

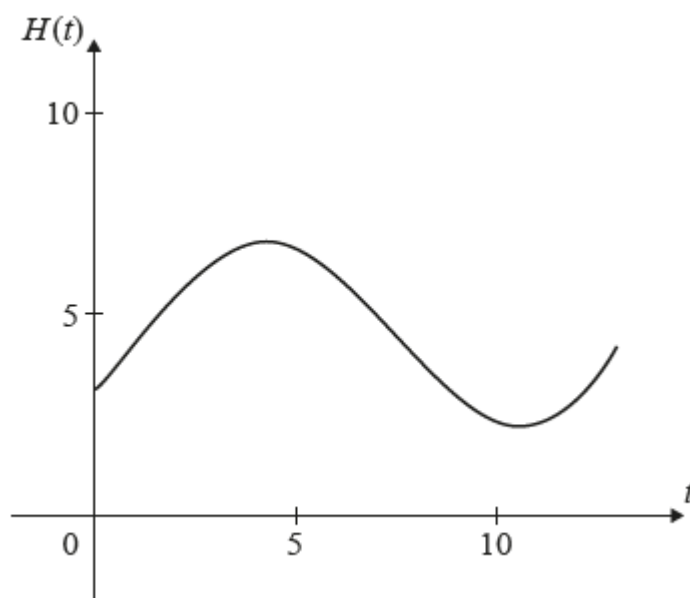
Trigonometry / the height of water [13 marks]

1. [Maximum mark: 13]

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The height of water, in metres, in Dungeness harbour is modelled by the function $H(t) = a \sin(b(t - c)) + d$, where t is the number of hours after midnight, and a , b , c and d are constants, where $a > 0$, $b > 0$ and $c > 0$.

The following graph shows the height of the water for 13 hours, starting at midnight.



The first high tide occurs at 04 : 30 and the next high tide occurs 12 hours later. Throughout the day, the height of the water fluctuates between 2. 2 m and 6. 8 m.

All heights are given correct to one decimal place.

- (a) Show that $b = \frac{\pi}{6}$. [1]
- (b) Find the value of a . [2]
- (c) Find the value of d . [2]
- (d) Find the smallest possible value of c . [3]
- (e) Find the height of the water at 12 : 00. [2]

- (f) Determine the number of hours, over a 24-hour period, for which the tide is higher than 5 metres.

[3]