Differentiation Ex 11.1 Q3

Let $\quad f(x) = e^{ax+b}$

$\Rightarrow \quad f(x+h) = e^{a(x+h)+b}$

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

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

$$= \lim_{h\to 0} \frac{e^{ax+b}e^{ax} - e^{ax+b}}{h}$$

$$= \lim_{h\to 0} e^{ax+b}\left\{\frac{\left(e^{ah} - 1\right)}{ah}\right\} \times a$$

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

So,

$$\frac{d}{dx}\left(e^{ax+b}\right) = ae^{ax+b}$$

Differentiation Ex 11.1 Q4

Let $\quad f(x) = e^{\cos x}$

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

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

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

$$= \lim_{h\to 0} e^{\cos x}\left[\frac{e^{\cos(x+h)-\cos x} - 1}{h}\right]$$

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

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

$$= \lim_{h\to 0} e^{\cos x} \times \left(\frac{-2\sin\frac{x+h+x}{2} \times \sin\frac{x+h-x}{2}}{h}\right) \qquad \left[\text{Since, } \cos A - \cos B = -2\sin\frac{A+B}{2}\sin\frac{A-B}{2}\right]$$

$$= e^{\cos x} \lim_{h\to 0} \frac{-2\sin\left(\frac{2x+h}{2}\right)}{2} \times \frac{\sin\left(\frac{h}{2}\right)}{\frac{h}{2}}$$

$$= e^{\cos x} \lim_{h\to 0} -2\sin\left(\frac{2x+h}{2}\right) \times \frac{1}{2} \qquad \left[\text{since, } \lim_{x\to 0} \frac{\sin x}{x} = 1\right]$$

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

$$= -\sin x e^{\cos x}$$

Hence,

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

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