

(i) Using the expansions of $\cos(3x + x)$ and $\cos(3x - x)$, show that

$$\frac{1}{2}(\cos 4x + \cos 2x) \equiv \cos 3x \cos x. \quad [3]$$

(ii) Hence show that $\int_{-\frac{1}{6}\pi}^{\frac{1}{6}\pi} \cos 3x \cos x \, dx = \frac{3}{8}\sqrt{3}.$ [3]