



Differentiation Ex 11.1 Q1

Let $f(x) = e^{-x}$

$\Rightarrow f(x+h) = e^{-(x+h)}$

$$\begin{aligned}\frac{d}{dx}(f(x)) &= \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} \\&= \lim_{h \rightarrow 0} \frac{e^{-(x+h)} - e^{-x}}{h} \\&= \lim_{h \rightarrow 0} \frac{e^{-x} \times e^{-h} - e^{-x}}{h} \\&= \lim_{h \rightarrow 0} e^{-x} \left\{ \frac{e^{-h} - 1}{-h} \right\} \times (-1) \\&= -e^{-x}\end{aligned}$$

$$\left[\text{Since, } \lim_{h \rightarrow 0} \frac{e^h - 1}{h} = 1 \right]$$

So,

$$\frac{d}{dx}(e^{-x}) = -e^{-x}$$

Differentiation Ex 11.1 Q2

Let $f(x) = e^{3x}$

$\Rightarrow f(x+h) = e^{3(x+h)}$

$$\begin{aligned}\frac{d}{dx}(f(x)) &= \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} \\&= \lim_{h \rightarrow 0} \frac{e^{3(x+h)} - e^{3x}}{h} \\&= \lim_{h \rightarrow 0} \frac{e^{3x} e^{3h} - e^{3x}}{h} \\&= \lim_{h \rightarrow 0} e^{3x} \left\{ \frac{e^{3h} - 1}{3h} \right\} \times 3 \\&= 3e^{3x}\end{aligned}$$

$$\left[\text{Since, } \lim_{x \rightarrow 0} \frac{e^x - 1}{x} = 1 \right]$$

Hence,

$$\frac{d}{dx}(e^{3x}) = 3e^{3x}$$

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