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Basic Maths (Physics)

(*) Geometrical meaning of differentiation:→ $y = f(x)$

Change in an interval = Δ

In $\triangle ABC$

$$\tan\theta = \left(\frac{\Delta y}{\Delta x}\right)$$

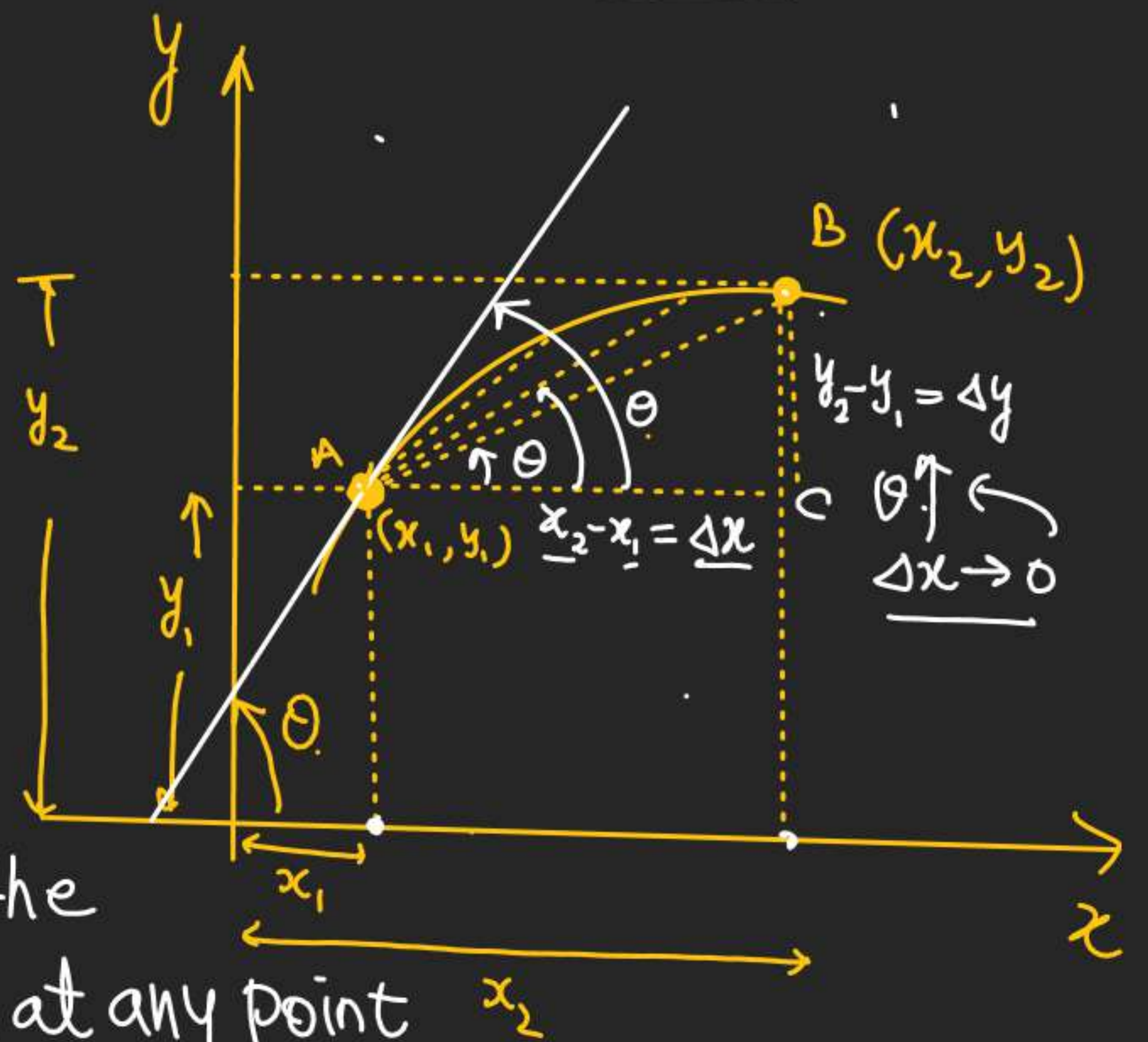
"Avg Change in y w.r.t x"

(limit)

$$\boxed{\lim_{\Delta x \to 0}\left(\frac{\Delta y}{\Delta x}\right) = \left(\frac{dy}{dx}\right)}$$

→ [It is Slope of the tangent drawn at any point on the Curve

$$\left(\frac{dy}{dx}\right)_{x=x_1} = \tan\theta$$



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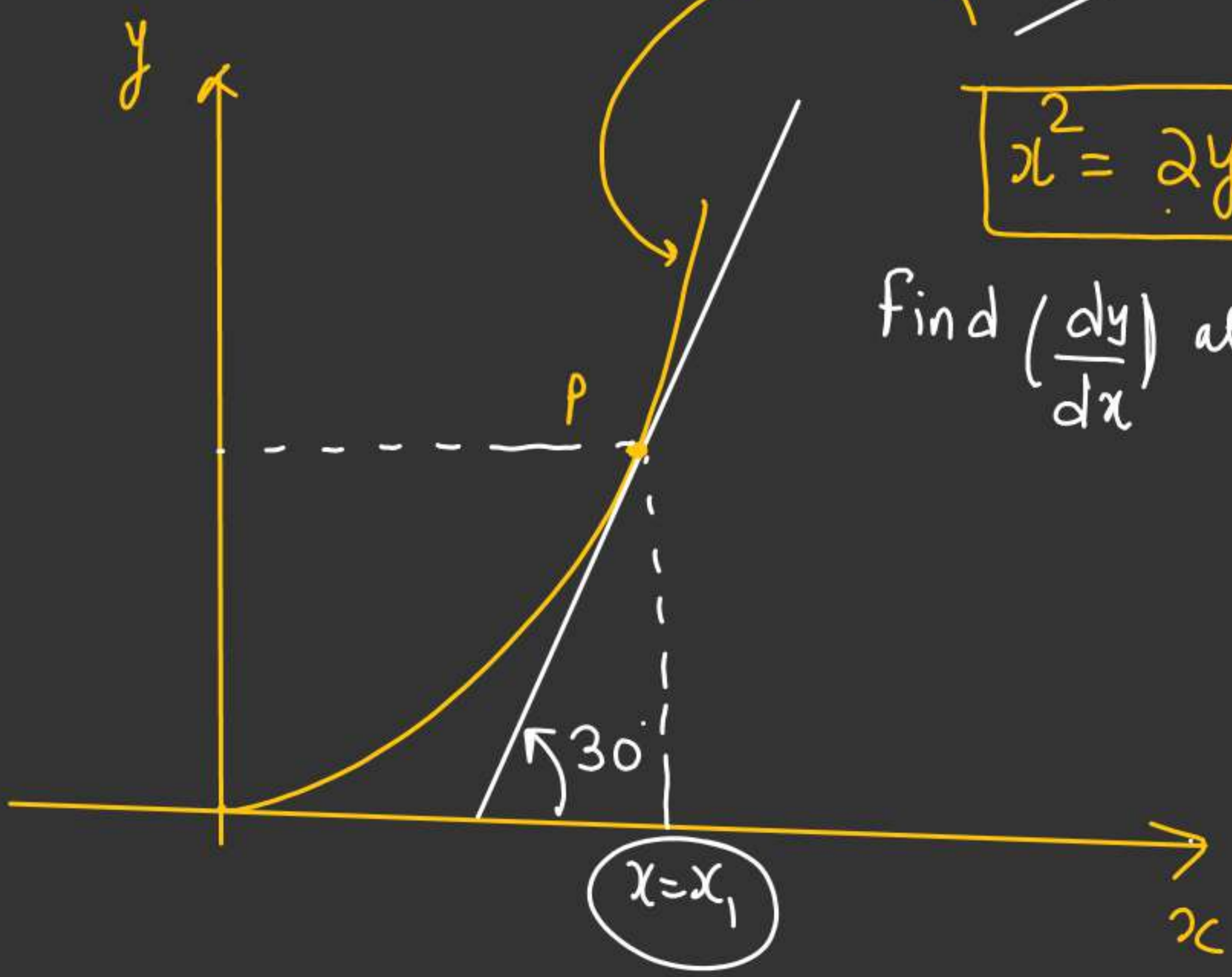

$\boxed{x^2 = 2y}$

$x^2 = 4ay$

find $\left(\frac{dy}{dx}\right)$ at P = ??

$y = \frac{1}{2}x^2$

$\downarrow$

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

$= \frac{1}{2} \times 2x = x$

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

$\left(\frac{dy}{dx}\right)_{x=x_1}$ = Slope of tangent drawn at P.

$= \tan 30° = \frac{1}{\sqrt{3}}$ ✓

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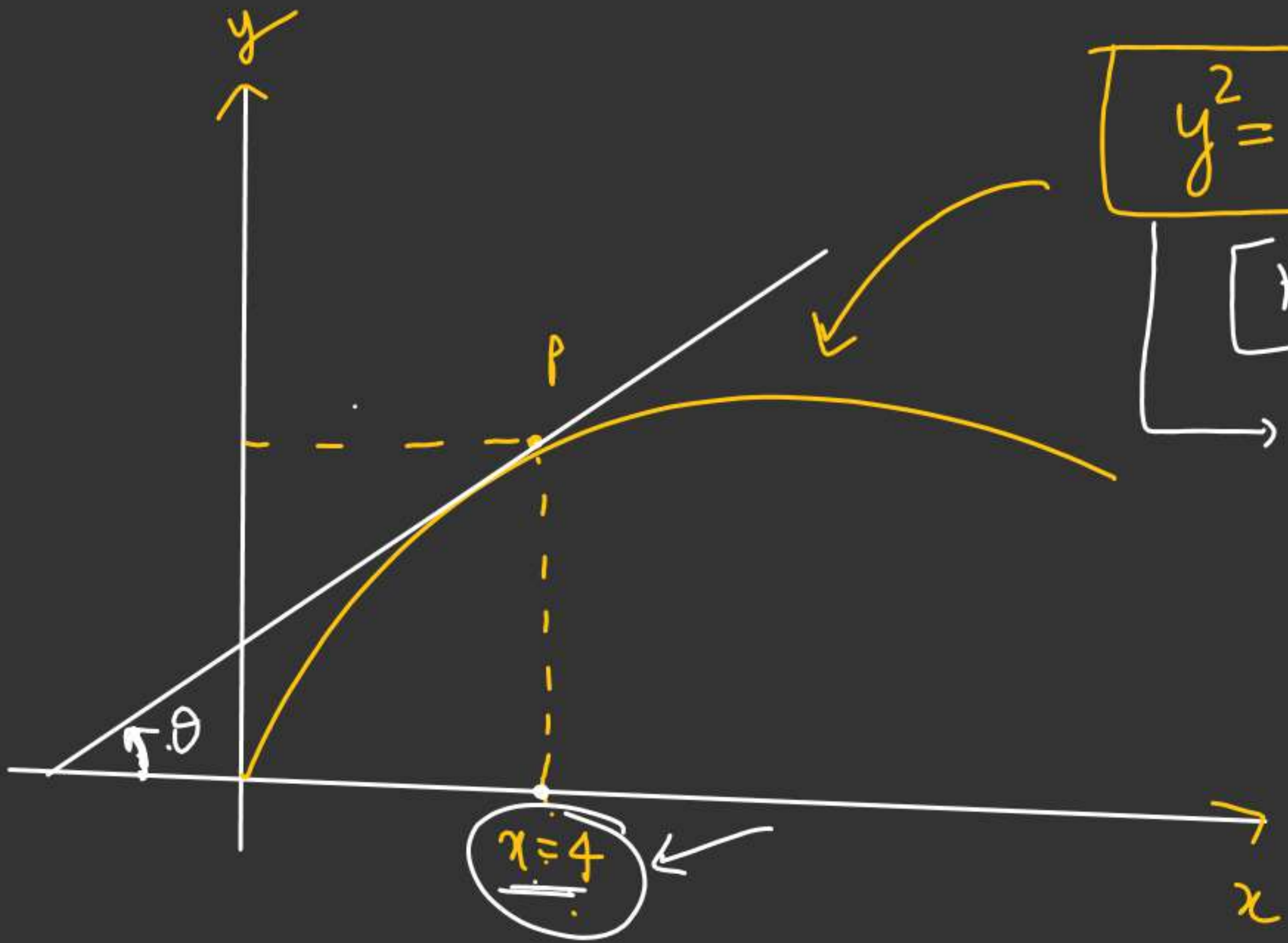
$y^2 = 4ax$



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

[Find slope of tangent at $x = 4$]

$$y = \sqrt{4x}$$

$$y = 2\sqrt{x}.$$

$$\frac{dy}{dx} = 2\,\frac{d}{dx}\left(x^{+1/2}\right)$$

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

$$\frac{dy}{dx} = x^{-1/2} = \left(\frac{1}{\sqrt{x}}\right)$$

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

$$(\tan\theta) = \left(\frac{dy}{dx}\right)_{x=4} = \left(\frac{1}{\sqrt{4}}\right) = \frac{1}{2}.$$

$\Downarrow$

Slope of tangent drawn at P.

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Basic Maths (Physics)

\# $\overset{y}{q} = (2\overset{x}{t}^2)$ $\rightarrow$ $q = f(t)$ " with respect to "

Find rate of change of 'q' w.r.t 't'

$$\boxed{\frac{dq}{dt} = (4t)} \Rightarrow \boxed{i = 4t}$$

Rate of Change of 'q' w.r.t t.

$$\frac{\Delta q}{\Delta t} = i_{avg}$$

$$i_{inst} = dq/dt$$

find i at $t = 2sec$

$$i_{inst} = 4 \times 2 = 8\,Amp$$

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Basic Maths (Physics)

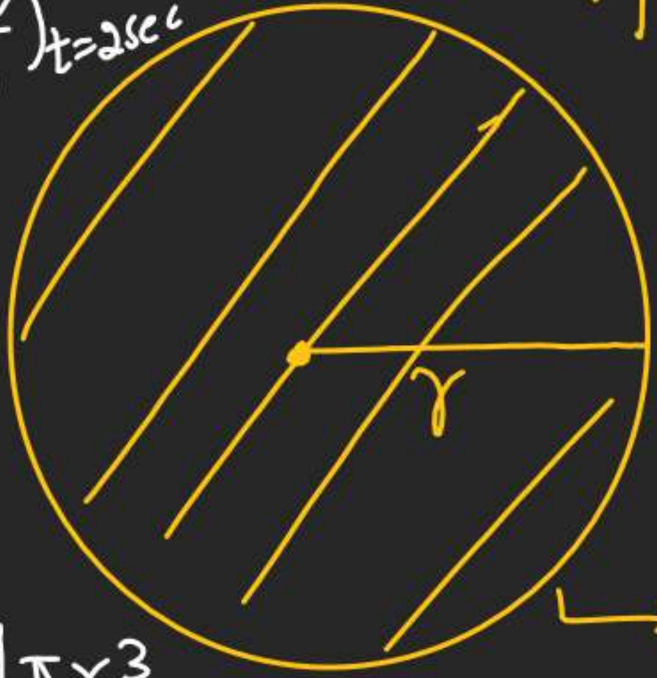
Spherical. $\boxed{r = 2t}$

Radius of sphere is a function of time.

Find 1) rate of change of Area

2) rate of change of volume.

3) find rate of change of Area and Volume at $\boxed{t = 2sec}$



$t = 0$, $r = 0$

dot

$$\boxed{A = 4\pi r^2}$$

Surface area of sphere

$$\boxed{A = f(r)}$$

$$A = 4\pi(2t)^2$$

$$A = 16\pi t^2$$

$$\frac{dA}{dt} = 16\pi \frac{d}{dt}(t^2)$$

$$= 16\pi \times 2t$$

$$= 32\pi t$$

$$\left(\frac{dA}{dt}\right)_{t=2sec} = 32\pi \times (2)$$

$$= 64\pi \ m^2/s$$

$$V = \frac{4}{3}\pi r^3$$

$$V = \frac{4}{3}\pi(2t)^3$$

$$V = \frac{4}{3}\pi \times 8t^3$$

$$\boxed{V = \frac{32\pi}{3}t^3}$$

$$\frac{dV}{dt} = \left(\frac{32\pi}{3}\right)\frac{d}{dt}(t^3)$$

$$\frac{dV}{dt} = \frac{32\pi}{\cancel{3}} \times (\cancel{3}t^2)$$

$$\frac{dV}{dt} = (32\pi t^2)$$

$$\left(\frac{dV}{dt}\right)_{t=2sec} = 128\pi \ \frac{m^3}{s}$$

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Basic Maths (Physics)

4. Integration: →

Symbol → $\int$

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

$\left[\sum_{i=1}^{n} a_i = a_1 + a_2 + \cdots + a_n\right]$

$x \to dx, \quad t \to dt,$

$y = x^2$ ✓

$y = e^x$

$y = \sin x$

$\boxed{x = 0,\ x = 1}$

Integration of y ⇒ $\boxed{\int y\,dx}$ → [Indefinite Integration] ×

Integrate y from $x = x_1$ to $x = x_2$

$= \left[\int_{x_1}^{x_2} y\,dx\right]$ ⇒ [Definite Integration] ✓

x_1 = Lower limit ✓

x_2 = Upper limit ✓

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Basic Maths (Physics)

⇒ Rules for Integration :-

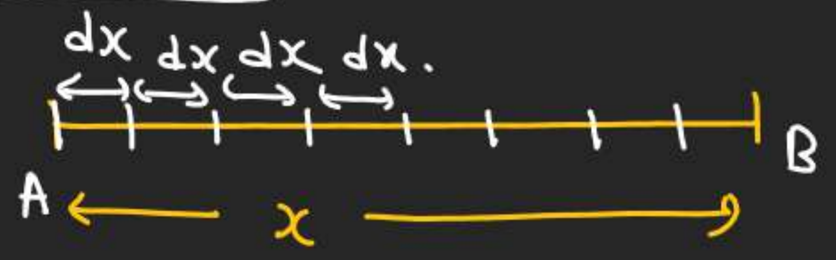
(I) $y = \underline{K} \cdot f(x)$

$$\int y \cdot dx = \int K[f(x)]dx$$

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

(II)

$$\Rightarrow \boxed{\int dx = x}$$



$y = 5x^2$

$y \to f(x)$

$$= \int y \cdot dx$$

$$= \int \underline{5} x^2 dx$$

$$= 5 \int x^2 dx$$

III)

$y = \overline{f(x)} \pm \overline{g(x)}$

$$\int y \cdot dx$$

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

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Formula

$\Rightarrow \quad y = x^n$

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

"Constant"

$n \neq -1$

Ex. $y = 2x^5$

"Integrate the function"

$$\int y \cdot dx = \int 2x^5 \cdot dx = 2 \int x^5 \cdot dx$$

$$= 2\left(\frac{x^{5+1}}{5+1}\right) + C$$

$$2\left(\frac{x^6}{6}\right) + c$$

$$\left(\frac{x^6}{3} + c\right)$$