



Differentiation Ex 11.7 Q1

Given that  $x = at^2$ ,  $y = 2at$

$$\text{So, } \frac{dx}{dt} = \frac{d}{dt}(at^2) = 2at$$

$$\frac{dy}{dt} = \frac{d}{dt}(2at) = 2a$$

$$\text{Therefore, } \frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}} = \frac{2a}{2at} = \frac{1}{t}$$

Differentiation Ex 11.7 Q2

Here,

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

Differentiating it with respect to  $\theta$ ,

$$\frac{dx}{d\theta} = a(1 + \cos \theta) \quad \text{---(i)}$$

And,

$$y = a(1 - \cos \theta)$$

Differentiating it with respect to  $\theta$ ,

$$\begin{aligned} \frac{dy}{d\theta} &= a(\theta + \sin \theta) \\ \frac{dy}{d\theta} &= a \sin \theta \quad \text{---(ii)} \end{aligned}$$

Using equation (i) and (ii),

$$\begin{aligned} \frac{dy}{dx} &= \frac{\frac{dy}{d\theta}}{\frac{dx}{d\theta}} \\ &= \frac{a \sin \theta}{a(1 - \cos \theta)} \end{aligned}$$

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

$$\left\{ \begin{aligned} &\text{Since, } 1 - \cos \theta = \frac{2 \sin^2 \theta}{2}, \\ &\frac{2 \sin \theta \cos \theta}{2} = \sin \theta \end{aligned} \right\}$$

$$= \frac{dy}{dx} = \frac{\tan \theta}{2}$$

Differentiation Ex 11.7 Q3

Here  $x = a \cos \theta$  and  $y = b \sin \theta$

Then,

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

$$\frac{dy}{d\theta} = \frac{d}{d\theta}(b \sin \theta) = b \cos \theta$$

$$\therefore \frac{dy}{dx} = \frac{\frac{dy}{d\theta}}{\frac{dx}{d\theta}} = \frac{b \cos \theta}{-a \sin \theta} = -\frac{b}{a} \cot \theta$$

Differentiation Ex 11.7 Q4

Here,

$$x = ae^{\theta} (\sin \theta - \cos \theta)$$

Differentiating it with respect to  $\theta$ ,

$$\begin{aligned} \frac{dx}{d\theta} &= a \left[ e^{\theta} \frac{d}{d\theta} (\sin \theta - \cos \theta) + (\sin \theta - \cos \theta) \frac{d}{d\theta} (e^{\theta}) \right] \\ &= a \left[ e^{\theta} (\cos \theta + \sin \theta) + (\sin \theta - \cos \theta) e^{\theta} \right] \\ \frac{dx}{d\theta} &= a [2e^{\theta} \sin \theta] \quad \text{---(i)} \end{aligned}$$

And,  $y = ae^{\theta} (\sin \theta + \cos \theta)$

Differentiating it with respect to  $\theta$ ,

$$\begin{aligned} \frac{dy}{d\theta} &= a \left[ e^{\theta} \frac{d}{d\theta} (\sin \theta + \cos \theta) + (\sin \theta + \cos \theta) \frac{d}{d\theta} (e^{\theta}) \right] \\ &= a \left[ e^{\theta} (\cos \theta - \sin \theta) + (\sin \theta + \cos \theta) e^{\theta} \right] \\ \frac{dy}{d\theta} &= a [2e^{\theta} \cos \theta] \quad \text{---(ii)} \end{aligned}$$

Dividing equation (ii) by equation (i),

$$\begin{aligned} \frac{\frac{dy}{d\theta}}{\frac{dx}{d\theta}} &= \frac{a(2e^{\theta} \cos \theta)}{a(2e^{\theta} \sin \theta)} \\ \frac{dy}{dx} &= \cot \theta \end{aligned}$$

Differentiation Ex 11.7 Q5

Here  $x = b \sin^2 \theta$  and  $y = a \cos^2 \theta$

Then,

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

$$\frac{dy}{d\theta} = \frac{d}{d\theta}(a \cos^2 \theta) = -2a \cos \theta \sin \theta$$

$$\therefore \frac{dy}{dx} = \frac{\frac{dy}{d\theta}}{\frac{dx}{d\theta}} = \frac{-2a \cos \theta \sin \theta}{2b \sin \theta \cos \theta} = -\frac{a}{b}$$

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