{x+1}{x-1} \right)^2 + \left(\frac{x-1}{x+1} \right)^2 - 2 \right\} dx \text{ is}$$

A. $\log\left(\frac{4}{3}\right)$

B. $4\log\left(\frac{3}{4}\right)$

C. $4\log\left(\frac{4}{3}\right)$

D. $\log\left(\frac{3}{4}\right)$

Answer: C



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98. The value of the integral $\int_{1/e}^e |\log x| dx$, is

A. $2\left(\frac{e-1}{e}\right)$

B. $2\left(\frac{1-e}{e}\right)$

C. $2 - \frac{1}{e}$

D. none of these

Answer: A



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99. The value of $\int_0^{\pi/2} \frac{\sin 8x \log \cot x}{\cos 2x} dx$, is

A. 0

B. π

C. $\frac{5\pi}{2}$

D. $\frac{3\pi}{2}$

Answer: A



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100. The value of $\int_0^{\pi/2} x^{10} \sin x dx$, is then the value of $\mu_{10} + 90\mu_8$,
is

A. $9\left(\frac{\pi}{2}\right)^8$

B. $\left(\frac{\pi}{2}\right)^9$

C. $10\left(\frac{\pi}{2}\right)^9$

D. $9\left(\frac{\pi}{2}\right)^9$

Answer: C



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101. The value of $\int_0^{\pi/2} \frac{1}{1 + \tan^3 x} dx$ is

A. 0

B. 1

C. $\pi/2$

D. $\pi/4$

Answer: D



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102. The value of $\int_0^{\pi} \frac{\sin\left(n + \frac{1}{2}\right)x}{\sin\left(\frac{x}{2}\right)} dx$ is

A. $\frac{\pi}{2}$

B. 0

C. π

D. 2π

Answer: C



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103. If $\frac{d}{dx}f(x) = g(x)$ for $a \leq x \leq b$ then, $\int_a^b f(x)g(x)dx$ equals

A. $f(b) - f(a)$

B. $g(b) - g(a)$

C. $\frac{[f(b)]^2 - [f(a)]^2}{2}$

D. $\frac{[g(b)]^2 - [g(a)]^2}{2}$

Answer: C



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104. For any integer n , the integral $\int_0^3 e^{\sin^2 x} \cos^3(2n+1)x \, dx$ has the value

A. π

B. 1

C. 0

D. none of these

Answer: C



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105. The value of the integral $\int_0^3 \sqrt{3+x^3} dx$ lies in the interval

A. (1,3)

B. (2,30)

C. $(4, 2\sqrt{30})$

D. none of these

Answer: C



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106. The value of the integral $\int_0^1 \frac{1}{(1+x^2)^{3/2}} dx$ is

A. $1/2$

B. $1/\sqrt{2}$

C. 1

D. $\sqrt{2}$

Answer: B



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107. If $I = \int_0^{2\pi} \sin^2 x \, dx$, then

A. $I = 4 \int_0^{\pi} \sin^2 x \, dx = 4 \int_0^{\pi/2} \sin^2 x \, dx$

B. $I = \int_0^{\pi/2} \cos^2 x \, dx$

C. $I = 8 \int_0^{\pi/4} \sin^2 x \, dx$

D. none of these

Answer: D



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108. If $\int_0^1 f(x) \, dx = M$, $\int_0^1 g(x) \, dx = N$, then which of the following is correct ?

A. $\int_0^1 (f(x) + g(x)) \, dx = M + N$

$$B. \int_0^1 (f(x) + g(x)) dx = MN$$

$$C. \int_0^1 \frac{1}{f(x)} dx = \frac{1}{M}$$

$$D. \int_0^1 \frac{f(x)}{g(x)} dx = \frac{M}{N}$$

Answer: A

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109. The value of $\int_0^{\pi/4} (\pi x - 4x^2) \log(1 + \tan x) dx$ is

A. $\frac{\pi^3}{192} \log_e 2$

B. $\frac{\pi^3}{192} \log \sqrt{2}$

C. $\frac{\pi^3}{36} \log 2$

D. $\frac{\pi^3}{48} \log \sqrt{2}$

Answer: A



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110. The value of $\int_{-\pi/2}^{\pi/2} \sin \left\{ \log \left(x + \sqrt{x^2 + 1} \right) \right\} dx$ is

A. 1

B. -1

C. 0

D. none of these

Answer: C



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111. The value of $\int_0^{2\pi} \cos^{99} x dx$, is

A. 1

B. -1

C. 99

D. 0

Answer: D



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112. If $f(a+x)=f(x)$, then $\int_0^{na} f(x)dx$ is equal to ($n \in N$)

A. $(n - 1) \int_0^a f(x) dx$

B. $n \int_0^a f(x) dx$

$(n-1a)$

C. $\int_0^a f(x)dx$

D. none of these

Answer: B



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113. If $f(t)$ is a continuous function defined on $[a,b]$ such that $f(t)$ is an odd function, then the function $\phi(x) = \int_a^x f(t)dt$

A. is an odd function

B. is an even function

C. is an increasing function on $[a,b]$

D. none of these

Answer: B



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114. If $f(x)$ is an integrable function over every interval on the real line such that $f(t+x)=f(x)$ for every x and real t , then

$\int_a^{a+1} f(x)dx$ is equal to

A. $\int_0^a f(x)dx$

B. $\int_0^t f(x)dx$

C. $\int_a^t f(x)dx$

D. none of these

Answer: B



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115. If $I_1 = \int_{3\pi}^0 f(\cos^2 x) dx$ and $I_2 = \int_{\pi}^0 f(\cos^2 x)$ then

A. $I_1 = I_2$

B. $I_1 = 2I_2$

C. $I_1 = 5I_2$

D. none of these

Answer: D



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116. If $f(x)$ is a quadratic polynomial in x such that

$$6 \int_0^1 f(x) dx - \left\{ f(0) + 4f\left(\frac{1}{2}\right) \right\} = kf(1), \text{ then } k =$$

A. -1

B. 0

C. 1

D. 2

Answer: C



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117. The value of integral $\int_{-2}^4 x[x] dx$ is

A. $41/2$

B. 20

C. $21/2$

D. none of these

Answer: A



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118. If $h(a)=h(b)$, the value of the integral

$\int_a^b [f(g(h(x)))^{-1} f'(g(h(x)))g'(h(x))h'(x)] dx$ is equal to

- A. 0
- B. $f(a)-f(b)$
- C. $f(g(a))-f(g(b))$
- D. none of these

Answer: A



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119. If $F(x) = \frac{1}{x^2} \int_4^x [4t^2 - 2F'(t)] dt$ then $F'(4)$ equals

A. 32

B. $32/3$

C. $32/9$

D. none of these

Answer: C



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120. If $f(x)$ is an odd function defined on $[-T/2, T/2]$ and has

period T , then $\phi(x) = \int_a^x f(t)dt$ is

A. a periodic function with period $T/2$

B. a periodic function with period T

C. not a periodic function

D. a periodic function with period $T/4$

Answer: B



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121. If for every integer n , $\int_n^{n+1} f(x)dx = n^2$, then the value of $\int_{-2}^4 f(x)dx$, is

A. 16

B. 14

C. 19

D. none of these

Answer: C



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122. $\int_{-\pi+4}^{\pi/4} \frac{\tan^2 x}{1+a^x} dx$ is equal to

A. $\frac{\pi+4}{4}$

B. $\frac{\pi-4}{4}$

C. $\frac{a\pi}{4}$

D. $\frac{a+\pi}{4}$

Answer: B



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123. The value of $\int_0^{\pi/2} \operatorname{cosec}(x - \pi/3)\operatorname{cosec}(x - \pi/6)dx$ is

A. $2 \log 3$

B. $-2\log 3$

C. $\log 3$

D. none of these

Answer: B



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124. The value of $\int_{-1}^1 x|x|dx$, is

A. 2

B. 1

C. 0

D. none of these

Answer: C



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125. $\int_0^3 |x^3 + x^2 + 3x| dx$ is equal to

A. $\frac{171}{2}$

B. $\frac{171}{4}$

C. $\frac{170}{4}$

D. $\frac{170}{3}$

Answer: B



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126. The value of the integral $\int_0^3 \frac{dx}{\sqrt{x+1} + \sqrt{5x+1}}$ is

A. $\frac{11}{15}$

B. $\frac{14}{15}$

C. $\frac{2}{5}$

D. none of these

Answer: D



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127. $\int_1^{-1} \frac{x^3 + |x| + 1}{x^2 + 2|x| + 1} dx$ is equal to

A. $\ln 3$

B. $2 \ln 3$

C. $\frac{1}{2} \ln 3$

D. none of these

Answer: D



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128. $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \log_e \left\{ \left(\frac{ax^2 + bx + c}{ax^2 - bx + c} \right) (a + b) |\sin x| \right\} dx$ is equal to

A. $\pi \log_e(a + b)$

B. $\pi \log_e \left(\frac{a + b}{2} \right)$

C. $\frac{\pi}{2} \log_e(a + b)$

D. none of these

Answer: B



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129. For any natural number n , the value of the integral

$$\int_0^{\sqrt{n}} [x^2] dx \text{ is}$$

A. $n\sqrt{n} + \sum_{r=1}^n \sqrt{r}$

B. $n\sqrt{n} - \sum_{r=1}^n \sqrt{r}$

C. $\sum_{r=1}^n \sqrt{r} - n\sqrt{n}$

D. none of these

Answer: B



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130. For any $n \in \mathbb{R}^+$, the value of the integral

$$\int_0^{n[x]} (x - [x]) dx \text{ is}$$

A. $n[x]$

B. $[x]$

C. $\frac{n}{2}[x]$

D. none of these

Answer: C



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131. If $\phi'(x) = \frac{\log_e |\sin x|}{x}$, $x \neq \pi$, $n \in Z$ and

$\int_1^3 \frac{3 \log_e |\sin x^3|}{x} dx = \phi(k) - \phi(1)$, then the possible value of k , is

A. 27

B. 18

C. 9

D. none of these

Answer: A



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132. The equation

$$\int_{-\pi/4}^{\pi/4} \left\{ a|\sin x| + \frac{b \sin x}{1 + \cos x} + c \right\} dx = 0 \text{ where } a, b, c \text{ are constants,}$$

gives a relation between

A. a, b and c

B. a and c

C. a and b

D. b and c

Answer: B



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133. Let $f(x)$ be a continuous function such that $f(a-x)+f(x)=0$ for all $x \in [0, a]$. Then, the value of the integral

$$\int_0^a \frac{1}{1 + e^{f(x)}} dx \text{ is equal to}$$

A. a

B. $\frac{a}{2}$

C. $f(a)$

D. $\frac{1}{2}f(a)$

Answer: B



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134. The value of $\int_a^\beta x|x|dx$, where $a < 0 < \beta$, is

A. $\frac{1}{2}(\alpha^2 + \beta^2)$

B. $\frac{1}{3}(\beta^2 - \alpha^2)$

C. $\frac{1}{3}(\alpha^2 + \beta^2)$

D. none of these

Answer: D



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135. $\int_{-\pi/2}^{\pi/2} \frac{|x|}{8\cos^2 2x + 1} dx$ has the value

A. $\frac{\pi^2}{6}$

B. $\frac{\pi^2}{12}$

C. $\frac{\pi^2}{24}$

D. none of these

Answer: B



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136. If $[.]$ denotes the greatest integer function and

$$f(x) = \begin{cases} 3[x] - \frac{5|x|}{x}, & x \neq 0 \\ 2, & x = 0 \end{cases}$$

then $\int_{-3/2}^2 f(x) dx$ is equal to

A. $-\frac{11}{2}$

B. $-\frac{7}{2}$

C. -6

D. $-\frac{17}{2}$

Answer: A



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137. Find the value of $\int_{-1}^1 [x^2 + \{x\}] dx$, where $[.]$ and $\{.\}$ denote the greatest function and fractional parts of x , respectively.

A. $\frac{5 + \sqrt{5}}{2}$

B. $\frac{5 - \sqrt{5}}{2}$

C. $-\frac{5 + \sqrt{5}}{2}$

D. none of these

Answer: B

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138. The value of

$$\int_{-1}^1 \sin^{-1} \left[x^2 + \frac{1}{2} \right] dx + \int_{-1}^1 \cos^{-1} \left[x^2 - \frac{1}{2} \right] dx, \text{ where } [.] \text{ denotes}$$

the greatest integer function, is

A. π

B. 2π

C. 4π

D. 0

Answer: B



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139. Let $\Delta(y) = \begin{vmatrix} y+a & y+b & y+a-c \\ y+b & y+c & y-1 \\ y+c & y+d & y-b+d \end{vmatrix}$

and, $\int_0^2 \Delta(y) dy = -16$, where a, b, c, d are in A.P., then the common difference of the A.P. is equal to

A. ± 1

B. ± 2

C. ± 3

D. none of these

Answer: B



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140. If $I = \int_0^1 \frac{1}{1+x^{\pi/2}} dx$, then \

A. $I > \ln 2$

B. $I < \ln 2$

C. $I < \frac{\pi}{4}$

D. $I > \frac{\pi}{4}$

Answer: A



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141. If $\int_0^x f(t) dt = x^2 + 2x - \int_0^x t f(t) dt, x \in (0, \infty)$. Then, $f(x)$ is

A. Periodic

B. Periodic but fundamental does not exist

C. Periodic but fundamental period exists

D. Nothing can be said

Answer: A::B



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142. The value of $\int_{-6}^6 \max(|2 - |x||, 4 - |x|, 3) dx$,is

A. 40

B. 50

C. 1

D. $\frac{2}{5}$

Answer: A



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143. If $I_n = \int_0^\pi e^x (\sin x)^n dx$, then $\frac{I_3}{I_1}$ is equal to

A. $\frac{3}{5}$

B. $\frac{1}{5}$

C. 1

D. $\frac{2}{5}$

Answer: A



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144. Given that

$$\lim_{n \rightarrow \infty} \sum_{r=1}^n \frac{\log(n^2 + r^2) - 2\log n}{n} = \log 2 + \frac{\pi}{2} - 2, \text{ then}$$

$$\lim_{n \rightarrow \infty} \frac{1}{n^{2m}} \left[(n^2 + 1^2)^m (n^2 + 2^2)^m \dots (n^2 + n^2)^m \right]^{1/n} \text{ is equal to}$$

A. $2^m e^m \left(\frac{\pi}{2} - 2 \right)$

B. $2^m e^m \left(2 - \frac{\pi}{2} \right)$

C. $e^m \left(\frac{\pi}{2} - 2 \right)$

D. $e^{2m} \left(\frac{\pi}{2} - 2 \right)$

Answer: A



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145. Let $f(x)$ be a differentiable function such that

$$f'(x) = f(x) + \int_0^2 f(x) dx \text{ and } f(0) = \frac{4 - e^2}{3}. \text{ Then } f(x) =$$

A. $e^x - \left(\frac{e^2 - 1}{3} \right)$

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

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

D. none of these

Answer: A



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146. Let $f(x)$ be a differentiable function satisfying $f'(x) = f(x) + \int_0^2 f(x) dx$ such that $f(0) = \frac{4 - e^2}{3}$. Then the number of solutions of $f(x) + x = 0$, is

A. 0

B. 1

C. 2

D. 3

Answer: B



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147. The value of the integral $\int_{-10}^0 \frac{\left| \frac{2[x]}{3x - [x]} \right|}{\left(\frac{2[x]}{3x - [x]} \right)} dx$ where $[.]$

denotes GIF

A. $\frac{28}{3}$

B. 0

C. 10

D. -10

Answer: A



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Chapter Test 1

1. $\int_{-\pi/2}^{\pi/2} \sin^2 x \cos^2 x (\sin x + \cos x) dx =$

A. $2/15$

B. $4/15$

C. $2/15$

D. 0

Answer: D



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2. $\lim_{n \rightarrow \infty} \frac{1}{n^2} \sum_{r=1}^n r e^{r/n} =$

A. 0

B. 1

C. e

D. 2e

Answer: B



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3. The value of the integral $\int_{-1}^1 \sin^{11} x \, dx$ is

A. $\frac{10}{11} \cdot \frac{8}{9} \cdot \frac{6}{7} \cdot \frac{4}{5} \cdot \frac{2}{3}$

B. $\frac{10}{11} \cdot \frac{8}{9} \cdot \frac{6}{7} \cdot \frac{4}{5} \cdot \frac{2}{3} \cdot \frac{\pi}{2}$

C. 1

D. 0

Answer: D



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4. The value of $\int_{-\pi}^{\pi} (1 - x^2) \sin x \cos^2 x \, dx$, is

A. 0

B. $\pi - \frac{\pi^3}{3}$

C. $2\pi - \pi^3$

D. $\frac{\pi}{2} - 2\pi^3$

Answer: A



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5. $\int_{-\pi}^{\pi} [\cos px - \sin qx]^2 dx$ where p, q are integers is equal to

A. $-\pi$

B. 0

C. π

D. 2π

Answer: D



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6. If $\int_0^{\pi/3} \frac{\cos x}{3 + 4\sin x} dx = k \log\left(\frac{3 + 2\sqrt{3}}{3}\right)$, then k is

A. $1/2$

B. $1/3$

C. $1/4$

D. $1/8$

Answer: C



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7. The value of $\int_3^5 \frac{x^2}{x^2 - 4} dx$, is

A. $2 - \log_e \left(\frac{15}{7} \right)$

B. $2 + \log_e \left(\frac{15}{7} \right)$

C. $2 + 4\log_e 3 - 4\log_e 7 + 4\log_e 5$

D. $2 - \tan^{-1} \left(\frac{15}{7} \right)$

Answer: B



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8. The greater value of $(x) = \int_{-1/2}^x |t| dt$ on the interval $[-1/2, 1/2]$, is

A. $\frac{3}{8}$

B. $\frac{1}{4}$

C. $-\frac{3}{8}$

D. $-\frac{1}{2}$

Answer: B



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9. $f(x) = \begin{cases} 1 - x, & 0 \leq x \leq 1 \\ 0, & 1 \leq x \leq 2 \\ (2 - x)^2, & 2 \leq x \leq 3 \end{cases}$ and $\phi(x) = \int_0^x f(t) dt$. Then for any

$x \in [2, 3]$, $\phi(x)$ equals

A. $\frac{(x - 2)^3}{3}$

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

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

D. none of these

Answer: C



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10. If $f(x) = \int_x^{-1} |t| dt$, then for any $x \geq 0$, $f(x)$ equals

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

B. $\frac{1}{2}x^2$

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

D. none of these

Answer: C



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11. $\int_0^2 (x - \log_2 a) dx = 2 \log \left(\frac{2}{a} \right)$, if

A. $a=2$

B. $a > 2$

C. 3

D. 4

Answer: A



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12. If $\int_1^a (a - 4x) dx \geq 6 - 5a$, $a > 1$, then a equals

A. 1

B. 2

C. 3

D. 4

Answer: B



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13. The value of $\int_1^2 \{f(g(x))\}^{-1} f'(g(x))g'(x) dx$, where $g(1)=g(2)$, is equal to

A. 1

B. 2

C. 0

D. none of these

Answer: C



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14. If $\frac{C_0}{1} + \frac{C_1}{2} + \frac{C_2}{3} = 0$, where C_0, C_1, C_2 are all real, the equation $C_2x^2 + C_1x + C_0 = 0$ has

A. at least one root in (0,1)

B. one root in (1,2) and the other in (3,4)

C. one root in (-1,1) and the other in (-5,2)

D. both roots imaginary

Answer: A



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15. The solution of the equation $\int_{\log_2}^x \frac{1}{e^x - 1} dx = \frac{\log(3)}{2}$ is given

by x=

A. e^2

B. $1/e$

C. $\log 4$

D. none of these

Answer: C



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16. If $\int_a^b \frac{x^n}{x^n + (16 - x)^n} dx = 6$, then

A. $a = 4, b = 12, n \in R$

B. $a = 2, b = 14, n \in R$

C. $a = -4, b = 20, n \in R$

D. $a = 2, b = 8, n \in R$

Answer: B



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17. Let m be any integer. Then, the integral $\int_0^{\pi} \frac{\sin 2mx}{\sin x} dx$ equals

A. 0

B. π

C. 1

D. none of these

Answer: A



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18. $\int_{-\pi/4}^{\pi/4} e^{-x} \sin x \, dx$ is

A. $-\frac{\sqrt{2}}{2} e^{\pi/4}$

B. $\frac{\sqrt{2}}{2} e^{-\pi/4}$

C. $\sqrt{2}(e^{-\pi/4} - e^{\pi/4})$

D. zero

Answer: A



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19. $\frac{d}{dx}(f(x)) = \phi(x)$ for $a \leq x \leq b$, $\int_a^b f(x)\phi(x)dx =$

A. $f(b) - f(a)$

B. $\phi(b) - \phi(a)$

C. $\frac{[f(b)]^2 - [f(a)]^2}{1 + e^x}$

D. $\frac{[\phi(b)]^2 - [\phi(a)]^2}{2}$

Answer: C



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$$20. \int_{-\pi/2}^{\pi/2} \frac{\cos x}{1 + e^x} dx =$$

A. 1

B. 0

C. -1

D. none of these

Answer: A



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$$21. \int_0^{\infty} \frac{dx}{\left[x + \sqrt{x^2 + 1}\right]^3} dx =$$

A. $\frac{3}{8}$

B. $\frac{1}{8}$

C. $-\frac{3}{8}$

D. none of these

Answer: A



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22. $\int_0^{\infty} \frac{x}{(1-x)^{3/4}} dx =$

A. $\frac{12}{5}$

B. $\frac{16}{5}$

C. $-\frac{16}{5}$

D. none of these

Answer: B



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23. $\int_0^{\pi} x \sin x \cos^4 x dx =$

A. $\frac{\pi}{10}$

B. $\frac{\pi}{5}$

C. $-\frac{\pi}{5}$

D. none of these

Answer: B



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24. $\int_0^{\pi} [2\sin x] dx =$

A. $2\pi/3$

B. $-5\pi/3$

C. $-\pi$

D. -2π

Answer: A



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25. $\int_{\pi/2}^{3\pi/2} [2\cos x] dx$ is equal to

A. $\frac{5\pi}{3}$

B. $-\frac{5\pi}{3}$

C. $-\pi$

D. -2π

Answer: B



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26. If $f(x)$ satisfies the conditions of Rolle's theorem in $[1,2]$ and is continuous on $[1,2]$, then $\int_1^2 f'(x) dx$ is equal to

A. 3

B. 0

C. 1

D. 2

Answer: B



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27. For $y = f(x) = \int_0^x 2|t|dt$, the tangent lines parallel to the bisector of the first quadrant angle are

A. $y = x \pm \frac{1}{4}$

B. $y = x \pm \frac{3}{2}$

C. $y = x \pm \frac{1}{2}$

D. none of these

Answer: A



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28. If $f(x) = ae^{2x} + be^x + cx$, satisfies the conditions $f(0)=-1$, $f'(\log 2)=31$, $\int_0^{\log 4} (f(x) - cx)dx = \frac{39}{2}$, then

A. $a=5, b=6, c=3$

B. $a=5, b=-6, c=3$

C. $a=-5, b=6, c=3$

D. none of these

Answer: B



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29. $\int_{\pi}^{2\pi} [\sqrt{2}\cos x] dx =$

A. $-\pi/2$

B. $\pi/2$

C. π

D. none of these

Answer: A



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30. $\int_0^{\pi/3} [\sqrt{3}\tan x] dx =$

A. $\frac{5\pi}{6}$

B. $\frac{5\pi}{6} - \tan^{-1}\left(\frac{2}{\sqrt{2}}\right)$

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

D. none of these

Answer: D



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31. $\int_{3\pi/2}^{5\pi/3} [2\cos x] dx =$

A. $\frac{5\pi}{3}$

B. $\frac{4\pi}{3}$

C. $\frac{2\pi}{3}$

D. none of these

Answer: D



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32. $\int_0^{50\pi} \cos x \, dx =$

A. 100

B. 50

C. 0

D. none of these

Answer: A



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33. If a be a positive integer, the number of values of a satisfying

$$\int_0^{\pi/2} \left\{ a^2 \left(\frac{\cos 3x}{4} + \frac{3}{4} \cos x \right) + a \sin x - 20 \cos x \right\} dx \leq -\frac{a^2}{2}, \text{ is}$$

A. only one

B. two

C. three

D. four

Answer: D



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34. The values of 'a' for which $\int_0^a (3x^2 + 4x - 5) dx < a^3 - 2$ are

A. $\frac{1}{2} < a < 2$

B. $\frac{1}{2} \leq a \leq 2$

C. $a \leq \frac{1}{2}$

D. $a \geq 2$

Answer: A



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35. If $(-1,2)$ and $(2,4)$ are two points on the curve $y=f(x)$ and if $g(x)$ is the gradient of the curve at point (x,y) then the value of the integral $\int_{-1}^2 g(x)dx$ is

A. 2

B. -2

C. 0

D. 1

Answer: A



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36. If $I_1 = \int_{1-x}^k x \sin\{x(1-x)\} dx$ and $I_2 = \int_{1-x}^k \sin\{x(1-x)\} dx$, then

A. $I_1 = 2I_2$

B. $2I_1 = I_2$

C. $I_1 = I_2$

D. none of these

Answer: B



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37. If $\int_{-\pi/3}^{\pi/3} \left(\frac{a}{3} |\tan x| + \frac{b \tan x}{1 + \sec x} + c \right) dx = 0$ where a, b, c are constants, then $c =$

A. $a \ln 2$

B. $\frac{a}{\pi} \ln 2$

C. $-\frac{a}{\pi} \ln 2$

D. $\frac{2a}{\pi} \ln 2$

Answer: C



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38. If $x = \int_2^{\sin t} \sin^{-1} \theta d\theta$ and $y = \int_n^{\sqrt{t} \sin \theta^2} \frac{d\theta}{\theta} \frac{dy}{dx}$ is equal to

A. $\frac{\sin t}{2t^2}$

B. $\frac{2t^2}{\tan t}$

C. $\frac{\tan t}{t^2}$

D. none of these

Answer: A



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39. $\left| \int_{10}^{19} \frac{\sin x}{1+x^8} dx \right|$ is less than

A. 10^{-10}

B. 10^{-11}

C. 10^{-7}

D. 10^{-9}

Answer: C



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40. The smallest interval $[a,b]$ such that

$$\int_0^1 \frac{1}{\sqrt{1+x^4}} dx \in [a, b], \text{ is}$$

A. $\left[\frac{1}{\sqrt{2}}, 1 \right]$

B. $[0,1]$

C. $\left[\frac{1}{2}, 1 \right]$

D. $\left[\frac{3}{4}, 1 \right]$

Answer: A



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41. Let $I_n = \int_0^{\pi/2} \sin^n x dx, n \in N$. Then

A. $I_n : I_{n-2} = n : (n - 1)$

B. $I_n > I_{n-2}$

C. $n(I_{n-2} - I_n) = I_{n-2}$

D. none of these

Answer: C



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42. If $f(x) = \int_0^x \sin^4 t dt$, then $f(x + 2\pi)$ is equal to

A. $f(x)$

B. $f(x) + f(2\pi)$

C. $gf(x) - f(2\pi)$

D. $f(x) \cdot f(2\pi)$

Answer: B



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43. $\int_0^{\pi} \frac{1}{1 + 3^{\cos x}} dx$ is equal to

A. π

B. 0

C. $\pi/2$

D. none of these

Answer: C



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44. Let $\int_0^a f(x)dx = \lambda$ and $\int_0^a f(2a - x)dx = \mu$. Then,

$\int_0^{2a} f(x)dx$ equal to

A. $\lambda + \mu$

B. $\lambda - \mu$

C. $2\lambda - \mu$

D. $\lambda - 2\mu$

Answer: A



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45. The value of $\int_{\pi/4}^{3\pi/4} \frac{x}{1 + \sin x} dx$ is equal to

A. $(\sqrt{2} - 1)\pi$

B. $(\sqrt{2+1})\pi$

C. π

D. none of these

Answer: A



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46. Let $I_n = \int_0^{\pi/2} \cos^n x \cos nx dx$. Then, $I_n : I_{n+1}$ is equal to

A. 3 : 1

B. 2 : 3

C. 2 : 1

D. 3 : 4

Answer: C



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47. The value of $\int_{-1}^1 \max [2 - x, 2, 1 + x] dx$ is

A. 4

B. $9/2$

C. 2

D. none of these

Answer: B



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48. $\int_0^{\pi/4} \sin(x - [x]) dx$ is equal to

A. $\frac{1}{2}$

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

C. 1

D. none of these

Answer: B



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49. The value of the integral $\int_{-1}^1 (x - [2x]) dx$, is

A. 1

B. 0

C. 2

D. 4

Answer: A



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50. Let $f: R \in R$ be a continuous function such that $f(1)=2$. If

$$\lim_{x \rightarrow 1} \int - (2)^{f(x)} \frac{2t}{x-1} dt = 4, \text{ then the value of } f'(1) \text{ is}$$

A. 1

B. 2

C. 4

D. none of these

Answer: A



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51. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a continuous function such that $f(x)$ is not identically equal to zero. If $\int_0^x |x - 2| dx, x \geq 0$. Then, $f'(x)$ is

- A. an even function
- B. an odd function
- C. a periodic function
- D. none of these

Answer: D



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52. Let $f(x) = \int_0^x |x - 2| dx, x \geq 0$. Then, $f'(x)$ is

- A. continuous and non differentiable at $x=2$
- B. discontinuous at $x=4$

C. neither continuous nor differentiable at $x=2$

D. non-differentiable at $x=4$

Answer: A



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53. $\lim_{n \rightarrow \infty} \left\{ \frac{n!}{(kn)^n} \right\}^{\frac{1}{n}}, k \neq 0$, is equal to (A) $\frac{k}{e}$ (B) $\frac{e}{k}$ (C) $\frac{1}{ke}$ (D)

none of these

A. ke

B. $\frac{e}{k}$

C. $\frac{k}{e}$

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

Answer: D



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54. Let $f(x)$ be an integrable function defined on $[a,b], b > a > 0$.

If $I_1 = \int_{\pi/6}^{\pi/3} f(\tan\theta + \cos\theta)\sec^2\theta d\theta$ and,

$I_2 = \int_{\pi/6}^{\pi/3} f(\tan\theta + \cot\theta)\operatorname{cosec}^2\theta d\theta$, then $\frac{I_1}{I_2} =$

- A. a positive integer
- B. a negative integer
- C. an irrational number none of these
- D. none of these

Answer: A



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55. $\int_0^{\sqrt{2}} [x^2] dx$, is

A. $2 - \sqrt{2}$

B. $2 + \sqrt{2}$

C. $\sqrt{2} - 1$

D. $\sqrt{2} - 2$

Answer: C



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56. Let $f(x)$ be a function satisfying $f'(x)=f(x)$ with $f(0)=1$ and $g(x)$ be a function that satisfies $f(x) + g(x) = x^2$, Then the value of the integral $\int_0^1 f(x)g(x)dx$, is

A. $e + \frac{e^2}{2} + \frac{5}{2}$

B. $e - \frac{e^2}{2} - \frac{5}{2}$

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

D. $e - \frac{e^2}{2} - \frac{3}{2}$

Answer: D



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57. $\left(\sum_{n=1}^{10} \int_{-2n-1}^{-2n} \sin^{27}(x) dx + \sum_{n=1}^{10} \int_{2n}^{2n+1} \sin^{27}(x) dx \right)$

A. 27^2

B. -54

C. 54

D. 0

Answer: D



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58. If $f(y) = e^y = e^y$, $g(y) = y$, $y > 0$ and $F(t) = \int_0^t f(t-y)g(y)dy$,

then

A. $F(t) = te^{-t}$

B. $F(t) = 1 - e^{-t}(t + 1)$

C. $F(t) = e^t - (1 + t)$

D. $F(t) = te^t$

Answer: D



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59. If $I_n = \int_0^{\pi/2} x^n \sin x dx$, then $I_4 + 12I_2$ is equal to \

A. 4π

B. $3\left(\frac{\pi}{2}\right)^3$

C. $\left(\frac{\pi}{2}\right)^2$

D. $4\left(\frac{\pi}{2}\right)^3$

Answer: C



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60. $\int_0^1 \sin \left\{ 2 \tan^{-1} \sqrt{\frac{1+x}{1-x}} \right\} dx =$

A. $\pi/6$

B. $\pi/4$

C. $\pi/2$

D. π

Answer: B



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Chapter Test 2

1. The integral $\int_0^{r\pi} \sin^{2x} x dx$ is equal to

A. $r \int_0^{\pi} \sin^{2x} x dx$

B. $2r \int_0^{\pi} \sin^{2x} x dx$

$\pi/2$
C. $r \int_0^{\pi/2} \sin^2 x dx$

D. none of these

Answer: C



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2. The value of the integral $\int_0^2 x[x] dx$

A. $\frac{7}{2}$

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

C. $\frac{5}{2}$

D. none of these

Answer: B



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3. The value of integral $\sum_{k=1}^n \int_0^1 f(k-1+x)dx$ is

A. $\int_0^1 f(x)dx$

B. $\int_0^2 f(x)dx$

C. $\int_0^2 f(x)dx$

D. $n \int_0^2 f(x)dx$

Answer: C



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4. Let $f(x)$ be a function satisfying $f'(x)=f(x)$ with $f(0)=1$ and $g(x)$ be the function satisfying $f(x) + g(x) = x^2$. The value of integral

$\int_0^1 f(x)g(x)dx$ is,

A. $\frac{1}{4}(e - 7)$

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

C. $\frac{1}{4}(e - 3)$

D. none of these

Answer: D



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5. If $I = \int_0^1 \cos \left\{ 2 \cot^{-1} \sqrt{\frac{1-x}{1+x}} \right\} dx$ then

A. $I > \frac{1}{2}$

B. $I = -\frac{1}{2}$

C. $0 < I < \frac{1}{2}$

D. $I = \frac{1}{2}$

Answer: B



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6. The value of $\int_a^{a + (\pi/2)} (\sin^4 x + \cos^4 x) dx$ is

A. $\frac{3\pi}{8}$

B. $a \left(\frac{\pi}{2}\right)^2$

C. $\frac{3\pi a^2}{8}$

D. none of these

Answer: A



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7. The value of $\int_{-1}^2 \frac{|x|}{x} dx$ is

A. 0

B. 1

C. 3

D. none of these

Answer: B

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8. The value of $\int_0^1 \frac{x^3}{1+x^8} dx$ is

A. $\frac{\pi}{4}$

B. $\frac{\pi}{8}$

C. $\frac{\pi}{16}$

D. none of these

Answer: C



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9. The value of $\int_0^3 x\sqrt{1+x} dx$, is

A. $\frac{9}{2}$

B. $\frac{27}{4}$

C. $\frac{126}{15}$

D. $\frac{116}{15}$

Answer: D



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10. The value of the integral $\int_0^1 \log \sin\left(\frac{\pi x}{2}\right) dx$ is

A. $\log 2$

B. $-\log 2$

C. $\frac{\pi}{2} \log 2$

D. $-\frac{\pi}{2} \log 2$

Answer: B



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11. The value of the integral $\int_0^{\pi} x \log \sin x dx$ is

A. $\frac{\pi}{2} \log 2$

B. $\frac{\pi^2}{2} \log 2$

C. $-\frac{\pi^2}{2} \log 2$

D. none of these

Answer: C



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12. If $I_1 = \int_0^{\infty} \frac{dx}{1+x^4}$ and $I_2 = \int_0^{\infty} dx$ then $\frac{I_1}{I_2} =$

A. 1

B. 2

C. 1/2

D. none of these

Answer: A



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13. If $f(x) = \begin{cases} x & \text{for } x < 1 \\ x - 1 & \text{for } x \geq 1 \end{cases}$, then $\int_0^2 x^2 f(x) dx$ is equal to

A. 1

B. $\frac{4}{3}$

C. $\frac{5}{3}$

D. $\frac{5}{2}$

Answer: C



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14. The value of the integral $\int_0^2 \frac{1}{(x^2 + 1)^{3/2}} dx$ is

A. $1/2$

B. $\sqrt{2}/2$

C. 1

D. $\sqrt{2}$

Answer: B



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15. If $\int_0^{2a} f(x) dx = \int_0^{2a} f(x) dx$, then

A. $f(2a - x) = -f(x)$

B. $f(2a - x) = f(x)$

C. $f(x)$ is an odd function

D. $f(x)$ is an even function

Answer: B



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16. If $\int_0^{36} \frac{1}{2x+9} dx = \log k$, is equal to

A. 3

B. $9/2$

C. 9

D. 81

Answer: A



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17. The value of the integral $\int_0^{\pi/2} \sin^6 x dx$, is

A. $\frac{3\pi}{4}$

B. $\frac{5}{32}\pi$

C. $\frac{3}{16}\pi$

D. none of these

Answer: B



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18. If $\int_0^{\infty} e^{-x^2} dx = \sqrt{\frac{\pi}{2}}$ then $\int_0^{\infty} e^{-ax^2} dx, a > 0$, is

A. $\frac{\sqrt{\pi}}{2}$

$$\sqrt{\pi}$$

B. $\frac{\sqrt{\pi}}{2a}$

C. $2\frac{\sqrt{\pi}}{a}$

D. $\frac{1}{2}\left(\sqrt{\frac{\pi}{a}}\right)$

Answer: D



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19. The value of the integral $\int_0^{\infty} \frac{1}{1+x^4} dx$ is

A. $\frac{\pi}{2}$

B. $\frac{\pi}{\sqrt{2}}$

C. $\frac{\pi}{2\sqrt{2}}$

D. none of these

Answer: C



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20. If $\int_{\pi/2}^x \sqrt{3 - 2\sin^2 u} dx + \int dx$ equal $\pi/2$

A. $\frac{\sqrt{4 - 3\sin^2 x}}{\cos y}$

B. $-\frac{\sqrt{3 - 2\sin^2 x}}{\cos y}$

C. $\sqrt{3 - 2\sin^2 x} + \cos y$

D. none of these

Answer: B



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21. The value of $\alpha \in [0, 2\pi]$ which does not satisfy the equation

$$\int_{\pi/2}^{\alpha} \sin x dx = \sin 2\alpha, \text{ is}$$

A. π

B. $\frac{3\pi}{2}$

C. $\frac{7\pi}{6}$

D. $\frac{11\pi}{6}$

Answer: A



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22. $\lim_{x \rightarrow 0} \frac{\int_0^t (x^2) \sin \sqrt{t} dt}{x^3}$ is equal to

A. $1/3$

B. 1

C. 2/3

D. none of these

Answer: C



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23. If x satisfies the equation

$$x^2 \left(\int_0^1 \frac{dt}{t^2 + 2t \cos \alpha + 1} \right) - x \left(\int_{-3}^3 \frac{t^2 + \sin 2t}{t^2 + 1} \right) - 2 = 0$$

($0 < \alpha < \pi$), then the value of x , is

A. $\pm 2 \sqrt{\frac{\sin \alpha}{\alpha}}$

B. $\pm \sqrt{\frac{\sin \alpha}{\alpha}}$

C. $\pm 4\sqrt{\frac{\sin\alpha}{\alpha}}$

D. none of these

Answer: A



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24. The value of $\alpha \in (-\pi, 0)$ satisfying $\sin\alpha + \int_{\alpha}^{2\alpha} \cos 2x dx = 0$, is

A. $-\pi/2$

B. $-\pi$

C. $-\pi/3$

D. π

Answer: C



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25. The value of $\int_0^{\pi/2} \frac{\sin^3 x \cos x}{\sin^4 x + \cos^4 x} dx$ is

A. $\pi/8$

B. $\pi/4$

C. $\pi/2$

D. π

Answer: A



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26. The value of $\int_0^{\pi} \frac{1}{5 + 3\cos x} dx$, is

A. π

B. $2\pi/3$

C. $\pi/4$

D. 2

Answer: C



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27. $\lim_{n \rightarrow \infty} \left[\sin' \frac{\pi}{n} + \sin' \frac{2\pi}{n} + \dots + \sin' \frac{(n-1)\pi}{n} \right]$ is equal to :

A. 0

B. π

C. 2

D. none of these

Answer: C



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28. $\lim_{n \rightarrow \infty} \sum_{r=1}^n \left\{ \frac{r^3}{r^4 + n^4} \right\}$ equals

A. $\log 2$

B. $\frac{1}{2} \log 2$

C. $\frac{1}{3} \log 2$

D. $\frac{1}{4} \log 2$

Answer: D



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29. $\lim_{n \rightarrow \infty} \left[\left(1 + \frac{1}{n}\right) \left(1 + \frac{2}{n}\right) \left(1 + \frac{n}{n}\right) \right]^{\frac{1}{n}}$

A. $e/4$

B. $4/e$

C. $2/e$

D. none of these

Answer: B



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30. Evaluate: $\left(\lim_{n \rightarrow \infty} n \left[\frac{1}{na} + \frac{1}{na+1} + \frac{1}{na+2} + \dots + \frac{1}{nb} \right] \right)$

A. $\log\left(\frac{b}{a}\right)$

B. $\log\left(\frac{a}{b}\right)$

C. $\log a$

D. $\log b$

Answer: A



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31. The solution of the equation $\int_0^x \frac{1}{x\sqrt{2^2 - 1}} dx = \frac{\pi}{12}$, is

A. $x=3$

B. $x=4$

C. $x=1$

D. none of these

Answer: D



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32. Let $I_n = \int_0^{\pi/4} \tan^n x dx$, ($n > 1$ and $n \in N$), then

A. $I_n = I_{n-2}$

B. $I_n + I_{n-2} = \frac{1}{n-1}$

C. $I_n - I_{n-2} = \frac{1}{n-1}$

D. none of these

Answer: B



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33. If $I_m = \int_1^x (\log x)^m dx$ satisfies the relation $I_m = k - lI_{m-1}$ then,

A. $k=e$

B. $l=m$

C. $k = \frac{1}{e}$

D. none of these

Answer: B



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34. If $I_m = \int_0^\infty e^{-x} x^{n-1} dx$, then $\int_0^\infty e^{-\lambda x} x^{n-1} dx$

A. λI_n

B. $\frac{1}{\lambda} I_n$

$$C. \frac{I_n}{\lambda^n}$$

$$D. \lambda^n I_n$$

Answer: C



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35. If $I(m, n) = \int_0^1 x^{m-1}(1-x)^{n-1} dx$ then

$$A. I(m, n) = \int_0^{\infty} \frac{x^{m-1}}{(1+x)^{m+n}} dx = \int_0^{\infty} \frac{x^{n-1}}{(1+x)^{m+n}} dx$$

$$B. I(m, n) = \int_0^{\infty} \frac{x^m}{(1+x)^{m+n}} dx = \int_0^{\infty} \frac{x^n}{(1+x)^{m+n}} dx$$

$$C. I(m, n) = \int_0^{\infty} \frac{x^n}{(1+x)^{m+n-1}} dx = \int_0^{\infty} \frac{x^n}{(1+x)^{m+n-1}} dx$$

D. none of these

Answer: A



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36. The total number of extremum(s) of $y = \int_0^{x^2 t^2 - 5t + 4} \frac{dt}{2 + e^t}$ are

A. $x = 0, \pm 1, +_1$

B. $X = \pm 1, \pm 2, \pm 3$

C. $x = 0, 1, 2, 3$

D. none of these

Answer: A

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37. The tangent to the curve $y = f(x)$ at the point with abscissa $x = 1$ from an angle of $\pi/6$ and at the point $x = 2$ an angle of

$\pi/3$ and at the point $x = 3$ and angle of $\pi/4$ with positive direction of x-axis in anticlockwise direction respectively. If

$f'(x)$ is continuous, then the value of

$$\int_1^3 f'(x)f(x)dx + \int_2^3 f'(x)dx \text{ is}$$

(where $f^n(x) = \frac{d^n y}{dx^n}$)

A. $\frac{4\sqrt{3} - 1}{3}$

B. $\frac{3\sqrt{3} - 1}{2}$

C. $\frac{4 - 3\sqrt{3}}{3}$

D. $\frac{4 + 3\sqrt{3}}{3}$

Answer: C



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38. $\int_{-\pi}^{\pi} \frac{2x(1 + \sin x)}{1 + \cos^2 x} dx$ is

A. $\pi^2/4$

B. π^2

C. 0

D. $\pi/2$

Answer: B



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39. The value of the inntegral $\int_{\alpha}^{\beta} \frac{1}{\sqrt{(x - \alpha)(\beta - x)}} dx$ is

A. 0

B. $\pi/2$

C. π

D. none of these

Answer: C



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40. The value of the integral $\int_{\alpha}^{\beta} \sqrt{(x - \alpha)(\beta - x)} dx$, is

A. $\frac{\pi}{4}(\beta - \alpha)^2$

B. $\frac{\pi}{2}(\beta - \alpha)^2$

C. $\frac{\pi}{8}(\beta - \alpha)^2$

D. none of these

Answer: C



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41. If $\int_0^{x^2} \sqrt{1-t^2} dt$, then $f'(x)$ equals

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

B. $\sqrt{1+x^4}$

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

D. none of these

Answer: C



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42. The value of integral $\int_1^e (\log x)^3 dx$, is

A. $6 + 2e$

B. $6 - 2e$

C. $2e - 6$

D. none of these

Answer: B



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43. If $\int_x^{x^4} \sin \sqrt{t} dt$, $f'(x)$ equals

A. $\sin x^2 - \sin x$

B. $4x^3 \sin x^2 - 2 \sin x$

C. $x^4 \sin x^2 - x \sin x$

D. none of these

Answer: B



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44. $\lim_{n \rightarrow \infty} \left[\left(1 + \frac{1}{n}\right) \left(1 + \frac{2}{n}\right) \left(1 + \frac{n}{n}\right) \right]^{\frac{1}{n}}$

A. $4/e$

B. $e/4$

C. $4e$

D. none of these

Answer: A



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45. The value of $\lim_{n \rightarrow \infty} \left[\left(1 + \frac{1}{n^2}\right) \left(1 + \frac{2^2}{n^2}\right) \dots \left(1 + \frac{n^2}{n^2}\right) \right]^{\frac{1}{n}}$

A. $\frac{e^{\pi/2}}{2e^2}$

B. $2e^2e^{\pi/2}$

C. $\frac{2}{e^2}e^{\pi/2}$

D. none of these

Answer: C



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46. If $\int_0^1 e^{x^2}(x - \alpha)dx = 0$ then

A. $1 < \alpha < 2$

B. $\alpha < 0$

C. $0 < \alpha < 1$

D. $\alpha = 0$

Answer: C



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47. If $f(x)$ satisfies the requirements of Rolle's Theorem in $[1,2]$ and $f(x)$ is continuous in $[1,2]$ then $\int_1^2 f(x) dx$ is equal to

A. 0

B. 1

C. 3

D. -1

Answer: A



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48. The value of the integral $\int_0^1 \cot^{-1}(1 - x + x^2) dx$, is

A. $\pi - \log 2$

B. $\frac{\pi}{2} - \log 2$

C. $\pi + \log 2$

D. $\frac{\pi}{2} + \log 2$

Answer: B



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49. The integral $\int_{-1}^1 \frac{|x+2|}{x+2} dx$ is equal to

A. 1

B. 2

C. 0

D. -1

Answer: B

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50. Let $I = \int_0^1 \frac{x^x}{x+1} dx$, then the value of the integral $\int_0^1 \frac{xe^{x^2}}{x+1} dx$, is

A. I^2

B. $\frac{1}{2}I$

C. $2I$

D. $\frac{1}{2}I^2$

Answer: B

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51. The value of the integral $\int_0^\pi \frac{x dx}{1 + \cos\alpha \sin x}$, $0 < \alpha < \pi$, is

A. $\frac{\pi\alpha}{\sin\alpha}$

B. $\frac{\pi\alpha}{1 + \sin\alpha}$

C. $\frac{\pi\alpha}{\cos\alpha}$

D. $\frac{\pi\alpha}{1 + \cos\alpha}$

Answer: A



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52. $\int_\pi^{10\pi} |\sin x| dx$ is equal to

A. 20

B. 8

C. 10

D. 18

Answer: D



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53. If $\int_0^{\pi} \frac{1}{a + b \cos x} dx = \frac{\pi}{\sqrt{a^2 - b^2}}$, then $\int_0^{\pi} \frac{1}{(a + b \cos x)^2} dx$ is

A. $\frac{\pi a}{(a^2 - b^2)^{3/2}}$

B. $\frac{\pi b}{(a^2 - b^2)^{3/2}}$

C. $\frac{\pi}{(a^2 - b^2)^{3/2}}$

D. none of these

Answer: A



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54. If $\int_1^{\infty} e^{-ax} dx = \frac{1}{a}$, then $\int_1^{\infty} x^n e^{-ax} dx$ is,

A. $\frac{(-1)^n n!}{a^{n+1}}$

B. $\frac{(-1)^n (n-1)!}{a^n}$

C. $\frac{n!}{a^{n+1}}$

D. none of these

Answer: C



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55. The value of $\int_{\pi}^{2\pi} [2\sin x] dx$, where $[\]$ represents the greatest integer function, is

A. $-\frac{5\pi}{3}$

B. $-\pi$

C. $\frac{5\pi}{2}$

D. -2π

Answer: A



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56. If $f(x) = A\sin\left(\frac{\pi x}{2}\right) + B$, $f\left(\frac{1}{2}\right) = \sqrt{2}$ and $\int_0^1 f(x) dx = \frac{2A}{\pi}$ then

constants A and B are

A. $\frac{\pi}{2}$ and $\frac{\pi}{2}$

B. $\frac{2}{\pi}$ and $\frac{3}{\pi}$

C. 0 and $-\frac{4}{\pi}$

D. $\frac{4}{\pi}$ and 0

Answer: D



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57. If $I_{m,n} = \int_0^1 x^m (\ln x)^n dx$ then $I_{m,n}$ is also equal to

A. $\frac{n}{n+1} I_{m,n-1}$

B. $\frac{-m}{n+1} I_{m,n-1}$

C. $\frac{-n}{n+1} I_{m,n-1}$

D. $\frac{m}{n+1} I_{m,n-1}$

Answer: C



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58. $\lim_{n \rightarrow \infty} \frac{1^{99} + 2^{99} + 3^{99} + \dots + n^{99}}{n^{100}} =$

A. $\frac{99}{100}$

B. $\frac{1}{100}$

C. $\frac{1}{99}$

D. $\frac{1}{101}$

Answer: B



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59. If $I_n = \int_0^{\pi/4} \tan^n x dx$, $\lim_{n \rightarrow \infty} n(I_{n+1} + I_{n-1})$ equals

A. 1

B. 2

C. $\pi/4$

D. π

Answer: A



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60. $\int_0^a f(x) dx = \lambda$ and $\int_0^a f(2a - x) dx = \mu$, then $\int_0^{2a} f(x) dx =$

A. $\lambda + \mu$

B. $\lambda - \mu$

C. $2\lambda + \mu$

D. $\lambda + 2\mu$

Answer: B



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