YAKEEN NEET 2.0

2026

Basic Maths and Calculus (Mathematical Tools)

PHYSICS | Lecture - 12

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Topics to be covered

- Differentiation product rule, divide rule, chain rule

$\frac{dy}{dx}$

1. Differentiation of y wrt x
2. Rate of change of y wrt x ≡ Qus वाली है
3. slope of the tangent at that point
4. 1^{st} derivation of y wrt x ("आ" वता दो)

$\underline{Q}$ $y = x^3 + \sin x - e^x$

$\frac{dy}{dx} = 3x^2 + \cos x - e^x = y' \longrightarrow$ Iska ek bar differentiation हो चुका है

$y' = \frac{dy}{dx}$

$\underline{Q}$ $y = \ln x + \sin x - e^x$

$y' = \frac{1}{x} + \cos x - e^x$

Q $y = x^2 + \sin x$

$y' = 2x + \cos x$

Product rule

$y = u \cdot v$

$y' = u \cdot v' + v \cdot u'$ ≡ पहला(दूसरा)' + दूसरा (पहला)'

$\frac{dy}{dx} = u \cdot \frac{dv}{dx} + v \frac{du}{dx}$

Q $y = x^2 \sin x$

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

$y' = x^2 \cdot \cos x + \sin x \cdot (2x)$

Q $y = e^x \sin x$

$$\frac{dy}{dx} = e^x \cos x + \sin x \cdot e^x$$

Q $y = e^x \tan x$

$$\frac{dy}{dx} = e^x(\sec^2 x) + \tan x \cdot e^x$$

Q $y = x^3 \cos x$

$$\frac{dy}{dx} = x^3(-\sin x) + (\cos x)\, 3x^2$$

Q $y = (\ln x)(\sin x)$

$$\frac{dy}{dx} = (\ln x)(\cos x) + (\sin x)\frac{1}{x}$$

$$y = u + v$$
$$y' = u' + v'$$

$$y = u \cdot v$$
$$y' = uv' + vu'$$

$y = \frac{u}{v}$

$$\frac{dy}{dx} = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$$

$$y' = \frac{vu' - uv'}{v^2}$$

Q $y = \frac{x^2}{\sin x}$

$$\frac{dy}{dx} = \frac{(\sin x)(2x) - x^2 \cos x}{(\sin x)^2}$$

Q $y = \frac{e^x}{x^3}$

$$y' = \frac{x^3 \cdot e^x - e^x(3x^2)}{(x^3)^2}$$

Q $\quad y = \dfrac{\sin x}{e^x}$

$$y' = \frac{e^x \cos x - \sin x \cdot e^x}{(e^x)^2}$$

Q $\quad y = \dfrac{x^2+1}{x^3-1}$ $\equiv$ KPP

$$y' = \frac{(x^3-1)\cdot(2x) - (x^2+1)(3x^2)}{(x^3-1)^2}$$

Q $\quad y = \dfrac{\ln x}{x^2}$

$$y' = \frac{x^2\left(\frac{1}{x}\right) - (\ln x)(2x)}{x^4}$$

Q $\quad y = \dfrac{e^x}{x^2+1}$

$$y' = \frac{(x^2+1)e^x - e^x(2x)}{(x^2+1)^2}$$

$\cancel{Q}$ $y = abc$

$y' = a'bc + ab'c + abc'$

SKC
abc methode

$Q \Rightarrow$ $y = x^2 . \sin x . e^x$

$$\frac{dy}{dx} = 2x . \sin x . e^x + x^2 . \cos x \, e^x + x^2 . \sin x . e^x$$

Q $y = x^3 \tan x . \ln x$

$$\frac{dy}{dx} = 3x^2 . \tan x \ln x + x^3 . \sec^2 x . \ln x + x^3 . \tan x . \frac{1}{x}$$

Q $y = x^3$

$\frac{dy}{dx} = 3x^2$ → Differentiation of y wrt x

1st derivative of y wrt x

Rate of change of y wrt x

} style

Differentiation

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

→ Double diff of y wrt x, y''

→ 2nd derivative of y wrt x

→ Rate of change of $\frac{dy}{dx}$ wrt x

} style

Q

$$y = x^5$$

$$y' = 5x^4$$

$$y'' = 20x^3$$

Q

$$y = \sin x$$

$$y' = \cos x$$

$$y'' = -\sin x$$

Diff

Diff

$y'' \longrightarrow$ y का दो बार differentiation

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

Q $y = x^3 + \sin x$

$y' = 3x^2 + \cos x$

$y'' = 6x - \sin x$

Q $y = x^5 + e^x + \sin x$

$y' = 5x^4 + e^x + \cos x$

$y'' = 20x^3 + e^x - \sin x$

Q $y = t^3 - 2t^2 + 10t + 4$

$\frac{dy}{dt} = y' = 3t^2 - 4t + 10$

$\frac{d^2y}{dt^2} = = y'' = 6t - 4$

(*) Q $\underbrace{x}_{\text{position}} = 3t^2 - 4t + 10$

$$\frac{dx}{dt} = x' = 6t - 4 = v$$

$$\frac{d^2x}{dt^2} = x'' = 6 = a_{cc}$$

find the time when particle will come to at rest

$$v = 0$$

$$6t - 4 = 0$$

$$t = 2/3$$

Chain rule (Book outside - Inside rule)

① $y = \sin(x^3)$

$$\frac{dy}{dx} = \cos(x^3) \times 3x^2$$

② $y = \cos(x^3)$

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

③ $y = \sin(x^2 + 3x)$

$$\frac{dy}{dx} = \cos(x^2+3x) \times [2x+3]$$

④ $y = \ln x^3$

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

maths

Dont write

$$y = f(g(x))$$

$$y' = f'(g(x)) \times g'(x).$$

Same

Q $y = \sin(\ln x)$

$$\frac{dy}{dx} = \cos(\ln x) \times \frac{1}{x}$$

Q. $y = \sin(x^3)$

$$\frac{dy}{dx} = \cos(x^3) \times 3x^2$$

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

$y' = \cos(3x^2 + 4x)\,[6x + 4]$

Q $y = \ln \sin(x^2 + 2)$

$y' = \frac{1}{\sin(x^2+2)} \times \cos(x^2+2) \times (2x+0)$

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Q $y = \sin(4t + \pi/2)$

$y' = \cos(4t + \pi/2) \times (4 + 0)$

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Q $y = \sin(\omega t + \phi)$ $(\omega, \phi \to \text{const})$

$y' = \cos(\omega t + \phi) \times (\omega + 0)$

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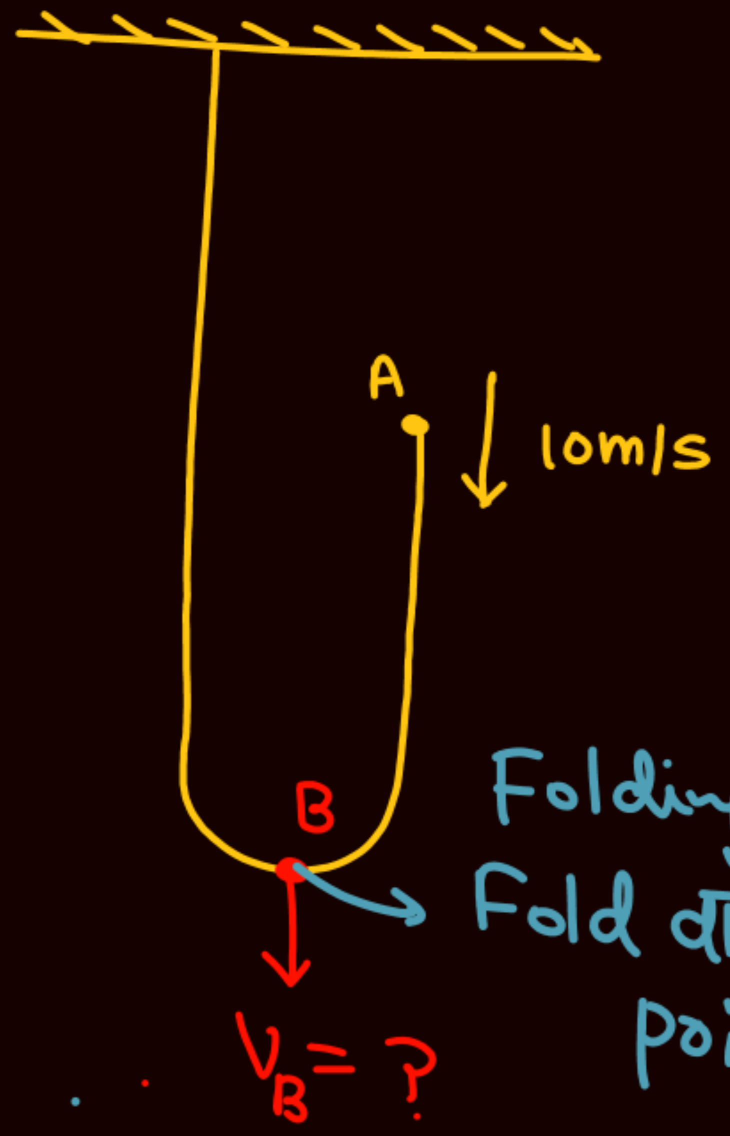
Q $y = 10 \sin(4\pi t + \pi/2)$

$y' = 10 \cos(4\pi t + \pi/2) \times 4\pi$

$= 40\pi \cos(4\pi t + \pi/2)$



Folding point

Fold वाला point

Q $y = \ln\left(\sin(x^3)\right)$

$$y' = \frac{1}{\left(\sin(x^3)\right)} \times \left(\cos x^3\right) \times 3x^2$$

* $y = \sin(\text{कद्दू})$

$$\frac{dy}{dx} = \cos(\text{कद्दू}) \times (\text{कद्दू})'$$

* $y = \ln(\text{कद्दू})$

$$y' = \frac{1}{\text{कद्दू}} \times (\text{कद्दू})'$$

Q $\frac{d}{dx}(e) = 0$

Q $\frac{d}{dx}(\pi) = 0$

Q $\frac{d}{dx}(\epsilon_0) = 0$

$\frac{d}{dx}(\sin^2\theta + \cos^2\theta) = 0$

$\frac{d}{dx}(\mu_0) = 0$

$\frac{d}{dx}(G) = 0$

Home work

- Kal Ka Lecture (quadratic eq^n wala dekhna hai.)
- KPP-05 (yesterday already given)
- KPP-06 (Arriving soon ....)

THANK
YOU