

Question 1

1620

$$\begin{aligned} \text{i. } \frac{d}{dx} [\log_e (\cos x)] &= \frac{-\sin x}{\cos x} \\ &= -\tan x \\ \text{(as } \frac{d}{dx} [\log_e f(x)] &= \frac{f'(x)}{f(x)}) \end{aligned}$$

$$\begin{aligned} \text{ii. } \int_0^{\frac{\pi}{4}} \tan x dx &= \left[-\log_e (\cos x) \right]_0^{\frac{\pi}{4}} \\ &= -\left[\log_e \left(\cos \frac{\pi}{4} - \cos 0 \right) \right] \\ &= -\left[\log_e \frac{1}{\sqrt{2}} - \log_e 1 \right] \\ &= -\left[\log_e \frac{1}{\sqrt{2}} - 0 \right] \\ &= -\log_e \frac{1}{\sqrt{2}} \\ &= \log_e \sqrt{2} \\ &= \log_e 2^{\frac{1}{2}} \\ &= \frac{1}{2} \log_e 2 \end{aligned}$$