Exercise 2

Paper 1 style · No calculator

2 6 marks SL 3.7 ●●○ Typical

The depth of water in a harbour, h metres, t hours after midnight, is modelled by $h(t) = a\cos(bt) + d$. High tide, 11 m, is at midnight; the next low tide, 5 m, is at 6:00.

(a) Find the values of a and d. **[2]**

(b) Find the value of b. **[2]**

(c) Find the depth of water at 4:00. **[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)

$a = \dfrac{11-5}{2} = 3$ **A1**

$d = \dfrac{11+5}{2} = 8$ **A1**

Total 2 marks

MARKSCHEME (b)

$\text{period} = 12$ **(A1)**

$b = \dfrac{2\pi}{12} = \dfrac{\pi}{6}$ **A1**

Total 2 marks

MARKSCHEME (c)

$h(4) = 3\cos\dfrac{2\pi}{3} + 8$ **(M1)**

$= 6.5\text{ m}$ **A1**

Total 2 marks

Note $\cos\frac{2\pi}{3} = -\frac{1}{2}$.