



### Differentiation Ex 11.2 Q71

Here,  $y = e^x + e^{-x}$

Differentiating with respect to  $x$ ,

$$\begin{aligned}
 \frac{dy}{dx} &= \frac{d}{dx} (e^x + e^{-x}) \\
 &= \frac{d}{dx} e^x + \frac{d}{dx} e^{-x} \\
 &= e^x + e^{-x} \frac{d}{dx} (-x) && \text{[Using chain rule]} \\
 &= e^x + e^{-x} (-1) \\
 &= (e^x - e^{-x}) \\
 &= \sqrt{(e^x + e^{-x})^2 - 4e^x \times e^{-x}} && \left[ \text{Since } (a-b)^2 = (a+b)^2 - 4ab \right] \\
 &= \sqrt{y^2 - 4} && \left[ \text{Since } e^x + e^{-x} = y \right]
 \end{aligned}$$

So,

$$\frac{dy}{dx} = \sqrt{y^2 - 4}.$$

### Differentiation Ex 11.2 Q72

Given,  $y = \sqrt{a^2 - x^2}$

Differentiating with respect to  $x$ ,

$$\begin{aligned}
 \frac{dy}{dx} &= \frac{d}{dx} (\sqrt{a^2 - x^2}) \\
 &= \frac{1}{2\sqrt{a^2 - x^2}} \frac{d}{dx} (a^2 - x^2) && \text{[Using chain rule]} \\
 &= \frac{1}{2\sqrt{a^2 - x^2}} (-2x) \\
 &= \frac{-x}{\sqrt{a^2 - x^2}} \\
 \Rightarrow \frac{dy}{dx} &= \frac{-x}{y} && \left[ \text{Since } \sqrt{a^2 - x^2} = y \right] \\
 \Rightarrow y \frac{dy}{dx} &= -x
 \end{aligned}$$

$$y \frac{dy}{dx} + x = 0$$

### Differentiation Ex 11.2 Q73

Here,  $xy = 4$

$$\Rightarrow y = \frac{4}{x}$$

Differentiate with respect to  $x$ ,

$$\begin{aligned}\frac{dy}{dx} &= \frac{d}{dx} \left( \frac{4}{x} \right) \\&= 4 \frac{d}{dx} (x^{-1}) \\&= 4 \left( -1 \times x^{-1-1} \right) \\&= 4 \left( -\frac{1}{x^2} \right) \\&= -\frac{4}{x^2} \\&= -\frac{4}{\left( \frac{x}{y} \right)^2} \quad \left[ \text{Since } x = \frac{4}{y} \right] \\&= -\frac{4y^2}{16}\end{aligned}$$

$$\begin{aligned}\Rightarrow \frac{dy}{dx} &= -\frac{y^2}{4} \\ \Rightarrow 4 \frac{dy}{dx} &= -y^2 \\ \Rightarrow 4 \frac{dy}{dx} &= 3y^2 - 4y^2 \\ \Rightarrow 4 \frac{dy}{dx} + 4y^2 &= 3y^2 \\ \Rightarrow 4 \left( \frac{dy}{dx} + y^2 \right) &= 3y^2\end{aligned}$$

Dividing both the sides by  $x$ ,

$$\begin{aligned}\Rightarrow \frac{4}{x} \left( \frac{dy}{dx} + y^2 \right) &= \frac{3y^2}{x} \\ \Rightarrow y \left( \frac{dy}{dx} + y^2 \right) &= \frac{3y^2}{x} \quad \left[ \text{Since } \frac{4}{x} = y \right] \\ \Rightarrow x \left( \frac{dy}{dx} + y^2 \right) &= \frac{3y^2}{y} \\ \Rightarrow x \left( \frac{dy}{dx} + y^2 \right) &= 3y.\end{aligned}$$

Differentiation Ex 11.2 Q74

$$\frac{d}{dx} \left\{ \frac{x}{2} \sqrt{a^2 - x^2} + \frac{a^2}{2} \sin^{-1} \frac{x}{a} \right\} = \sqrt{a^2 - x^2}$$

$$\begin{aligned} \text{LHS} &= \frac{d}{dx} \left\{ \frac{x}{2} \sqrt{a^2 - x^2} + \frac{a^2}{2} \sin^{-1} \frac{x}{a} \right\} \\ &= \frac{d}{dx} \left( \frac{x}{2} \sqrt{a^2 - x^2} \right) + \frac{d}{dx} \left( \frac{a^2}{2} \sin^{-1} \frac{x}{a} \right) \\ &= \frac{1}{2} \left[ x \frac{d}{dx} \sqrt{a^2 - x^2} + \sqrt{a^2 - x^2} \frac{d}{dx} (x) \right] + \frac{a^2}{2} \times \frac{1}{\sqrt{1 - \left( \frac{x}{a} \right)^2}} \times \frac{d}{dx} \left( \frac{x}{a} \right) \end{aligned}$$

[Using product rule, chain rule]

$$\begin{aligned} &= \frac{1}{2} \left[ x \times \frac{1}{2\sqrt{a^2 - x^2}} \frac{d}{dx} (a^2 - x^2) + \sqrt{a^2 - x^2} \right] + \left( \frac{a^2}{2} \right) \times \frac{1}{\sqrt{\frac{a^2 - x^2}{a^2}}} \times \left( \frac{1}{a} \right) \\ &= \frac{1}{2} \left[ \frac{x(-2x)}{2\sqrt{a^2 - x^2}} + \sqrt{a^2 - x^2} \right] + \left( \frac{a^2}{2} \right) \frac{a}{\sqrt{a^2 - x^2}} \times \left( \frac{1}{a} \right) \\ &= \frac{1}{2} \left[ \frac{-2x^2 + 2(a^2 - x^2)}{2\sqrt{a^2 - x^2}} \right] + \frac{a^2}{2\sqrt{a^2 - x^2}} \\ &= \frac{1}{2} \left[ \frac{2(a^2 - 2x^2)}{2\sqrt{a^2 - x^2}} \right] + \frac{a^2}{2\sqrt{a^2 - x^2}} \\ &= \frac{a^2 - 2x^2}{2\sqrt{a^2 - x^2}} + \frac{a^2}{2\sqrt{a^2 - x^2}} \\ &= \frac{a^2 - 2x^2 + a^2}{2\sqrt{a^2 - x^2}} \\ &= \frac{2a^2 - 2x^2}{2\sqrt{a^2 - x^2}} \\ &= \frac{2(a^2 - x^2)}{2\sqrt{a^2 - x^2}} \\ &= \frac{(a^2 - x^2)}{\sqrt{a^2 - x^2}} \\ &= \sqrt{a^2 - x^2} \\ &= \text{RHS} \end{aligned}$$

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