

Formula**Basic Maths (Physics)**

$$\# \int x^n dx = \left(\frac{x^{n+1}}{n+1} \right) + C.$$

$$\# \int e^x \cdot dx = \frac{e^x}{1} + C.$$

$$\# \int \frac{dx}{x} = \underline{\ln x} + C$$

$$\# \int \underline{\sin x} dx = -\frac{\cos x}{1} + C$$

$$\# \int \cos x dx = \sin x + C$$

$$\Rightarrow \int e^{\overbrace{ax+b}} dx = \frac{1}{a} (e^{\overbrace{ax+b}}) + C.$$

$$\Rightarrow \int \frac{dx}{a+\overbrace{bx}} = \frac{\ln(a+bx)}{b}$$

$$\Rightarrow \int \sin \overbrace{Kx} dx = -\frac{\cos Kx}{K} + C$$

$$\Rightarrow \int \underline{\cos Kx} dx = \frac{\sin Kx}{K} + C$$

$$\frac{d}{dx} \ln(x) = \frac{1}{x}$$

Basic Maths (Physics)

Upper limit
↓
 $x=b$
Definite Integration

$$\int_{\substack{x=a \\ \text{lower limit}}}^{\substack{x=b \\ \text{upper limit}}} f(x) \cdot dx = \left[g(x) \right]_a^b = \boxed{g(b) - g(a)}$$

$$\int f(x) \cdot dx = g(x)$$

$$= \left(\frac{2}{3} + 2 \right)$$

$$= \frac{8}{3} \text{ Sq. unit}$$

Ex:-

$$y = (x^2 - 2x + 1)$$

$$\int_{-1}^{+1} y \cdot dx = \int_{-1}^{+1} (x^2 - 2x + 1) \cdot dx$$

$$= \int_{-1}^{+1} x^2 \cdot dx - 2 \int_{-1}^{+1} x \cdot dx + \int_{-1}^{+1} 1 \cdot dx$$

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

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

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

$$= \frac{1}{3} [1+1] - \{0\} + \{2\}$$

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

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Integrate the functions

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

$\int_0^1 x^{3/2} dx = \frac{\left[x^{\frac{3}{2}+1} \right]_0^1}{\frac{3}{2}+1} = \frac{2}{5} \left[x^{5/2} \right]_0^1 = \frac{2}{5} \left[(1)^{5/2} - (0)^{5/2} \right] = \frac{2}{5} \underline{\underline{\text{Ans}}}$

$\int_0^1 \left(\frac{1}{\sqrt{x}} + x^2 \right) dx = \int_0^1 (x^{-1/2} + x^2) dx = \int_0^1 x^{-1/2} dx + \int_0^1 x^2 dx = \frac{\left[x^{-1/2+1} \right]_0^1}{-\frac{1}{2}+1} + \frac{\left[x^{2+1} \right]_0^1}{2+1}$

$\int_0^1 e^{3x+2} dx = \frac{\left[e^{3x+2} \right]_0^1}{3} = \frac{1}{3} \left[e^{(3 \times 1)+2} - e^{(3 \times 0)+2} \right] = \left(\frac{e^5 - e^2}{3} \right) \underline{\underline{\text{Ans}}}$

$= 2 \left[x^{1/2} \right]_0^1 + \frac{1}{3} \left[x^3 \right]_0^1 = \frac{2+1}{3} = \frac{7}{3} \underline{\underline{\text{Ans}}}$

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$$\int_0^{\pi/4} \sin 2x \, dx = ??$$

$$\boxed{\frac{\pi}{4} = 45^\circ}$$

Radian degree

$$\int \sin Kx \, dx = \frac{-\cos Kx}{K}$$

$$= -\frac{[\cos 2x]}{2} \Big|_0^{\pi/4}$$

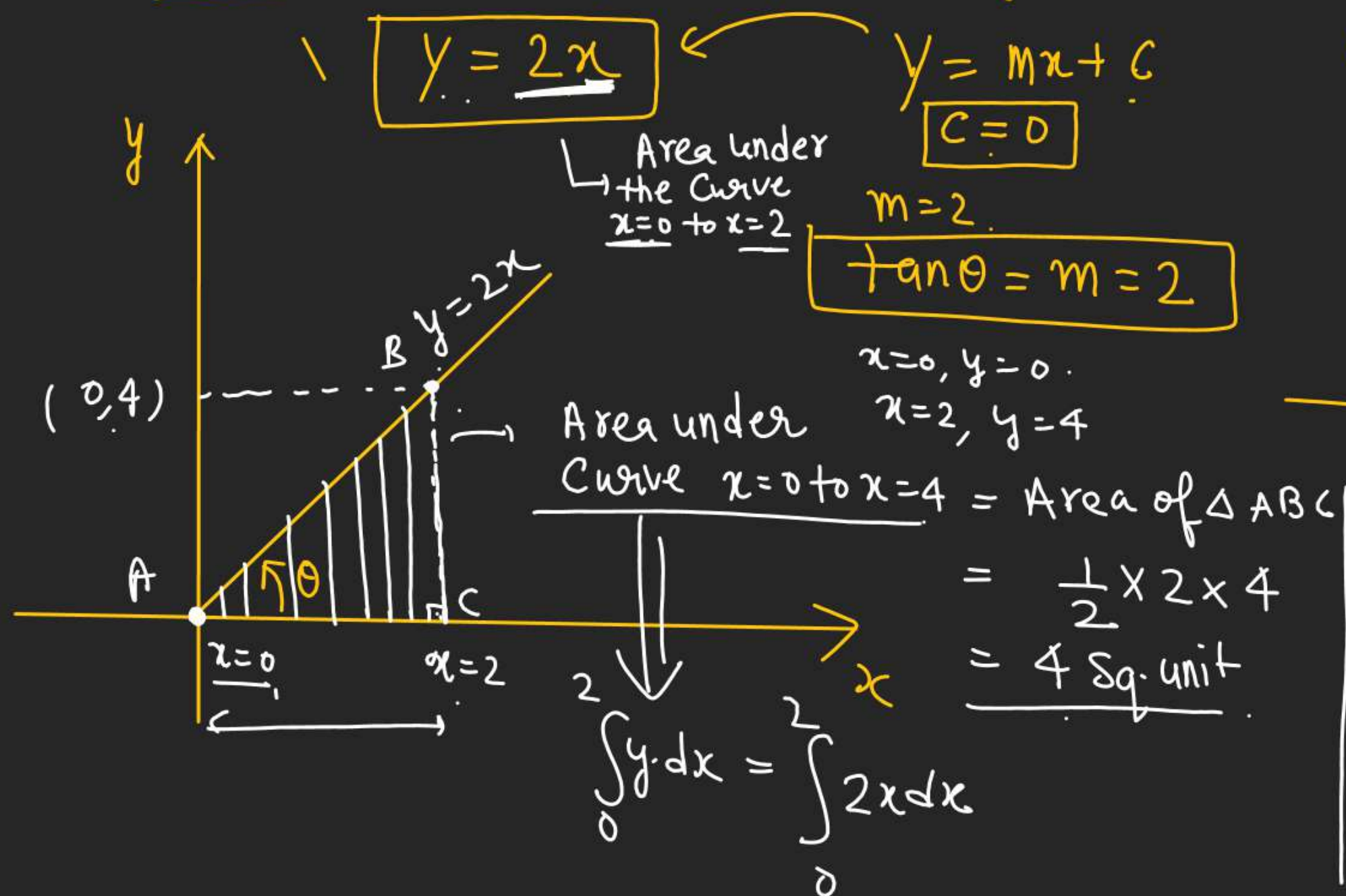
$$\left[\begin{array}{c} \cos \frac{\pi}{2} = 0 \\ \downarrow \\ \cos 90 = 0 \\ [\cos 0 = +1] \end{array} \right]$$

$$= -\frac{1}{2} \left[\cos 2\left(\frac{\pi}{4}\right) - \cos 0 \right]$$

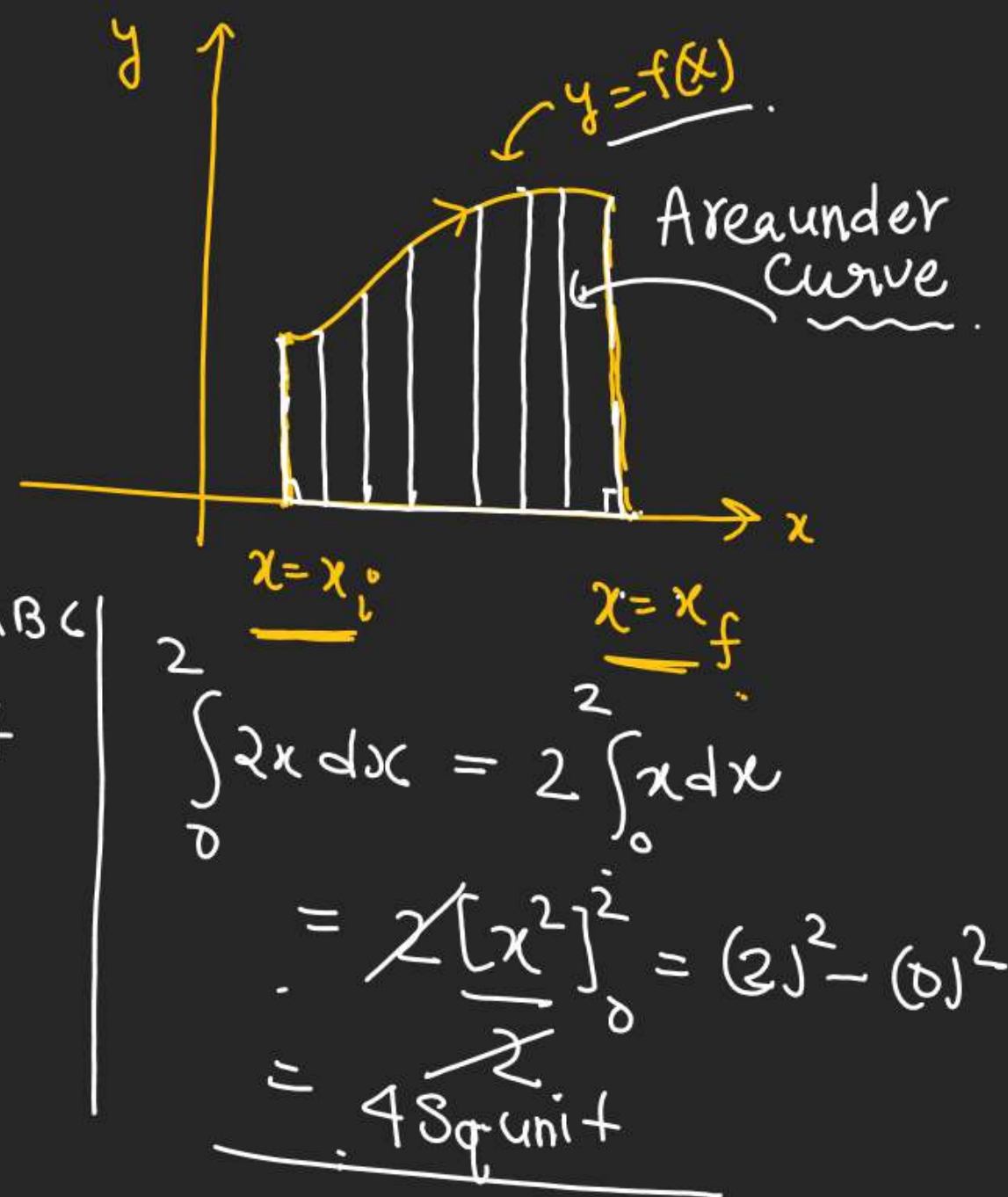
$$= -\frac{1}{2} [0 - (+1)] = \left(\frac{1}{2}\right) \underline{\underline{\text{Ans}}}$$

Basic Maths (Physics)

Geometrical meaning of definite integration



Area under the Curve

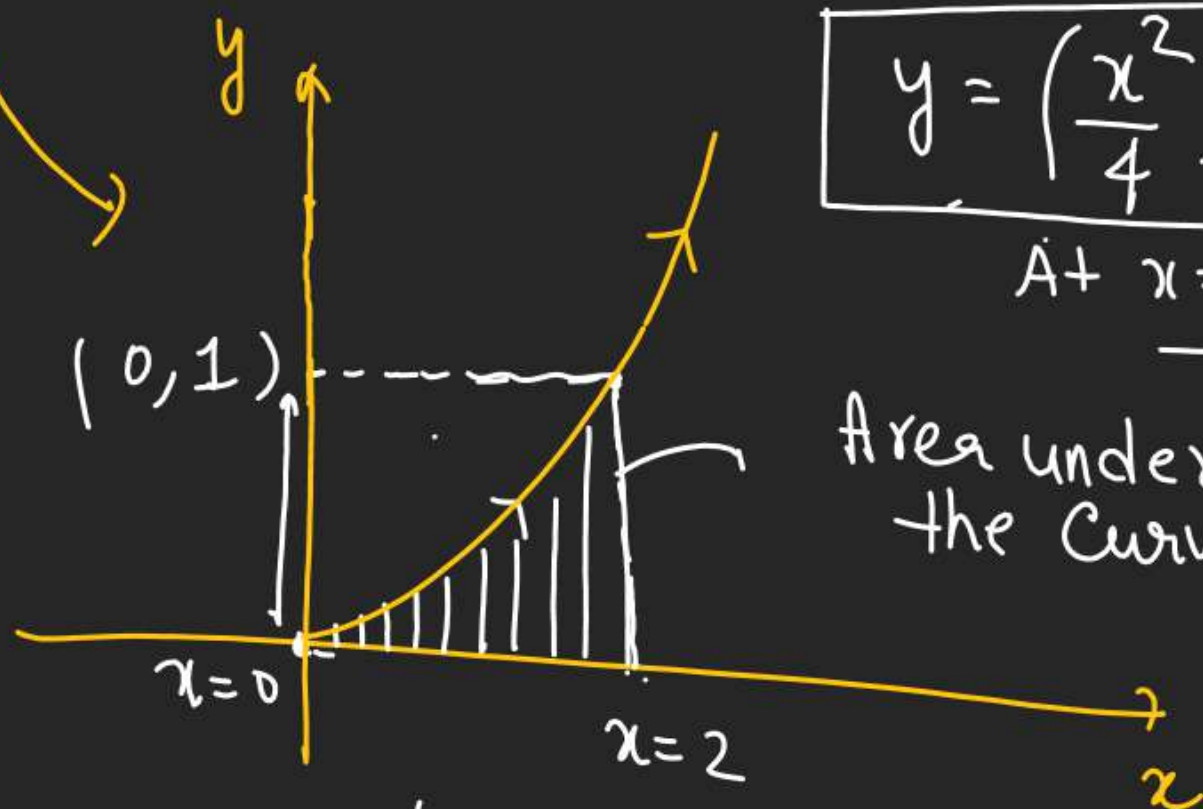


Basic Maths (Physics)

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$$x^2 = 4y$$

Find Area under the Curve from $x=0$ to $x=2$.



$$y = \left(\frac{x^2}{4}\right)$$

At $x=2, y=1$

Area under the Curve =

$$\int_0^2 \left(\frac{x^2}{4}\right) dx = \frac{1}{4} \int_0^2 x^2 dx$$

$$= \frac{1}{4} \left[\frac{x^3}{3} \right]_0^2 = \frac{1}{12} [x^3]_0^2 = \frac{1}{12} [2^3 - 0^3] = \frac{8}{12} = \left(\frac{2}{3}\right) \text{ Sq. unit}$$

$$x^2 = 4ay$$

#.

$$\int_0^1 (e^{-x} + e^{+x}) dx \quad \begin{array}{l} x^0 = 1 \\ e^0 = 1 \end{array}$$

$$= \int_0^1 e^{-x} dx + \int_0^1 e^x dx$$

$$= \frac{[e^{-x}]_0^1}{(-1)} + \frac{[e^x]_0^1}{1}$$

$$= -(e^{-1} - e^0) + (e^1 - e^0)$$

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

$$(e - \frac{1}{e}) \text{ Ans.}$$

(★)

$$y = (x^3 + 2x^2 + 1)$$

Find $\left(\frac{d^2y}{dx^2}\right)_{x=2} = ??$

$$\frac{d^2y}{dx^2} = \frac{d}{dx} \left(\frac{dy}{dx} \right)$$

$$\frac{dy}{dx} = (3x^2 + 4x)$$

$$\frac{d^2y}{dx^2} = \frac{d}{dx} (3x^2 + 4x)$$

$$= 3 \frac{d}{dx} (x^2) + 4 \frac{d}{dx} (x)$$

$$\left(\frac{d^2y}{dx^2} \right) = (6x + 4)$$

$$\left(\frac{d^2y}{dx^2} \right)_{x=2} = (6 \times 2) + 4 = \underline{16} \text{ } \textcircled{\text{Q}}$$