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Differentiation Ex 11.1 Q1

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

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

$$\frac{d}{dx}(f(x)) = \lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$$

$$= \lim_{h\to 0}\frac{e^{-(x+h)}-e^{-x}}{h}$$

$$= \lim_{h\to 0}\frac{e^{-x}\times e^{-h}-e^{-x}}{h}$$

$$= \lim_{h\to 0} e^{-x}\left\{\frac{\left(e^{-h}-1\right)}{-h}\right\}\times(-1)$$

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

So,

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

Differentiation Ex 11.1 Q2

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

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

$$\frac{d}{dx}(f(x)) = \lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$$

$$= \lim_{h\to 0}\frac{e^{3(x+h)}-e^{3x}}{h}$$

$$= \lim_{h\to 0}\frac{e^{3x}e^{3h}-e^{3x}}{h}$$

$$= \lim_{h\to 0} e^{3x}\left\{\frac{\left(e^{3h}-1\right)}{3h}\right\}\times 3$$

$$= 3e^{3x} \qquad \left[\text{Since, } \lim_{x\to 0}\frac{e^{x}-1}{x} = 1\right]$$

Hence,

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

********** END **********