YAKEEN NEET 2.0

2026

Basic Maths and Calculus (Mathematical Tools)

PHYSICS | Lecture – 11

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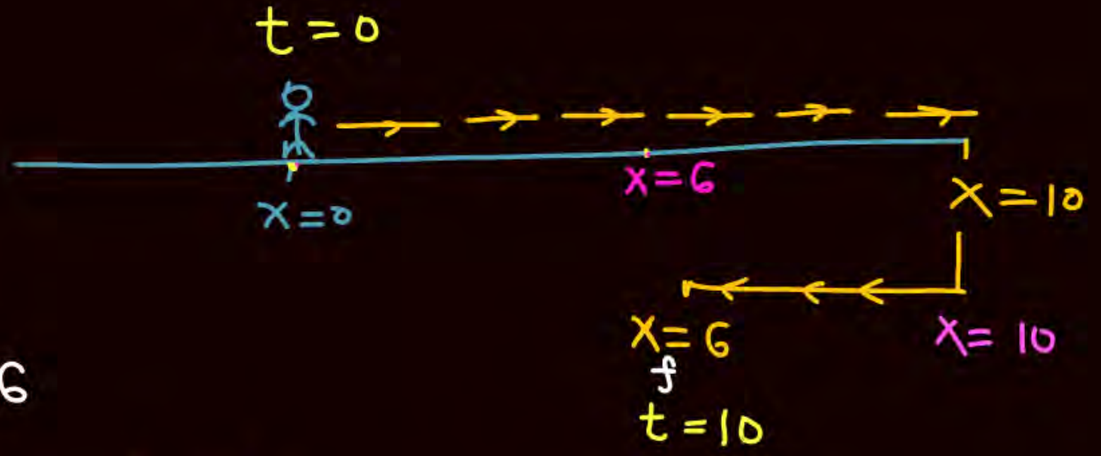
Topics to be covered

- Differentiation

##



Distance = 10 + 4 = 14

$\Rightarrow$ Displacement $= x_f - x_i$

$= 6 - 0 = 6$

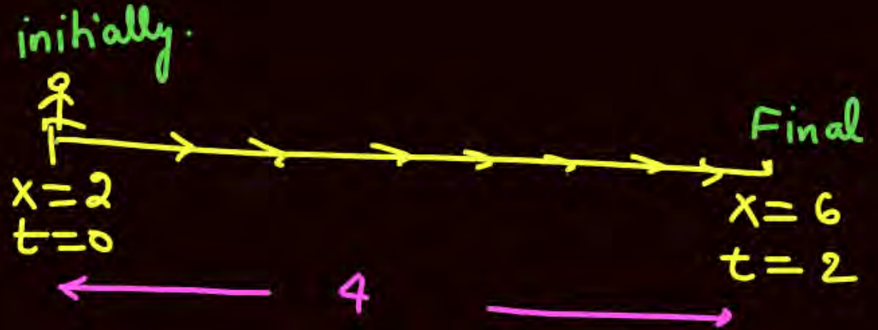
Average Speed $= \frac{\text{Distance}}{\text{time}} = \frac{10+4}{10} = 1.4$

$\Rightarrow$ Average Velocity $= \frac{\text{total Displacement}}{\text{total time}} = \frac{6}{10}$

$$\text{Displacement} = x_f - x_i$$

$$\text{Average velocity} = \frac{\text{Displacement}}{\text{time}} = \frac{x_f - x_i}{\left(\text{time interval}\right)} = \frac{\Delta x}{\Delta t}$$

Q

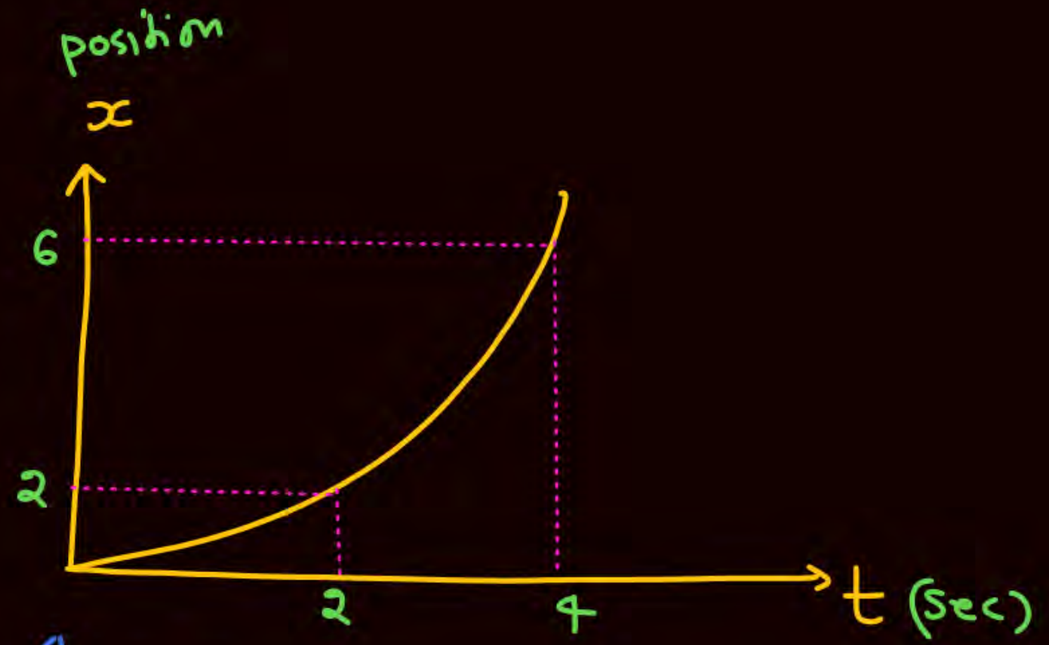


Displacement = $x_f - x_i = 6 - 2$
$= 4$

Avrg Velocity = $\frac{\text{Displacement}}{\text{time}} = \frac{4}{2} = 2$

$= \frac{\Delta x}{\Delta t} = \frac{x_f - x_i}{t_2 - t_1} = \frac{6-2}{2-0} =$ ✓

Q Find Diplacament and average velocity from $t = 2$ to $t = 4$ sec



Sol

Displacement $= x_f - x_i = 6 - 2 = 4$

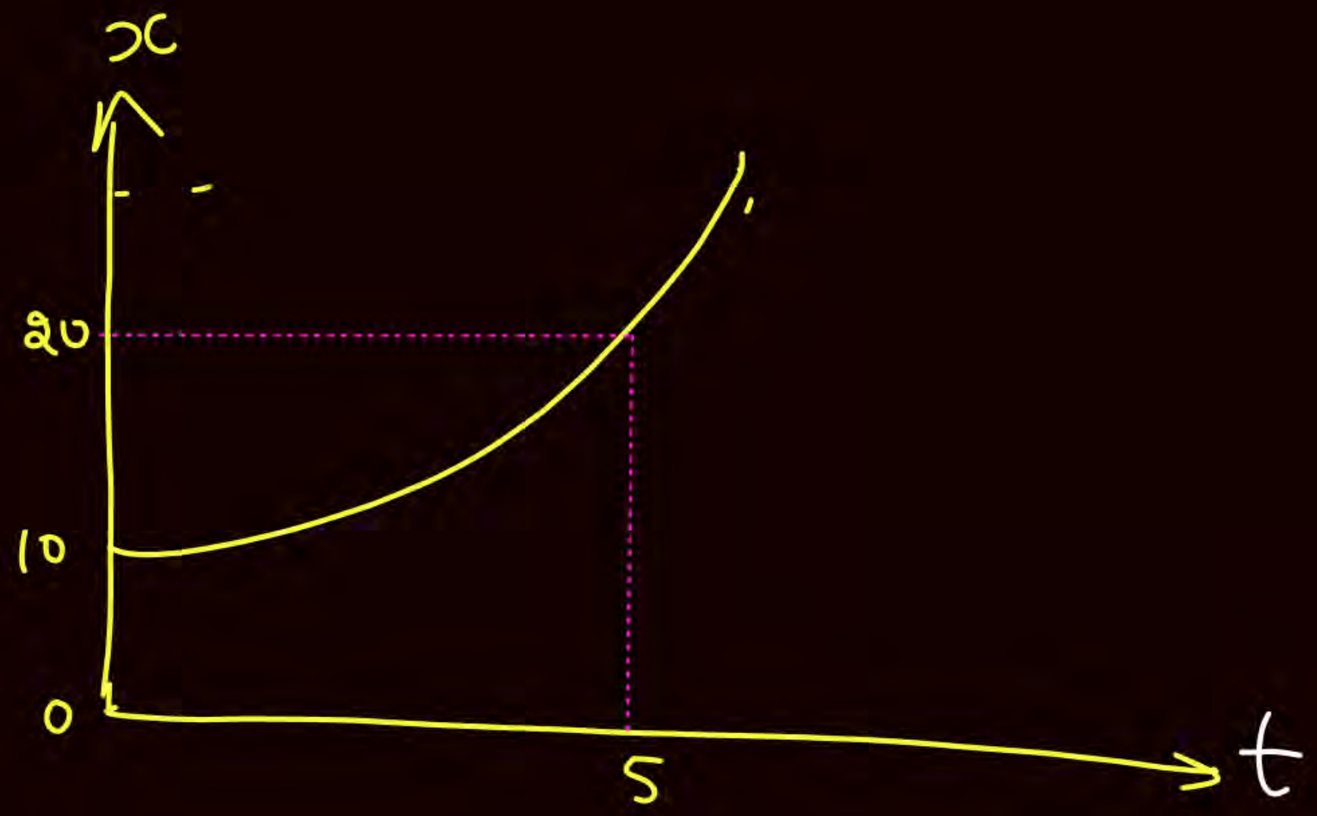
Avrg Velocity $= \frac{x_f - x_i}{\text{time}} = \frac{4}{4-2} = \frac{4}{2} = 2$

$= \frac{\Delta x}{\Delta t} = \frac{x_f - x_i}{t_2 - t_1} = \frac{6-2}{4-2} = 2$

$t = 0 \longrightarrow t = 5$

$$\text{Avrg velocity} = \frac{\Delta x}{\Delta t} = \frac{x_f - x_i}{t_2 - t_1}$$

$$= \frac{20 - 10}{5 - 0} = 2$$



$\Rightarrow$ Instantaneous Velocity $\Rightarrow$ उस particular instant par velocity.

Change in Kaddu = $(\text{Kaddu})_f - (\text{Kaddu})_i$

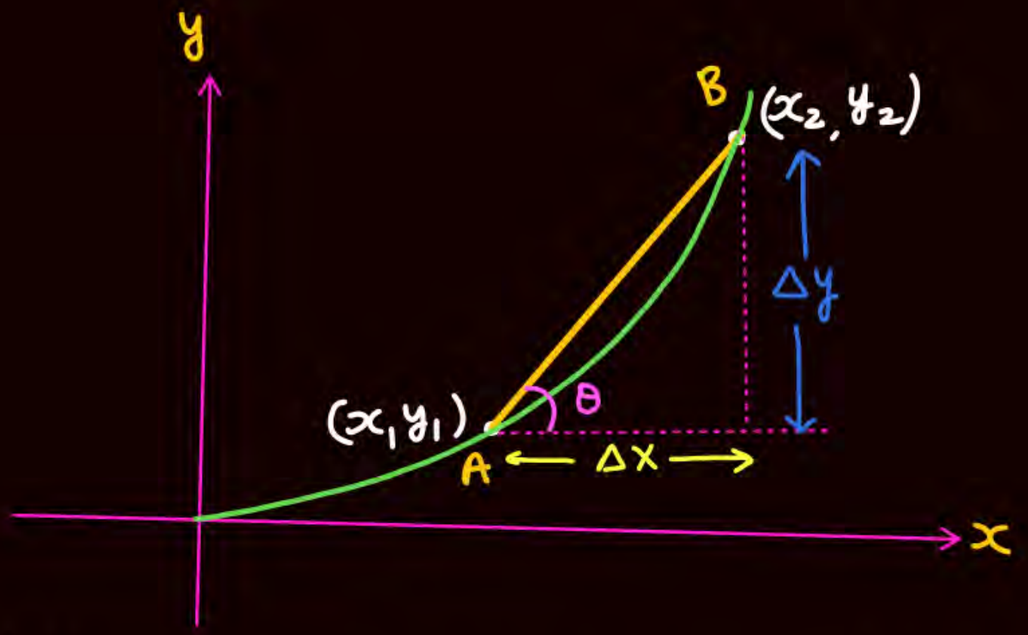
$= \Delta(\text{Kaddu})$

note ध्यान दें

Change in $y = y_2 - y_1 = \Delta y$

Change in $x = x_2 - x_1 = \Delta x$

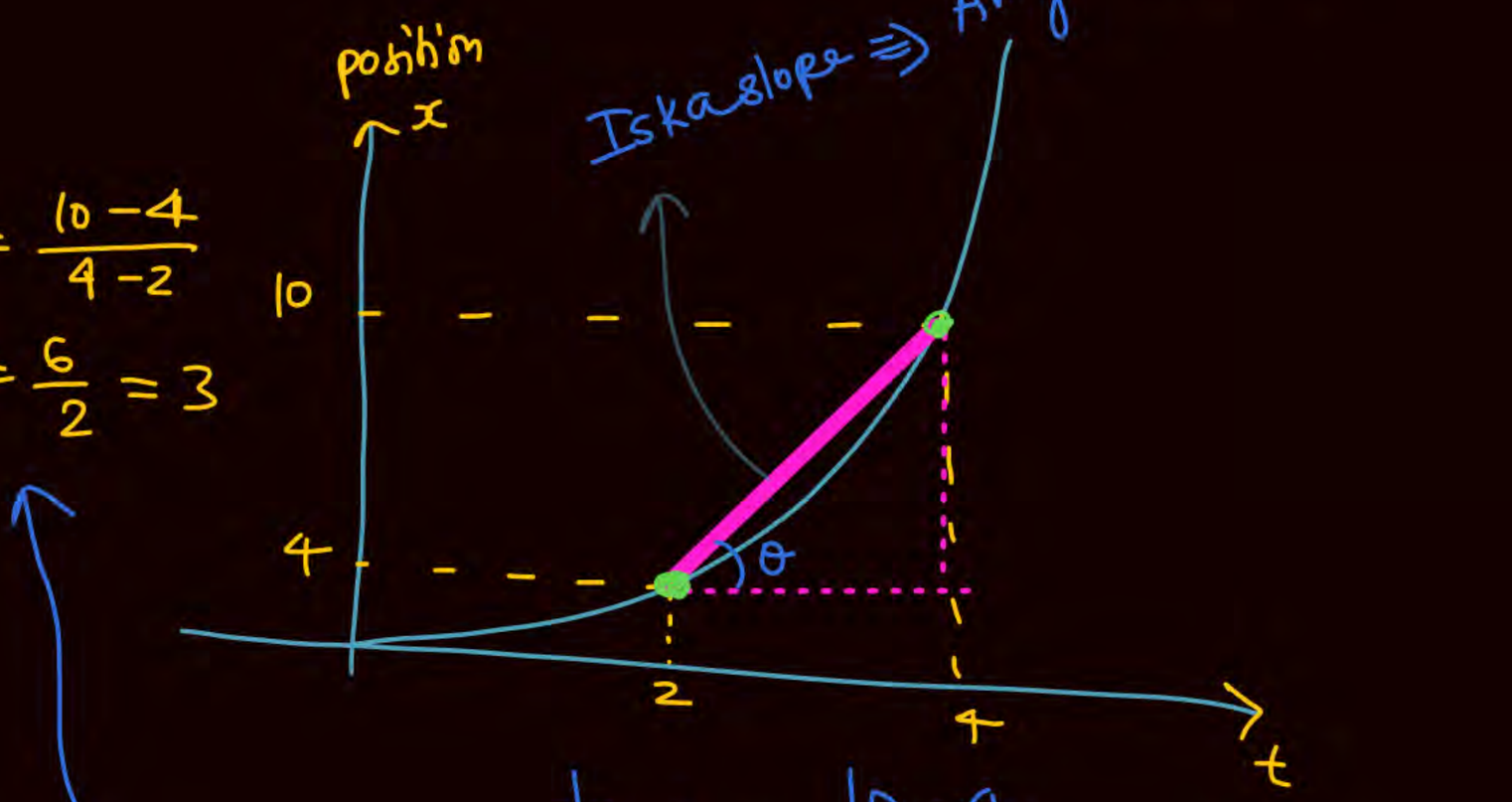
$$\frac{\text{Change in } y}{\text{Change in } x} = \frac{\Delta y}{\Delta x} = \tan\theta$$



→ Ye to 'A' ko 'B' se Connect karne wali straight line का Slope Hai.

Avg velocity $= \frac{x_f - x_i}{t_2 - t_1} = \frac{10-4}{4-2}$

$= \frac{6}{2} = 3$



$\tan\theta = \frac{10-4}{4-2} = \frac{6}{2} = 3$

→ Detail Me (Kinematics)

SKC

x-t Graph Me Kisi Do point Ko join Karne wali straight line Ka Slope Un dono point के Beech Average velocity Dega.

Change in $y = \Delta y$

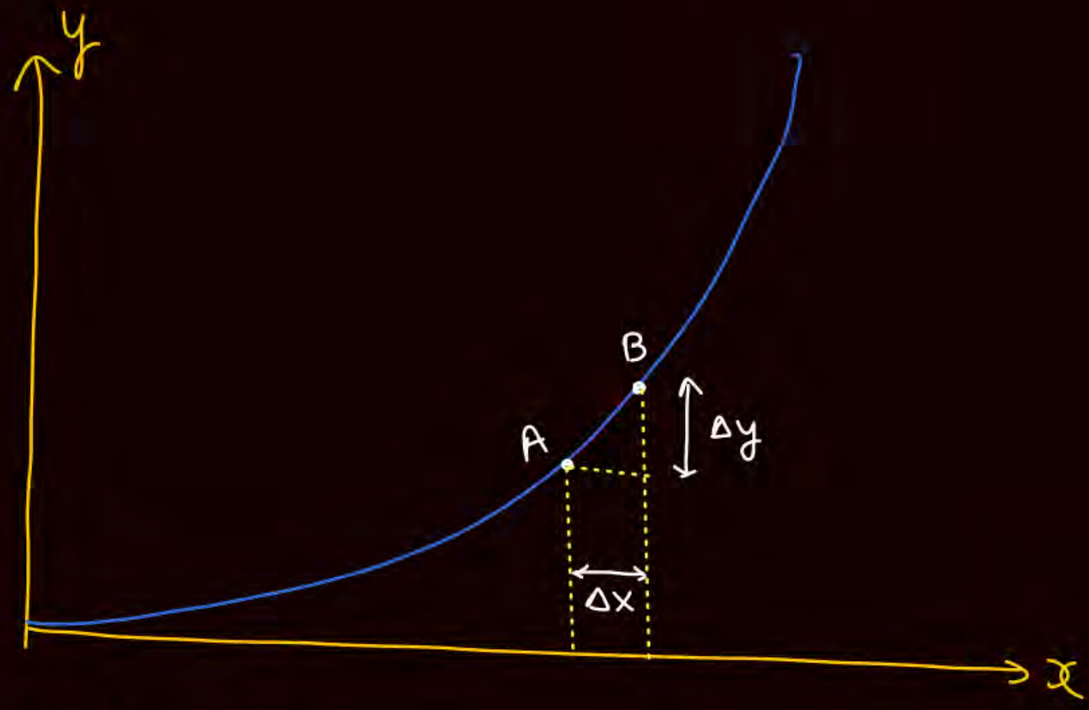
Change in $x = \Delta x$

If change in y is very very small

$$\Delta y = dy$$

If change in x is very very small

$$\Delta x = dx$$



$$\frac{\Delta y}{\Delta x} = \frac{dy}{dx}$$

- Differentiation of y wrt x
- Slope of tangent at that point
- 1st derivative of y wrt x
- Rate of change in y wrt x

$y = x^n$

$$\frac{dy}{dx} = n x^{n-1}$$

Q $y = x^3$

$$\frac{dy}{dx} = 3x^{3-1} = 3x^2$$

Q $y = x^4$

$$\frac{dy}{dx} = 4x^3$$

Q $y = x^7$

$$\frac{dy}{dx} = 7x^6$$

Q $y = x^{10}$

$$\frac{dy}{dx} = 10x^9$$

Q $y = x^3 + x^7$

$$\frac{dy}{dx} = 3x^2 + 7x^6$$

Q $y = x^2 + x^4 + x^8$

$$\frac{dy}{dx} = 2x + 4x^3 + 8x^7$$

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

$\frac{d}{dx}(\sin x) = \cos x$

$\frac{d}{dx}(\cos x) = -\sin x$

$\frac{d}{dx}(\tan x) = \sec^2 x$

$\frac{d}{dx} e^x = e^x$

$\frac{d}{dx}(\text{const}) = 0$

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

$\frac{d}{dx}(\sec x) = \sec x \tan x$

$\frac{d}{dx}(\cot x) = -\operatorname{cosec}^2 x$

Q $y = x^2 + x^3$

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

Q $y = x^7 + \sin x$

$\frac{dy}{dx} = 7x^6 + \cos x$

Q $y = x^6 + \tan x$

$\frac{dy}{dx} = 6x^5 + \sec^2 x$

Q $y = \sin x + \cos x$

$\frac{dy}{dx} = \cos x + (-\sin x) = \cos x - \sin x$

Q $y = \sin x$

$\frac{dy}{dx} = \cos x$

Q $y = \sin 45^\circ = \frac{1}{\sqrt{2}} = \text{Const.}$

$\frac{dy}{dx} = 0$

$y = kx^3$ (k → const)

$$\frac{dy}{dx} = \frac{d}{dx}(kx^3)$$

$$= k\frac{d}{dx}(x^3)$$

$$= k.(3x^2)$$

$\Longleftrightarrow$

$y = k + x^3$ (k → const)

$$\frac{dy}{dx} = 0 + 3x^2$$

Q $y = 3x^5$

$$\frac{dy}{dx} = 3 \times 5x^4 = 15x^4$$

Q $y = 4x^7$

$$\frac{dy}{dx} = 4 \times 7x^6 = 28x^6$$

Q $y = 3x^2 + 4x^3$

$\text{Slope} = \frac{dy}{dx} = 6x + 12x^2$

Q $y = x^1$

$\frac{dy}{dx} = 1 \cdot x^{1-1}$

$= 1 \cdot x^0 = 1$

Q $y = 2x$

$\frac{dy}{dx} = 2 \times 1$

$= 2$

$y = mx + 10$

Slope = 4

Q $y = 4x + 10$

$\frac{dy}{dx} = 4 \times 1 + 0$

$\text{Slope} = \frac{dy}{dx} = 4 = \text{Const}$

Q $y = 3x^2 - 4x^3 + \sin x$

$\frac{dy}{dx} = 6x - 12x^2 + \cos x$

Q $y = \frac{1}{x} = x^{-1} = x^n$

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

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

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

$\frac{dy}{dx} = (-2)\ x^{-2-1} = -2\ x^{-3}$

$\boxed{\frac{dy}{dx} = -\frac{2}{x^3}}$

Q $y = \frac{1}{x^3} = x^{-3}$

$\frac{dy}{dx} = -3\ x^{-3-1} = -3x^{-4} = -\frac{3}{x^4}$

Q $y = \frac{1}{x^2} + \sin x + 4x^3$

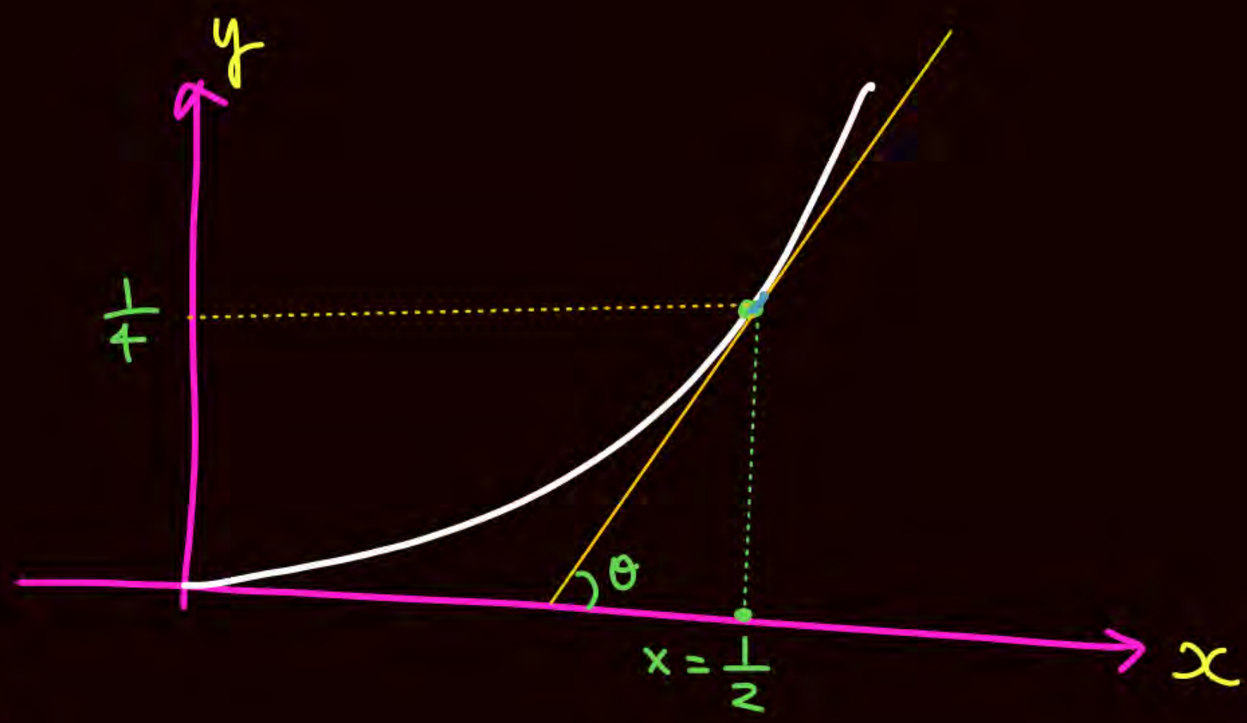
$\frac{dy}{dx} = -2\frac{1}{x^3} + \cos x + 12x^2$

Q $y = \frac{1}{x^5} + \cos x + e^x$

$\frac{dy}{dx} = -5\frac{1}{x^6} - \sin x + e^x$

Q $y = x^2$

find $\frac{dy}{dx}$ at $x = \frac{1}{2}$



Soln $\frac{dy}{dx} = 2x$

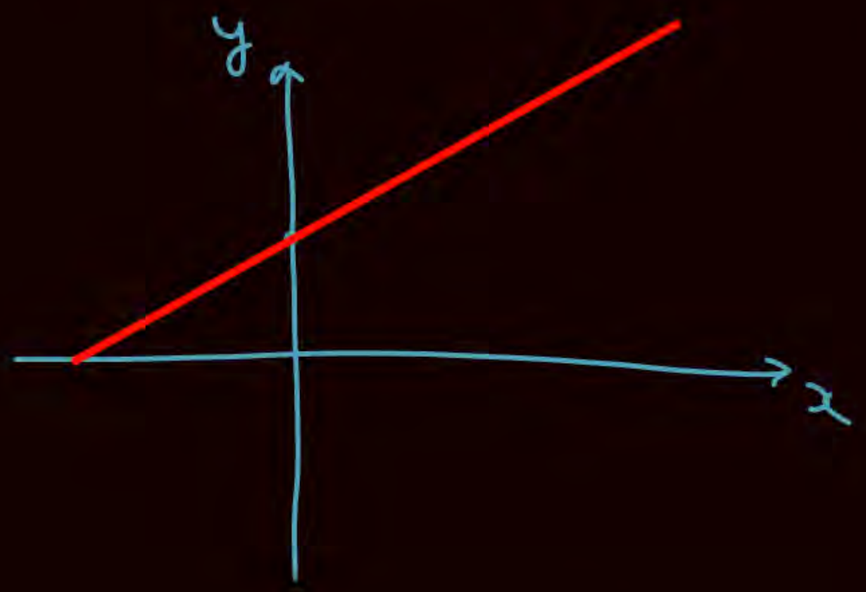
at $x = \frac{1}{2}$ $\frac{dy}{dx} = 2 \times \frac{1}{2}$

$\frac{dy}{dx} = 1 = \text{slope} = \tan\theta$

$\tan\theta = 1$

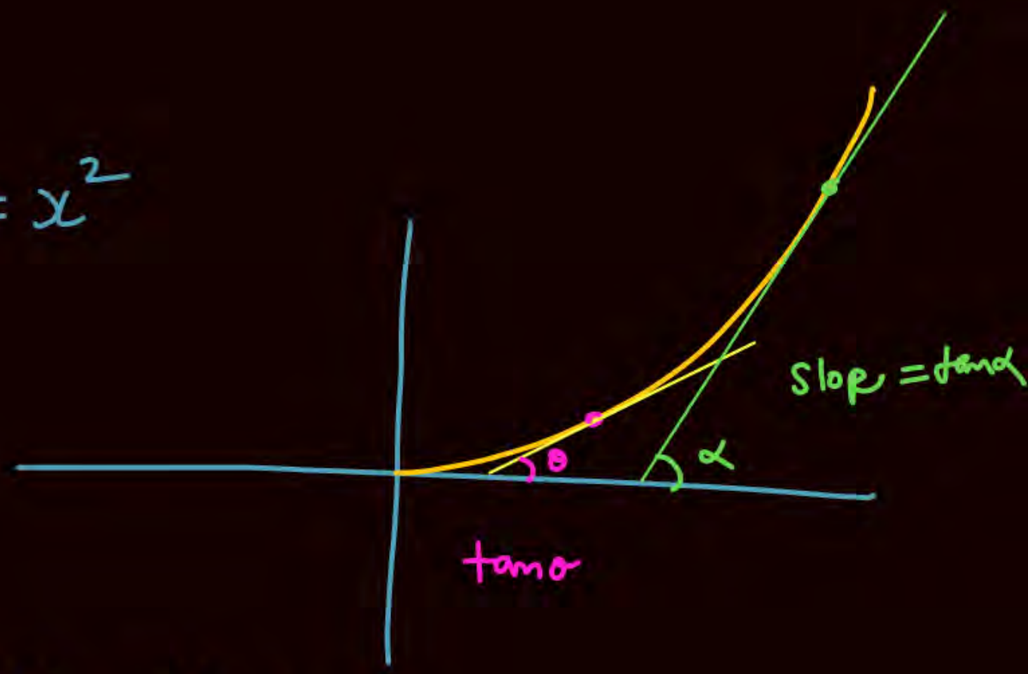
$\theta = 45°$

Q $y = 4x + 10$



$y = x^2$

$\frac{dy}{dx} = 2x = \text{slope}$



$x = 0$, slope $= 0$

$x = 1$ slope $= 2$

$x = 2$ slope $= 4$

$x = 3$ slop $= 6$

$x = 20$ slop $= 40$

$\tan\theta = \checkmark$

$$y = mx + c$$

$$\frac{dy}{dx} = m \times 1 + 0$$

$$\text{slope} = m$$

Homework

— DPP

— KPP will be uploaded today (evening) ≡ (30 min)

THANK YOU