Exercise 2

Paper 1 style · No calculator

2 7 marks AHL 3.9 ●●○ Typical

Let $f(x) = 2\cos(3x) - 1$, for $0 \leq x \leq \frac{\pi}{3}$.

(a) Find the range of f. **[2]**

(b) Find an expression for $f^{-1}(x)$, and state its domain. **[3]**

(c) Solve the equation $f^{-1}(x) = \frac{\pi}{9}$. **[2]**

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)

$f(0) = 1,\ f\left(\frac{\pi}{3}\right) = -3$ **A1**

$-3 \leq f(x) \leq 1$ **A1**

Total 2 marks

Note Either value.

MARKSCHEME (b)

$x = 2\cos(3y) - 1,\ \cos(3y) = \frac{x+1}{2}$ **M1**

$f^{-1}(x) = \frac{1}{3}\arccos\left(\frac{x+1}{2}\right)$ **A1**

$-3 \leq x \leq 1$ **A1**

Total 3 marks

Note Interchanging x and y, at any stage.

MARKSCHEME (c)

$\arccos\left(\frac{x+1}{2}\right) = \frac{\pi}{3},\ \frac{x+1}{2} = \frac{1}{2}$ **M1**

$x = 0$ **A1**

Total 2 marks

Note Or $x = f\left(\frac{\pi}{9}\right)$.