5: **In this question you must show all stages of your working.**
Solutions relying on calculator technology are not acceptable.

The sequence $u_1, u_2, u_3, \ldots$ is defined by

$$u_{n+1} = 1 - \frac{1}{u_n}$$

$$u_1 = 4$$

(a) Show that this is a periodic sequence of order 3

(3)

(b) Find the value of

$$\sum_{n=1}^{180} \left(5n + 3 + u_n\right)$$

(4)

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Question 5 continued

(Total for Question 5 is 7 marks)

6: **In this question you must show all stages of your working.**
Solutions relying on calculator technology are not acceptable.

(i) Given that θ is measured in degrees and

- $\cos\theta = \dfrac{1}{\sqrt{5}}$
- $180° < \theta < 360°$

use trigonometric identities to find the exact value of

(a) $\sin\theta$

(b) $\tan\theta$

giving the answers as fully simplified surds where appropriate.

(4)

(ii)

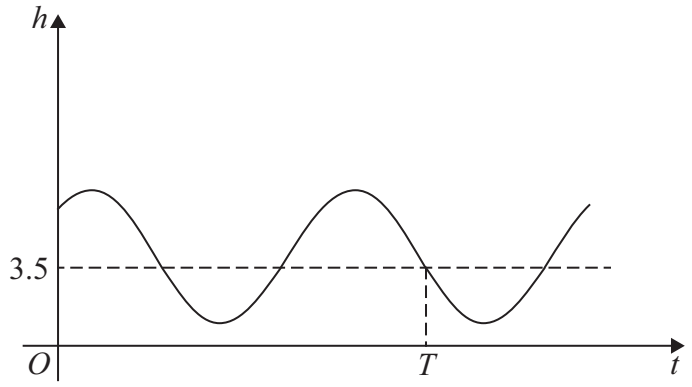


Figure 2

The height of sea water, h metres, on a harbour wall, t hours after midnight on a particular day is given by

$$h = 4 + 3\cos(30t - 40)° \qquad 0 \leqslant t < 24$$

A sketch of h against t is shown in Figure 2.

(a) Find the minimum height of sea water on the harbour wall.

(1)

(b) Find the exact time of day when this minimum height **first** occurs.

(3)

When $t = T$, as shown in Figure 2, a boat enters the harbour when the height of sea water on the harbour wall is 3.5 m.

(c) Use Figure 2 and the given equation to find the value of T to 2 decimal places.

(4)

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