

### حساب التكامل المطلوب

ليكن  $x$  عنصرا من  $\left[0, \frac{\pi}{4}\right]$

$$\tan'(x) = \frac{1}{\cos^2 x} \quad \text{نعلم أن}$$

$$L = \int_0^{\frac{\pi}{4}} \tan'(x) \cdot x \, dx \quad \text{ومنه}$$

$$= [\tan x \cdot x]_0^{\frac{\pi}{4}} - \int_0^{\frac{\pi}{4}} \tan x \, dx$$

$$= \frac{\pi}{4} - \int_0^{\frac{\pi}{4}} \frac{\sin x}{\cos x} \, dx$$

ليكن  $x$  عنصرا من  $\left[0, \frac{\pi}{4}\right]$

$$\frac{\sin x}{\cos x} = \frac{-\cos'(x)}{\cos x} \quad \text{لدينا}$$

$$L = \frac{\pi}{4} + \int_0^{\frac{\pi}{4}} \frac{\cos'(x)}{\cos x} \, dx \quad \text{ومنه}$$

$$= \frac{\pi}{4} + [\ln(\cos x)]_0^{\frac{\pi}{4}}$$

$$= \frac{\pi}{4} + \ln\left(\cos \frac{\pi}{4}\right) - \ln(\cos 0)$$

$$= \frac{\pi}{4} + \ln \frac{\sqrt{2}}{2}$$

$$= \frac{\pi}{4} - \frac{1}{2} \ln 2$$