Applied Mathematics

CSTA Launchpad
Open Mind Guruji

Derivatives of Parametric Functions

Derivatives

2 ND Semester Diploma All Branches

Lec-8

MSBTE -Polytechnic

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$x = 1$ $\quad \frac{d\theta}{d\theta} = 1$

Find $\frac{dy}{dx}$ **if** $x = a(\theta + \sin\theta), y = a(1 - \cos\theta)$

⟶ given eq.

$x = a(\theta + \sin\theta)$ — (1) | $y = a(1 - \cos\theta)$ — (2)

diff w.r.t. θ

$$\frac{dx}{d\theta} = \frac{d}{d\theta} a(\theta + \sin\theta)$$

$$= a\left[\frac{d}{d\theta}\theta + \frac{d}{d\theta}\sin\theta\right]$$

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

$$\frac{dx}{d\theta} = a[1 + \cos\theta] \quad \text{— (3)}$$

Find $\frac{dy}{dx}$ *if* $x = a(\theta + \sin\theta), y = a(1 - \cos\theta)$ — (2)

$y = a(1 - \cos\theta)$ — (2)

diff w.r.t θ

$$\frac{dy}{d\theta} = \frac{d}{d\theta} a[1 - \cos\theta]$$

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

$$= a\left[\frac{d}{d\theta}1 - \frac{d}{d\theta}\cos\theta\right]$$

$$= a[0 - (-\sin\theta)]$$

$$= a(0 + \sin\theta)$$

$$\frac{dy}{d\theta} = a\sin\theta \quad \text{— (4)}$$

Find $\frac{dy}{dx}$ **if** $x = a(\theta + \sin\theta), y = a(1 - \cos\theta)$

$\sin\theta = 2\sin\frac{\theta}{2}\cdot\cos\frac{\theta}{2}$

$1+\cos\theta = 2\cos^2\frac{\theta}{2}$

divide eq (4) by eq (3)

$$\frac{dy/d\theta}{dx/d\theta} = \frac{a\sin\theta}{a(1+\cos\theta)}$$

$$\frac{dy}{dx} = \frac{\sin\theta}{1+\cos\theta}$$ (2)

Linear

$$= \frac{2\sin\frac{\theta}{2}\cos\frac{\theta}{2}}{2\cos^2\frac{\theta}{2}}$$

Find $\frac{dy}{dx}$ *if* $x = a(\theta + \sin\theta), y = a(1 - \cos\theta)$

$$\frac{dy}{dx} = \frac{\sin\theta/2}{\cos\theta/2}$$

$$\frac{\sin x}{\cos x} = \tan x$$

$$\frac{dy}{dx} = \tan\frac{\theta}{2} \quad \text{--- (2)}$$

Final

Find $\frac{dy}{dx}$ if $x = a(\theta + \sin\theta), y = a(1 - \cos\ \theta)$

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