Nishant Jindal

Basic Maths (Physics)

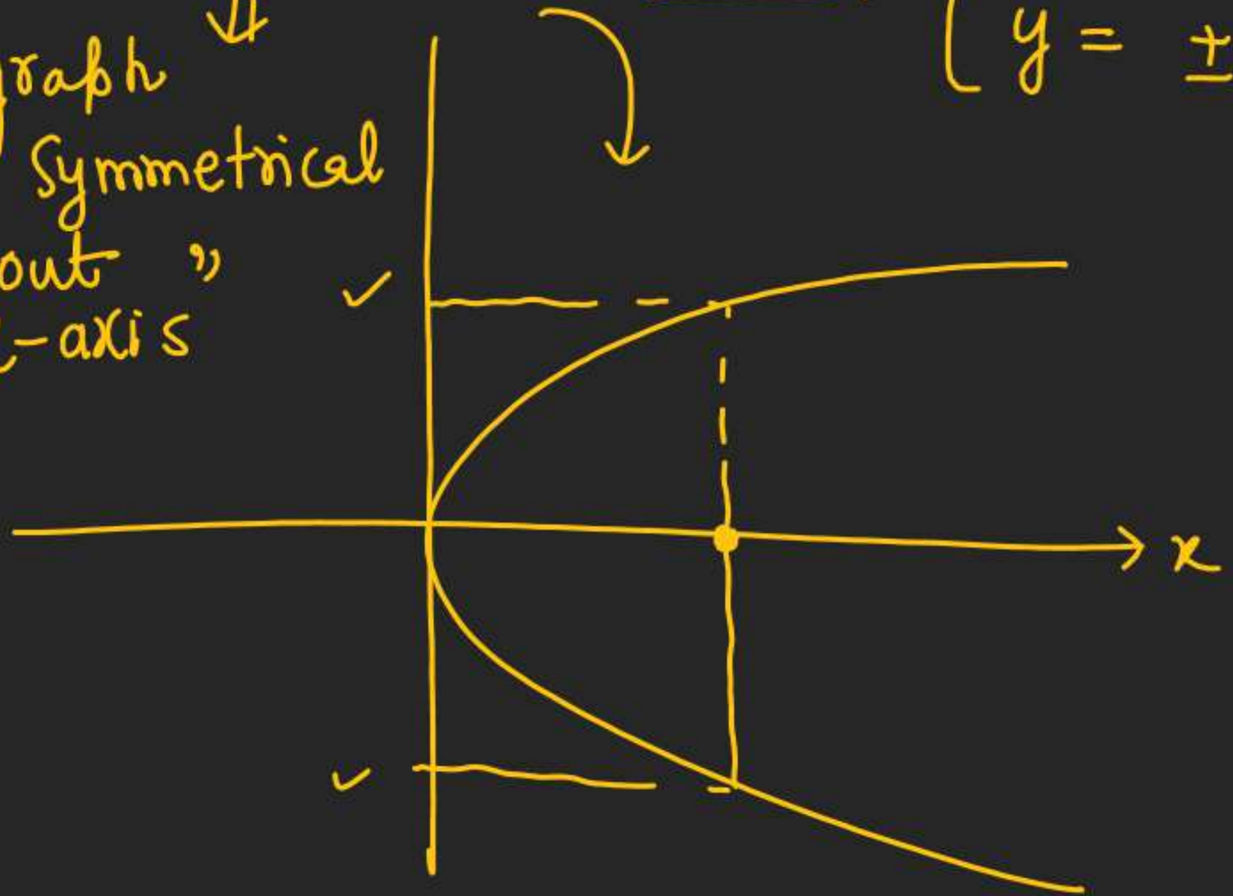
$$\boxed{y^2 = 4ax}$$

$\Downarrow$

i.e graph is symmetrical about x-axis

$x > 0$

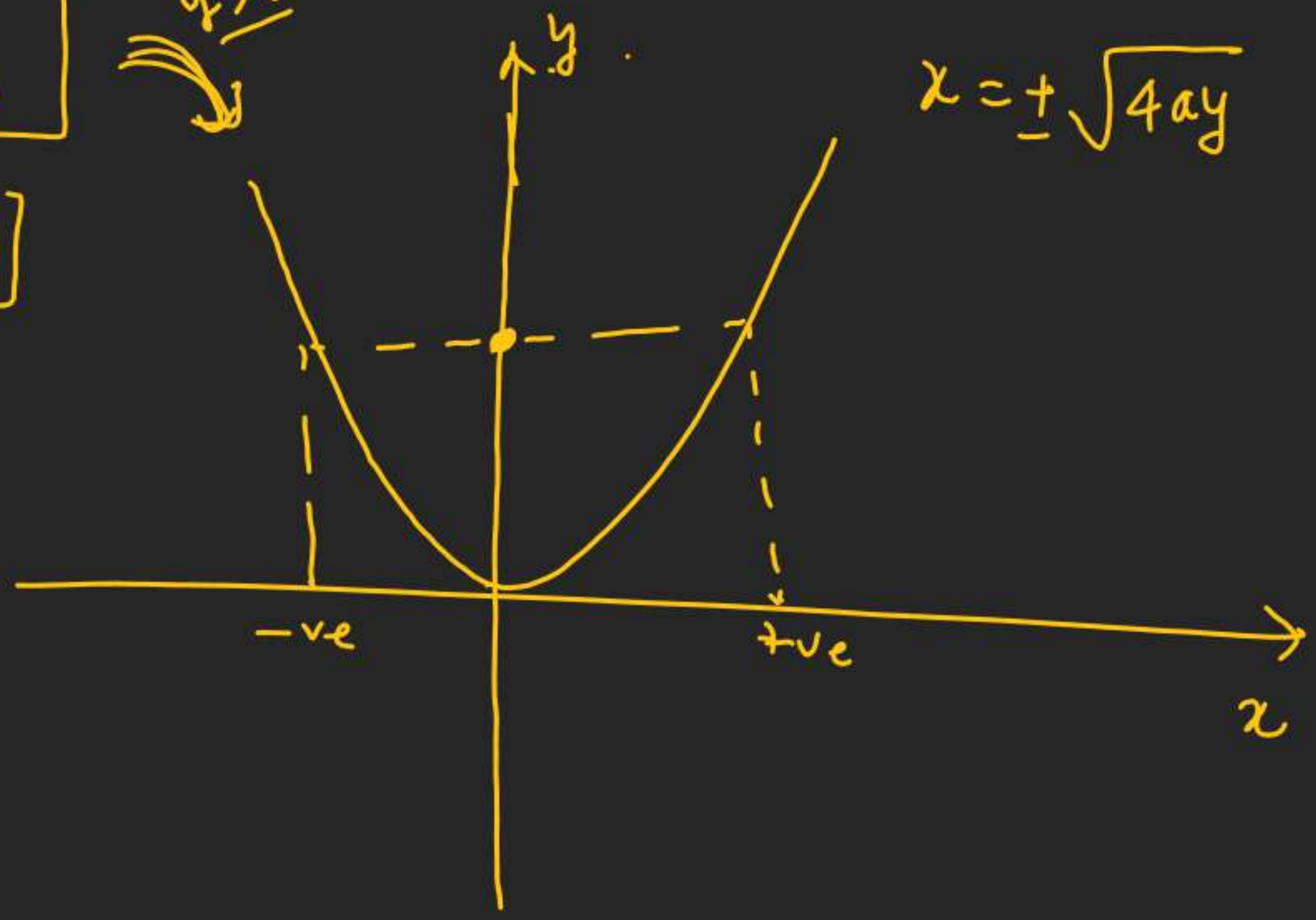
$$\left[\, y = \pm\sqrt{4ax} \,\right]$$



$$\boxed{x^2 = 4ay}$$

$y > 0$

$$x = \pm\sqrt{4ay}$$



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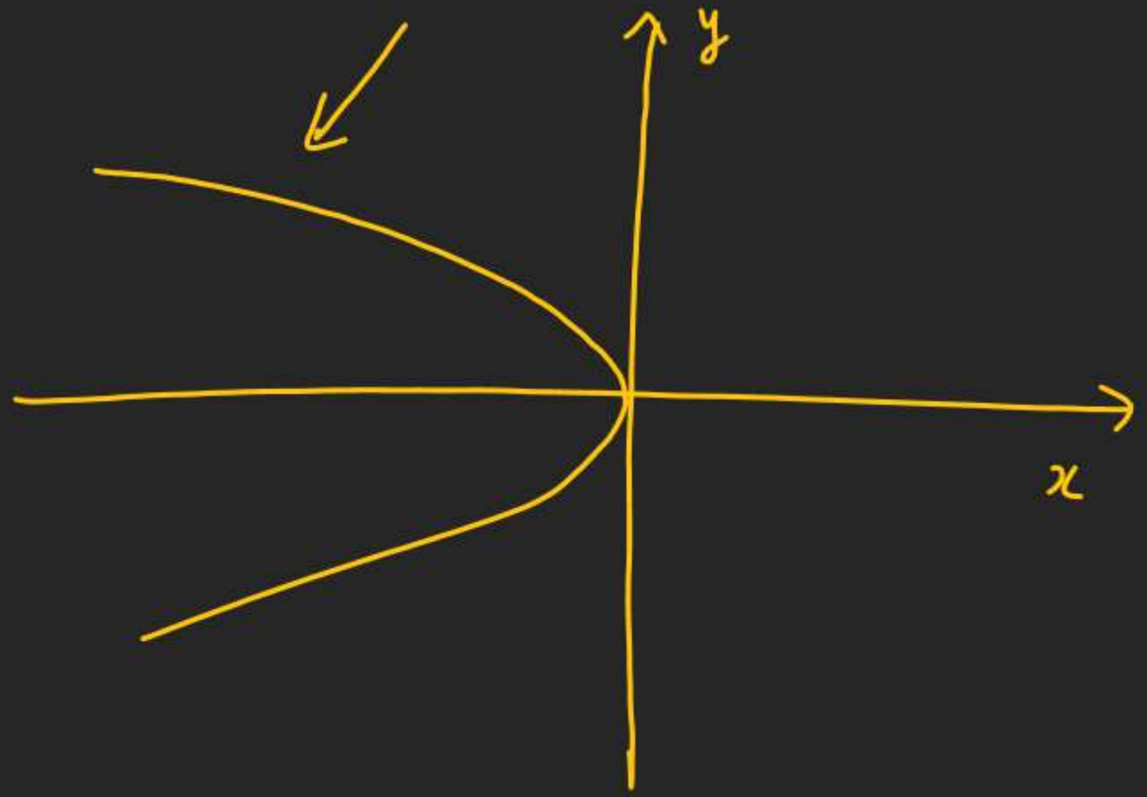
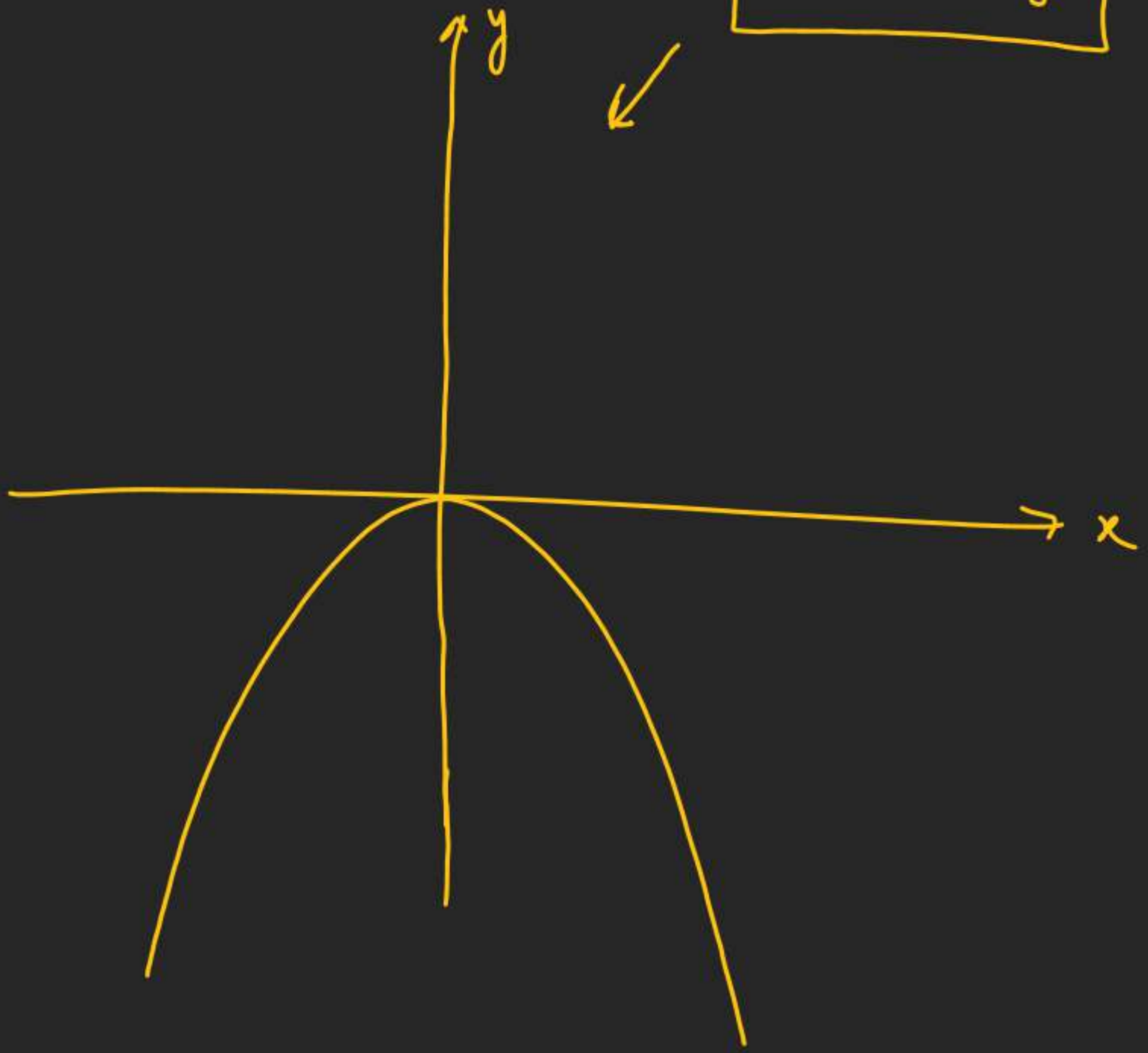
Basic Maths (Physics)

$$\boxed{y^2 = -4ax}$$



$$\boxed{x^2 = -4ay}$$



Basic Maths (Physics)

→ 3^{rd} kinematics Equation

$[v^2 = u^2 + 2as]$ ⇒ (acclerated Motion)

$\boxed{v \to f(s)}$

Dependent Variable — Independent Variable

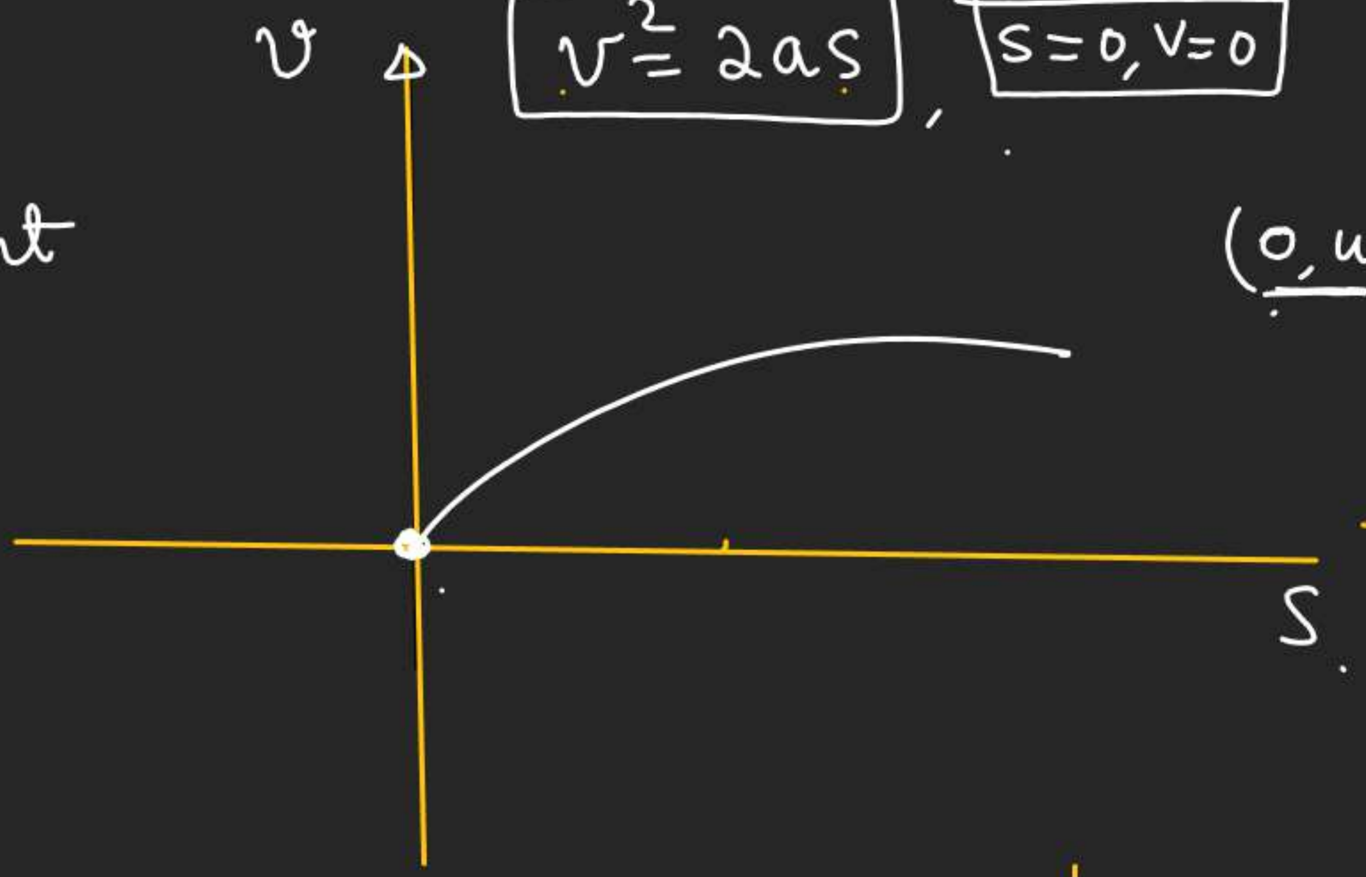
If $\boxed{u=0}$

$\boxed{v^2 = 2as}$

↓

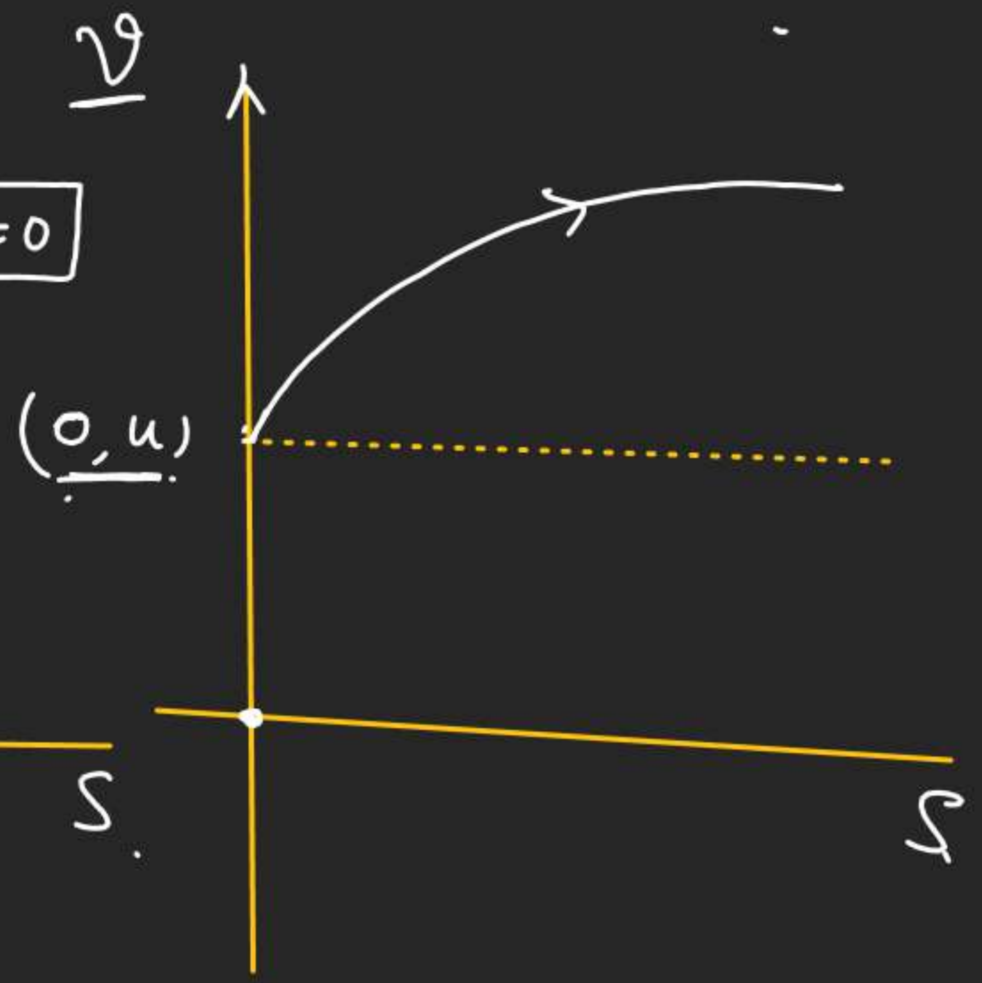
$\boxed{y^2 = 4ax}$

$\boxed{v^2 = 2as}$, $\boxed{s=0, v=0}$



$v^2 = u^2 + 2as$.

$s=0$, $\boxed{v=u}$.



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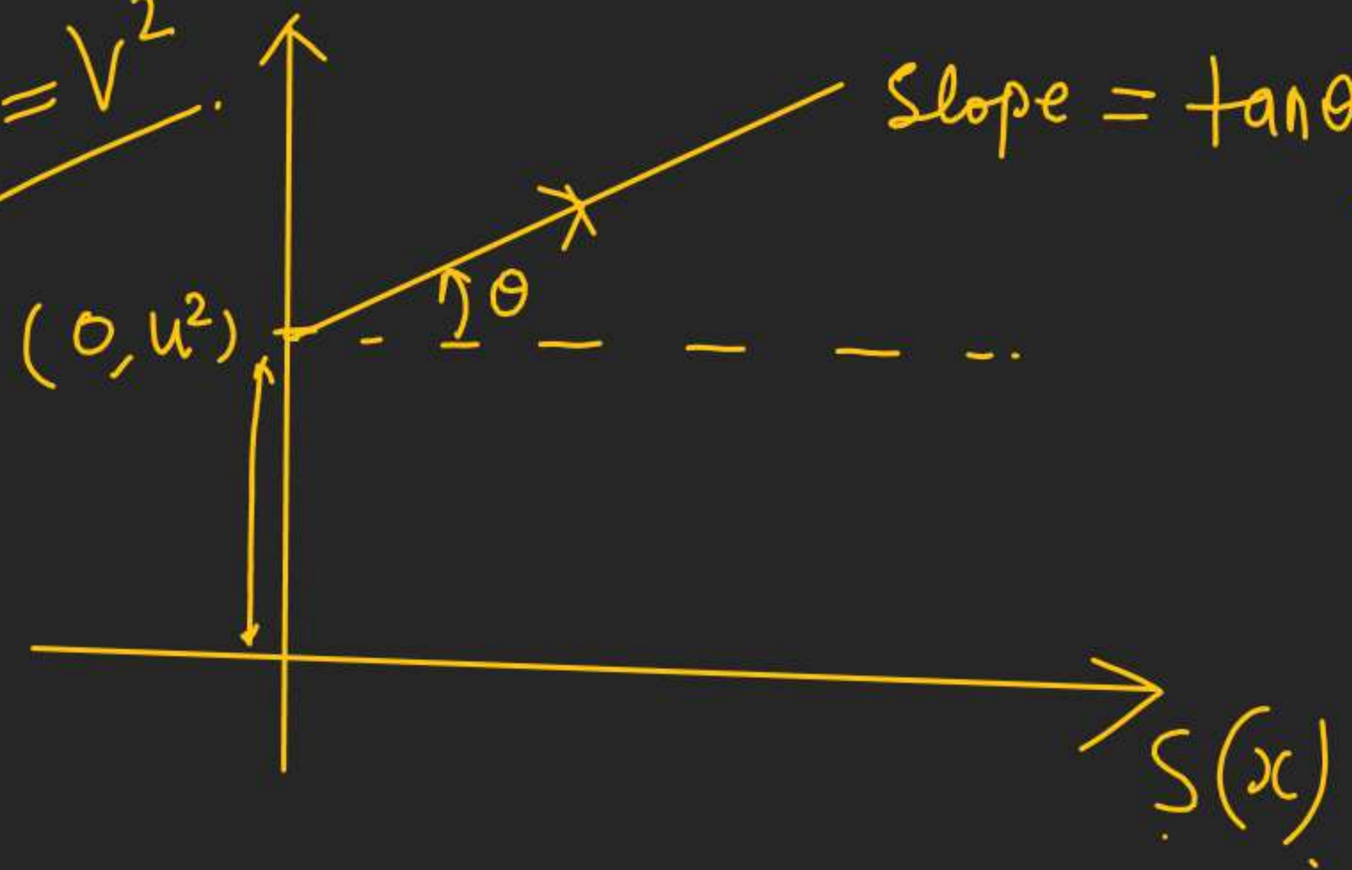
Basic Maths (Physics)

$$y = c + m x.$$

$$\boxed{v^2 = u^2 + \widetilde{2a}\, s}$$

At $s = 0$,
$v^2 = u^2$.

$y = v^2$.



Slope $= \tan\theta =$ "($\underline{2 \times \text{accleration}}$)"

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Differentiation :-

$\boxed{y = f(x)}$ → y as a function of x.

$y = (x^2,)$ $y = (e^x,)$ $y = (\sin x,)$ $y = (\log x)$

$\left(\frac{dy}{dx}\right)$ → [It is rate of change of 'y' w.r.t x]

→ [Differentiating 'y' w.r. x]

$y = f(x)$

$$\boxed{\left(\frac{dy}{dx}\right) = f'(x)}$$

Dependent variable ↓ Independent variable ↓

$y = f(t)$.

$\left(\frac{dy}{dt}\right)$ ⇒ Rate of Change of y w.r.t 't'

↳ Differentiating 'y' w.r.t t

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Basic Maths (Physics)

Dependent variable

Independent

$$\boxed{x = f(y)}$$

With respect to

$\left(\frac{dx}{dy}\right) \rightarrow$ Rate of Change of x w.r.t y

$\hookrightarrow$ Differentiating x w.r.t y

Rules for Differentiation.

(I) Differentiation of a constant function is alway zero.

$$\boxed{y = c}$$ $c \rightarrow$ Constant

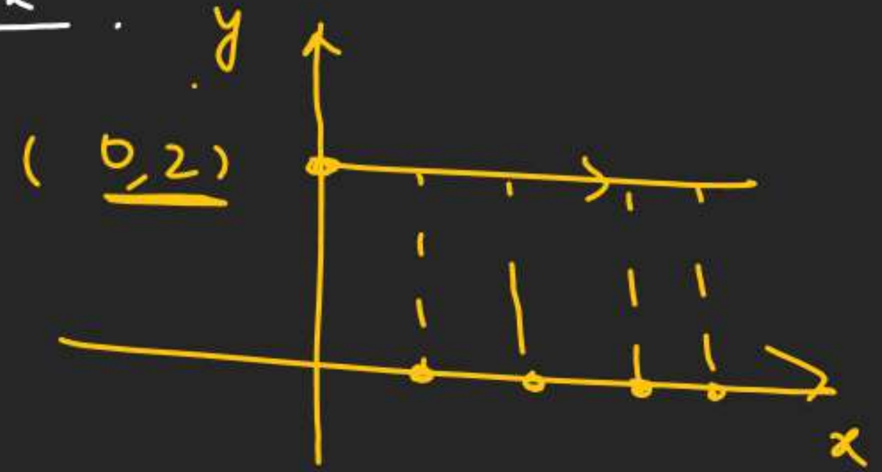
$$\boxed{\frac{dy}{dx} = \frac{d}{dx}(c) = 0}$$

$$\left[y = 2,\ y = \frac{1}{2},\ y = -2\right]$$

(Constant function)

$$\boxed{y = 2}$$

Ex.



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Rule - (II)

$$\boxed{y = K f(x)}$$

K → Constant.

$$\boxed{\frac{dy}{dx} = \frac{d}{dx}\{K[f(x)]\} = K\frac{d}{dx}[f(x)]}$$

Ex:-

$$y = 2x^2$$

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

Rule - III

↳ $$\boxed{y = f(x) \pm g(x)}$$

$$\frac{dy}{dx} = \frac{d}{dx}[f(x)] \pm \frac{d}{dx}[g(x)]$$

Ex:-

$$y = \underbrace{5x^2}_{f(x)} + \underbrace{2x}_{g(x)}$$

$$\frac{dy}{dx} = \frac{d}{dx}(5x^2) + \frac{d}{dx}(2x)$$

$$= 5\frac{d}{dx}(x^2) + 2\frac{d}{dx}(x)$$

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Rule - IV (product rule)

$$y = \underset{(\mathrm{I})}{f(x)} \cdot \underset{(\mathrm{II})}{g(x)}$$

$$\boxed{\frac{dy}{dx} = \mathrm{I}\,\frac{d}{dx}(\mathrm{II}) + \mathrm{II}\,\frac{d}{dx}(\mathrm{I})}$$

$$\boxed{\frac{dy}{dx} = f(x)\,\frac{d}{dx}(g(x)) + g(x)\,\frac{d}{dx}(f(x))}$$

Rule - V (Division Rule)

$$\boxed{y = \frac{f(x)}{g(x)}} \quad f(x) \to N, \quad g(x) \to D$$

$$\boxed{\frac{dy}{dx} = \frac{D\,\frac{d}{dx}(N) - N\,\frac{d}{dx}(D)}{D^2}}$$

$$\frac{dy}{dx} = \frac{g(x)\,\frac{d}{dx}[f(x)] - f(x)\,\frac{d}{dx}[g(x)]}{[g(x)]^2}$$

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$\boxed{x^0 = 1}$

(*) Formulae for Differentiation

$\Rightarrow \boxed{y = x^n}$

$$\boxed{\frac{dy}{dx} = \frac{d}{dx}(x^n) = n\,x^{n-1}}$$

Ex:- $y = [5x^2 - 2x + 1]$

a) Differentiate the function = ??

b) Find $\left(\frac{dy}{dx}\right)_{x=2} = ??$

$$\frac{dy}{dx} = \frac{d}{dx}(5x^2) - \frac{d}{dx}(2x) + \frac{d}{dx}(1)$$

$$= 5\frac{d}{dx}(x^{2=n}) - 2\frac{d}{dx}(x^1) + \frac{d}{dx}(1)$$

$$= 5\times 2[x^{2-1}] - 2(1)x^{1-1}) + 0$$

$$\boxed{\frac{dy}{dx} = 10x^1 - 2}$$

$\Downarrow$

$$f'(x) = 10x - 2$$

$$\frac{dy}{dx} = (10x - 2)$$

$$\left(\frac{dy}{dx}\right)_{x=2} = (10\times 2 - 2) = 18$$

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Basic Maths (Physics)

Differentiate

a) $y = \left(x^5 + \frac{1}{x^4} + 1\right)$

Find $\left(\frac{dy}{dx}\right)_{x=1} = ??$

$\frac{1}{x^4} = x^{-4}$

$$\boxed{\frac{d}{dx}x^n = nx^{n-1}}$$

$$\frac{dy}{dx} = \frac{d}{dx}(x^5) + \frac{d}{dx}(x^{-4}) + \frac{d}{dx}(1)$$

$$= 5x^{(5-1)} - 4x^{(-4-1)} + 0$$

$$\boxed{\frac{dy}{dx} = 5x^4 - 4x^{-5}}$$

$$\frac{dy}{dx} = 5x^4 - \frac{4}{x^5}$$

$\frac{d}{dx}(x^5) = 5x^{5-1}$

$= 5x^4$

$$\left(\frac{dy}{dx}\right)_{x=1} = 5(1)^4 - 4\frac{1}{(1)^5}$$

$$= 5 - 4$$

$$= 1$$