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IIT JEE

Physics DPP

DPP-8 Basic Maths: Definite Integration
By Physicsaholics Team

Q) Find $\int_1^3 x \, dx = ?$

(a) 2

(b) 4

(c) 6

(d) 8

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Ans. b

$$I = \int_1^3 x \, dx$$

$$I = \left[\frac{x^2}{2} + c \right]_1^3$$

$$I = \left(\frac{3^2}{2} + \cancel{c} \right) - \left(\frac{1^2}{2} + \cancel{c} \right)$$

$$I = \frac{3^2}{2} - \frac{1^2}{2} = \frac{9-1}{2}$$

$$\boxed{I = 4}$$

Q) Find $\int_{-2}^1 (5z^2 - 7z + 3) dz = ?$

(a) 69

(b) $-\frac{69}{2}$

(c) $\frac{69}{2}$

(d) $\frac{89}{2}$

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Ans. c

$$I = \int_{-2}^1 (5z^2 - 7z + 3) dz$$

$$I = \left(\frac{5z^3}{3} - \frac{7z^2}{2} + 3z \right)_{-2}^1$$

$$I = \left(\frac{5}{3} - \frac{7}{2} + 3 \right) - \left(-\frac{40}{3} - \frac{28}{2} - 6 \right)$$

$$I = \frac{+45}{3} + \frac{21}{2} + 9 = \frac{207}{6}$$

$$I = \frac{69}{2}$$

Q) Find $\int_0^{\frac{\pi}{2}} (7 \sin t - 2 \cos t) dt = ?$

(a) π

(b) 5

(c) $\frac{\pi}{2}$

(d) $\frac{5}{2}$

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Ans. b

$$I = \int_0^{\pi/2} (7 \sin t - 2 \cos t) dt$$

$$= \int_0^{\pi/2} (7 \sin t) dt - \int_0^{\pi/2} 2 \cos t dt$$

$$= 7 \int_0^{\pi/2} (\sin t) dt - 2 \int_0^{\pi/2} (\cos t) dt$$

$$= 7 (-\cos t) \Big|_0^{\pi/2} - 2 (\sin t) \Big|_0^{\pi/2}$$

$$= 7 [-\cos \frac{\pi}{2} + \cos 0] - 2 (\sin \frac{\pi}{2} - \sin 0)$$

$$= 7 [-0 + 1] - 2 [1 - 0]$$

$$= 7 - 2$$

$$\boxed{I = 5}$$

Q) Find $\int_5^2 \left(\frac{2}{y}\right) dy = ?$

(a) $2 \ln(2 - 5)$

(c) $2 \ln 2 - \ln 5$

(b) $\ln \frac{2}{5}$

(d) $2 \ln \frac{2}{5}$

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Ans. d

$$I = \int_{+5}^{+2} \left(\frac{2}{y}\right) dy = 2 \int_{+5}^{+2} \frac{1}{y} dy$$

$$I = 2 \left[\ln(y) \right]_{+5}^{+2} = 2 \left[\ln(2) - \ln(5) \right]$$

$$I = 2 \ln\left(\frac{2}{5}\right)$$

Q) Find $\int_{-1}^1 (2 e^x) dx = ?$

(a) $2 \left(\frac{e^2 - 1}{e} \right)$

(b) $2 \left(\frac{e^2}{e - 1} \right)$

(c) $2(e^2)$

(d) $2(e^2 - 1)$

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Ans. a

$$I = \int_{-1}^1 (2e^u) du = 2 \int_{-1}^1 e^u du$$

$$= 2 [e^u]_{-1}^1$$

$$= 2 (e^1 - e^{-1})$$

$$= 2 \left(e - \frac{1}{e} \right)$$

$$\boxed{I = 2 \left(\frac{e^2 - 1}{e} \right)}$$

Q) Find $\int_1^2 \left(x^2 + \frac{1}{x^2} \right) dx = ?$

(a) 17

(c) 27

(b) $\frac{17}{6}$

(d) $\frac{27}{6}$

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Ans. b

$$I = \int_1^2 (x^2 + x^{-2}) dx$$

$$I = \left(\frac{x^3}{3} + \frac{x^{-2+1}}{-2+1} \right)_1^2$$

$$I = \left[\frac{x^3}{3} - \frac{1}{x} \right]_1^2$$

$$I = \left[\left(\frac{8}{3} - \frac{1}{2} \right) - \left(\frac{1}{3} - 1 \right) \right]$$

$$I = \frac{7}{3} + \frac{1}{2}$$

$$\boxed{I = \frac{17}{6}}$$

Q) Find $\int_e^{e^2} \frac{dx}{x} = ?$

(a) 1

(c) e

(b) $\frac{1}{2}$

(d) $\frac{1}{e}$

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Ans. a

$$I = \int_e^{e^2} \frac{dx}{x} = [\ln(x)]_e^{e^2}$$

$$I = \ln e^2 - \ln e$$

$$I = 2 \ln e - \ln e$$

$$I = 2(1) - (1)$$

$$I = 2 - 1$$

$$\boxed{I = 1}$$

Q) Find $\int_0^{\frac{\pi}{2}} \sin \left(2x + \frac{\pi}{4} \right) dx = ?$

(a) $\frac{1}{2}$

(c) $\frac{1}{2\sqrt{2}}$

(b) $\frac{1}{\sqrt{2}}$

(d) $\sqrt{2}$

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Ans. b

$$I = \int_0^{\pi/2} \sin(2x + \frac{\pi}{4}) dx$$

$$\text{Now, } \int \sin(2x + \frac{\pi}{4}) = ?$$

$$\therefore \int \sin(ax + b) = \underline{\underline{-\frac{\cos(ax+b)}{a} + c}}$$

$$I = \left[\underline{\underline{-\frac{\cos(2x + \pi/4)}{2}}} \right]_0^{\pi/2}$$

Q) Find $\int_0^1 \frac{1}{(x+1)} dx = ?$

(a) *zero*

(c) $\ln 3$

(b) $\ln 2$

(d) $2 \ln 2$

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Ans. b

$$I = \int_0^1 \frac{1}{(x+1)} dx$$

$$\therefore \int \frac{1}{ax+b} dx = \frac{\ln(ax+b)}{a} + c$$

$$\therefore I = \int_0^1 \frac{1}{x+1} dx = \left[\frac{\ln(x+1)}{1} \right]_0^1$$

$$I = \ln(2) - \ln(1)$$

$$I = \ln(2) - 0$$

$$\boxed{I = \ln(2)}$$

Q) Find $\int_{-1}^1 (3x + 2)^3 dx = ?$

(a) 50

(c) 52

(b) 51

(d) 53

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Ans. c

$$I = \int_{-1}^1 (3x+2)^3 dx$$

$$\therefore \int (ax+b)^n = \frac{(ax+b)^{n+1}}{a(n+1)} + c$$

$$\therefore I = \int_{-1}^1 (3x+2)^3 dx = \left[\frac{(3x+2)^4}{3(4)} \right]_{-1}^1$$

$$I = \left[\frac{(3x+2)^4}{12} \right]_{-1}^1 = \left[\frac{5^4}{12} - \frac{(-1)^4}{12} \right]$$

$$I = \frac{624}{12} = 52$$

$$\boxed{I = 52}$$

Q) Find $\int_0^4 \frac{1}{\sqrt{x}} dx = ?$

(a) 1

(c) 3

(b) 2

(d) 4

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Ans. d

$$I = \int_0^4 \frac{1}{\sqrt{x}} dx = \int_0^4 x^{-1/2} dx$$

$$= \left[\frac{x^{-\frac{1}{2}+1}}{-\frac{1}{2}+1} \right]_0^4 = \left[\frac{x^{1/2}}{1/2} \right]_0^4$$

$$= [2\sqrt{x}]_0^4 = [2\sqrt{4} - 2\sqrt{0}]$$

$$= [2 \cdot 2 - 0]$$

$$\boxed{I = 4}$$

Q) Find $\int_0^{\frac{\pi}{2}} (e^x + \sin x) dx = ?$

(a) $e^{\frac{\pi}{2}}$

(c) $e^{\frac{\pi}{2}} - 1$

(b) $e^{\frac{\pi}{2}} + 1$

(d) 1

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Ans. a

$$I = \int_0^{\pi/2} (e^u + \sin u) du$$

$$= [e^u - \cos u]_0^{\pi/2}$$

$$= [(e^{\pi/2} - \cos \frac{1}{2}) - (e^0 - \cos 0)]$$

$$= [(e^{\pi/2} - 0) - (1 - 1)]$$

$$\boxed{I = e^{\pi/2}}$$

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Chalo Niklo