Exercise 2

Paper 1 style · No calculator

2 7 marks AHL 3.10 · 3.11 ●●● Demanding

Consider the expression $\cos\left(x+\frac{\pi}{3}\right)+\cos\left(x-\frac{\pi}{3}\right)$, for $x \in \mathbb{R}$.

(a) Show that $\cos\left(x+\frac{\pi}{3}\right)+\cos\left(x-\frac{\pi}{3}\right)=\cos x$. **[3]**

(b) Hence solve the equation $\cos\left(x+\frac{\pi}{3}\right)+\cos\left(x-\frac{\pi}{3}\right)=\cos 2x$, for $0 \leq x \leq 2\pi$. **[4]**

The markscheme is on the next page: try the question first. Written and verified by a practising IB mathematics teacher, produced with AI assistance; solved twice and recomputed by software. Not affiliated with or endorsed by the International Baccalaureate Organization.
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MARKSCHEME (a)

$\cos x\cos\frac{\pi}{3}-\sin x\sin\frac{\pi}{3}+\cos x\cos\frac{\pi}{3}+\sin x\sin\frac{\pi}{3}$ **M1**

$=2\cos x\cos\frac{\pi}{3}$ **A1**

$=2\times\frac{1}{2}\cos x=\cos x$ **A1**

Total 3 marks

Note Both expansions.

Note AG.

MARKSCHEME (b)

$\cos x=2\cos^2 x-1$ **M1**

$(2\cos x+1)(\cos x-1)=0$ **A1**

$x=\frac{2\pi}{3},\ x=\frac{4\pi}{3}$ **A1**

$x=0,\ x=2\pi$ **A1**

Total 4 marks

Note Using $\cos 2x=2\cos^2 x-1$.

Note Or $\cos x=-\frac{1}{2}$, $\cos x=1$.