

## Differentiation Ex 11.4 Q1 Given,

$$xy = c^2$$

Differentiate with respect to x,

$$\frac{d}{dx}(xy) = \frac{d}{dx}(c^2)$$

$$\Rightarrow x \frac{dy}{dx} + y \frac{d}{dx}(x) = 0$$
[Using product rule]
$$\Rightarrow x \frac{dy}{dx} + y = 0$$

$$\Rightarrow x \frac{dy}{dx} = -y$$

$$\Rightarrow \frac{dy}{dx} = -\frac{y}{x}$$

## Differentiation Ex 11.4 Q2

Here, 
$$y^3 - 3xy^2 = x^3 + 3x^2y$$

Differentiating with respect to x,

$$\Rightarrow \frac{d}{dx}\left\{y^{3}\right\} - \frac{d}{dx}\left\{3xy^{2}\right\} = \frac{d}{dx}\left\{x^{3}\right\} + \frac{d}{dx}\left\{3x^{2}y\right\}$$

$$\Rightarrow 3y^{2}\frac{dy}{dx} - 3\left[x\frac{d}{dx}y^{2}\frac{d}{dx}(x)\right] = 3x^{2} + 3\left[x^{2}\frac{d}{dx}(y) + y\frac{d}{dx}\left\{x^{2}\right\}\right] \qquad \text{[Using product rule]}$$

$$\Rightarrow 3y^{2}\frac{dy}{dx} - 3\left[x\left(2y\right)\frac{dy}{dx} + y^{2}\right] = 3x^{2} + 3\left[x^{2}\frac{dy}{dx} + y\left(2x\right)\right]$$

$$\Rightarrow 3y^{2}\frac{dy}{dx} - 6xy\frac{dy}{dx} - 3y^{2} = 3x^{2} + 3x^{2}\frac{dy}{dx} + 6xy$$

$$\Rightarrow 3y^{2}\frac{dy}{dx} - 6xy\frac{dy}{dx} - 3x^{2}\frac{dy}{dx} = 3x^{2} + 6xy + 3y^{2}$$

$$\Rightarrow 3\frac{dy}{dx}\left\{y^{2} - 2xy - x^{2}\right\} = 3\left\{x^{2} + 2xy + y^{2}\right\}$$

$$\Rightarrow \frac{dy}{dx} = \frac{3\left(x + y\right)^{2}}{3\left\{y^{2} - 2xy - x^{2}\right\}}$$

$$\Rightarrow \frac{dy}{dx} = \frac{(x + y)^{2}}{y^{2} - 2xy - x^{2}}$$

Differentiation Ex 11.4 Q3

Here, 
$$x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$$

Differentiate it with respect to x,

$$\frac{d}{dx} \left( x^{\frac{2}{3}} \right) + \frac{d}{dx} \left( y^{\frac{2}{3}} \right) = \frac{d}{dx} \left( a^{\frac{2}{3}} \right)$$

$$\Rightarrow \frac{2}{3} x^{\left(\frac{2}{3}-1\right)} + \frac{2}{3} y^{\left(\frac{2}{3}-1\right)} \frac{dy}{dx} = 0$$

$$\Rightarrow \frac{2}{3} x^{\frac{-1}{3}} + \frac{2}{3} y^{\frac{-1}{3}} \frac{dy}{dx} = 0$$

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

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

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

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

$$\Rightarrow \frac{dy}{dx} = -\left(\frac{y}{x}\right)^{\frac{1}{3}}$$

$$\Rightarrow \frac{dy}{dx} = -\left(\frac{y}{x}\right)^{\frac{1}{3}}$$

Differentiation Ex 11.4 Q4 Given,  $4x + 3y = \log(4x - 3y)$ 

Differentiating with respect to x,

$$\frac{d}{dx}(4x) + \frac{d}{dx}(3y) = \frac{d}{dx}(\log(4x - 3y))$$

$$\Rightarrow 4 + 3\frac{dy}{dx} = \frac{1}{(4x - 3y)}\frac{d}{dx}(4x - 3y)$$

$$\Rightarrow 4 + 3\frac{dy}{dx} = \frac{1}{(4x - 3y)}\left(4 - 3\frac{dy}{dx}\right)$$

$$\Rightarrow 4 + 3\frac{dy}{dx} = \frac{4}{(4x - 3y)} - \frac{3}{(4x - 3y)}\frac{dy}{dx}$$

$$\Rightarrow 3\frac{dy}{dx} + \frac{3}{(4x - 3y)}\frac{dy}{dx} = \frac{4}{(4x - 3y)} - 4$$

$$\Rightarrow 3\frac{dy}{dx}\left(1 + \frac{1}{(4x - 3y)}\right) = 4\left(\frac{1}{(4x - 3y)} - 1\right)$$

$$\Rightarrow 3\frac{dy}{dx}\left[\frac{4x - 3y + 1}{(4x - 3y)}\right] = 4\left[\frac{1 - 4x + 3y}{(4x - 3y)}\right]$$

$$\Rightarrow \frac{dy}{dx} = \frac{4}{3}\left[\frac{1 - 4x + 3y}{(4x - 3y)}\right]\left[\frac{4x - 3y}{4x - 3y + 1}\right]$$

$$\Rightarrow \frac{dy}{dx} = \frac{4}{3}\left(\frac{1 - 4x + 3y}{4x - 3y + 1}\right)$$

Differentiation Ex 11.4 Q5

Given, 
$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

Differentiating with respect to  $\boldsymbol{x}$ ,

$$\frac{d}{dx} \left( \frac{x^2}{a^2} + \frac{y^2}{b^2} \right) = \frac{d}{dx} (1)$$

$$\Rightarrow \qquad \frac{d}{dx} \left( \frac{x^2}{a^2} \right) + \frac{d}{dx} \left( \frac{y^2}{b^2} \right) = 0$$

$$\Rightarrow \qquad \frac{1}{a^2} (2x) + \frac{1}{b^2} (2y) \frac{dy}{dx} = 0$$

$$\Rightarrow \qquad \frac{2y}{b^2} \frac{dy}{dx} = -\frac{2x}{a^2}$$

$$\Rightarrow \qquad \frac{dy}{dx} = -\left( \frac{2x}{a^2} \right) \left( \frac{b^2}{2y} \right)$$

$$\Rightarrow \qquad \frac{dy}{dx} = -\frac{b^2x}{a^2y}$$

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