Continuity and Differentiability

Derivatives of Functions in Parametric Forms

Class XII CBSE

NCERT Solutions

Exercise 5.6

If x and y are connected parametrically by the equations given in Exercises 1 to 10, without eliminating the parameter, find $\frac{dy}{dx}$.

1. $x = 2at^2, \quad y = a\,t^4$

Solution:

Given that $x = 2at^2$ and $y = a\,t^4$

$\therefore \quad \frac{dx}{dt} = 4at$ and $\frac{dy}{dt} = 4\,a\,t^3$

Hence $\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}} = \frac{4\,a\,t^3}{4at} = \boldsymbol{t^2}$

2. $x = a\cos\theta\ ,\ y = b\cos\theta$

Solution:

Given that $x = a\cos\theta$ and $y = b\cos\theta$

$\therefore \quad \frac{dx}{d\theta} = -a\sin\theta$ and $\frac{dy}{d\theta} = -b\sin\theta$

Hence, $\frac{dy}{dx} = \frac{\frac{dy}{d\theta}}{\frac{dx}{d\theta}} = \frac{-\,b\sin\theta}{-\,a\sin\theta} = \boldsymbol{\frac{b}{a}}$

3. $x = \sin t\ ,\ y = \cos 2t$

Solution:

Given that, $x = \sin t$ and $y = \cos 2t$

$\therefore \quad \frac{dx}{dt} = \cos t$ and $\frac{dy}{dt} = -2\sin 2t$

Hence $\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}} = \frac{-\,2\sin 2t}{\cos t} = \frac{-4\sin t\cos t}{\cos t} = \boldsymbol{-4\sin t}$

4. $x = 4\,t,\ y = \frac{4}{t}$

Solution:

Given that $x = 4t$ and $y = \frac{4}{t}$

$\therefore \quad \frac{dx}{dt} = 4$ and $\frac{dy}{dt} = -\frac{4}{t^2}$

Hence $\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}} = \frac{-\frac{4}{t^2}}{4} = \boldsymbol{-\frac{1}{t^2}}$