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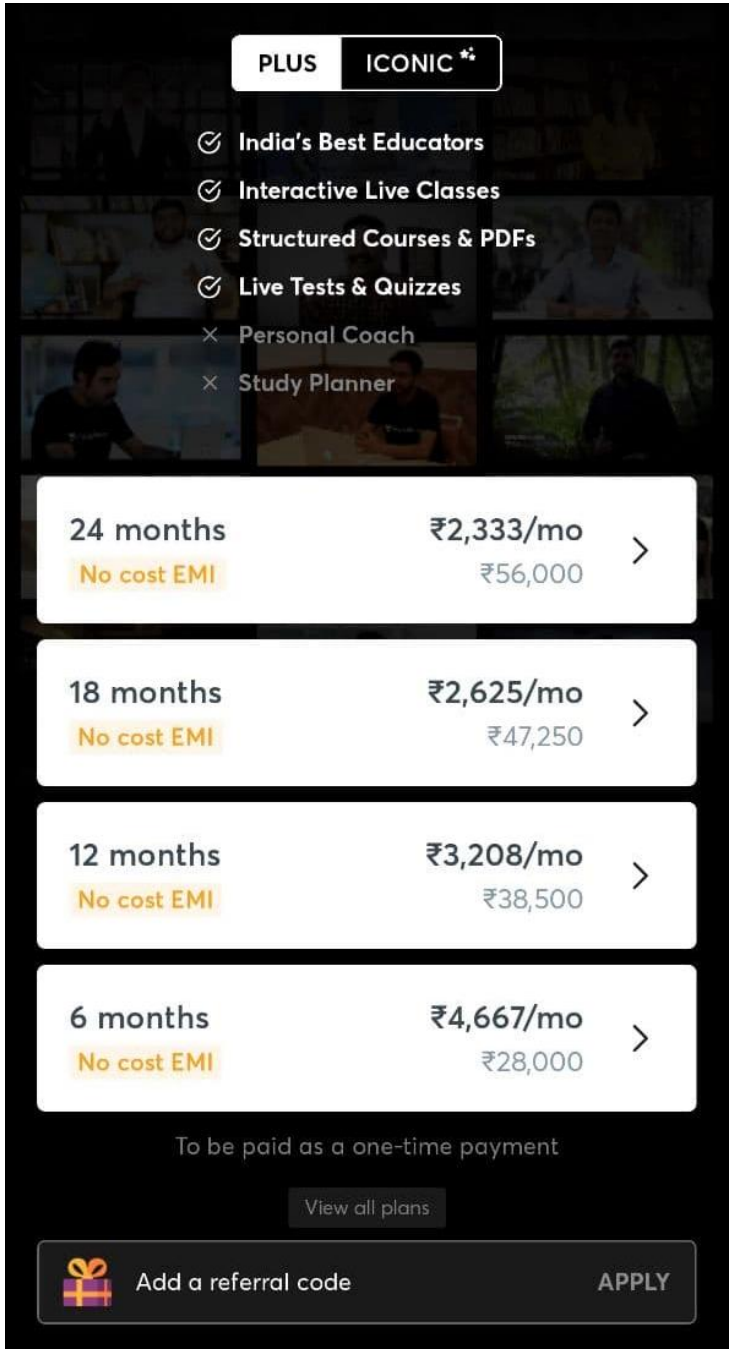

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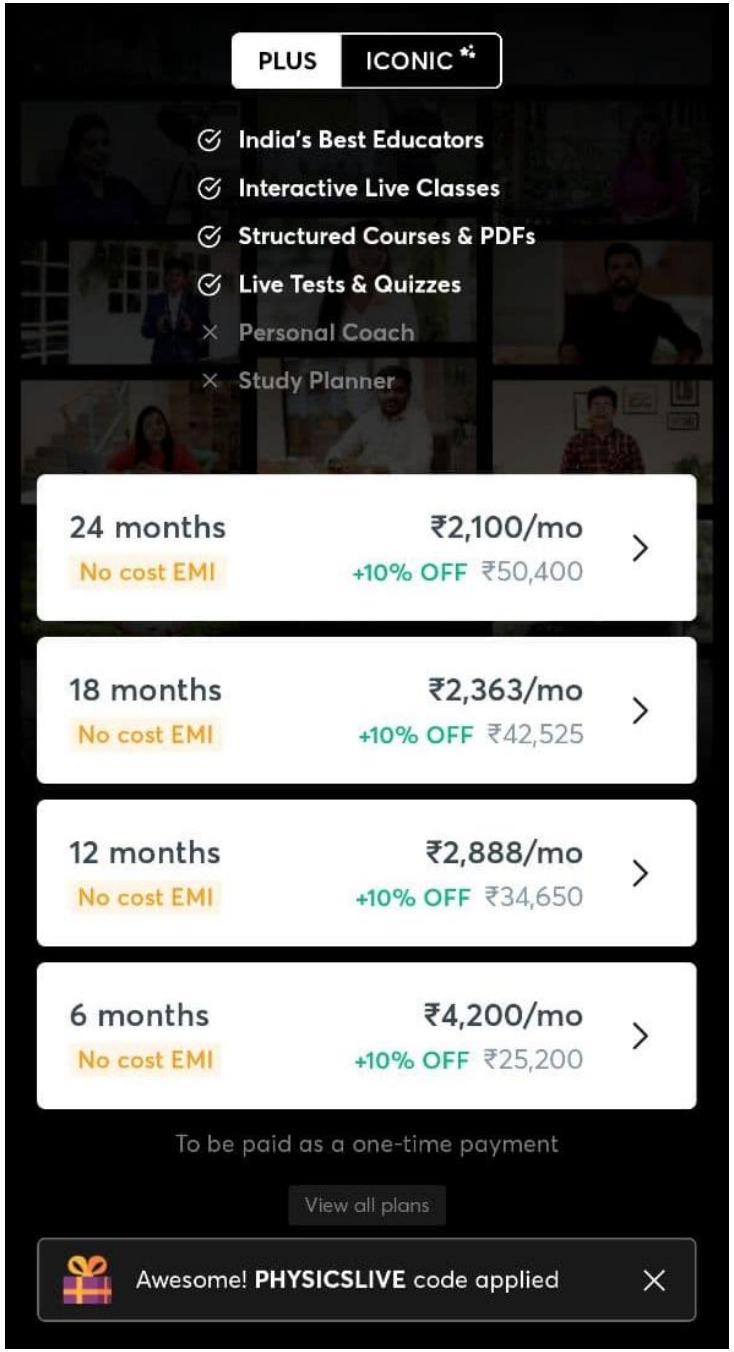

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IIT JEE
Physics DPP

DPP-8 Basic Maths: Definite Integration

By Physicsaholics Team

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

(a) 2 (b) 4 (c) 6 (d) 8

Ans. b

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

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

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

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

$$\boxed{I = 4}$$

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

(a) 69 (b) $-\frac{69}{2}$ (c) $\frac{69}{2}$ (d) $\frac{89}{2}$

Ans. c

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

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

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

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

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

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

(a) π (b) 5 (c) $\frac{\pi}{2}$ (d) $\frac{5}{2}$

Ans. b

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

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

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

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

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

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

$$= 7 - 2$$

$$\boxed{I = 5}$$

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

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

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

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

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

Ans. d

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

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

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

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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) $2(e^2-1)$

Ans. a

$$I = \int_{-1}^{1} (2e^x)\, dx = 2\int_{-1}^{1} e^x\, dx$$

$$= 2\left[e^x\right]_{-1}^{1}$$

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

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

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

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

(a) 17

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

(c) 27

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

Ans. b

$$I = \int_1^2 (x^2 + x^{-3})\, dx$$

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

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

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

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

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

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

(a) 1

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

(c) e

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

Ans. a

$$I = \int_{e}^{e^2} \frac{dx}{x} = \left[\ln(x) \right]_{e}^{e^2}$$

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

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

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

$$I = 2 - 1$$

$$\boxed{I = 1}$$

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

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

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

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

(d) $\sqrt{2}$

Ans. b

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

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

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

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

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

(a) *zero*

(b) ln 2

(c) ln 3

(d) 2 ln 2

Ans. b

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

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

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

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

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

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

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

(a) 50

(b) 51

(c) 52

(d) 53

Ans. c

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

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

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

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

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

$$\boxed{I = 52}$$

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

(a) 1
(b) 2
(c) 3
(d) 4

Ans. d

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

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

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

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

$$\boxed{I = 4}$$

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

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

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

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

(d) 1

Ans. a

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

$$= \left[e^x - \cos x\right]_0^{\pi/2}$$

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

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

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

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Chalo Niklo