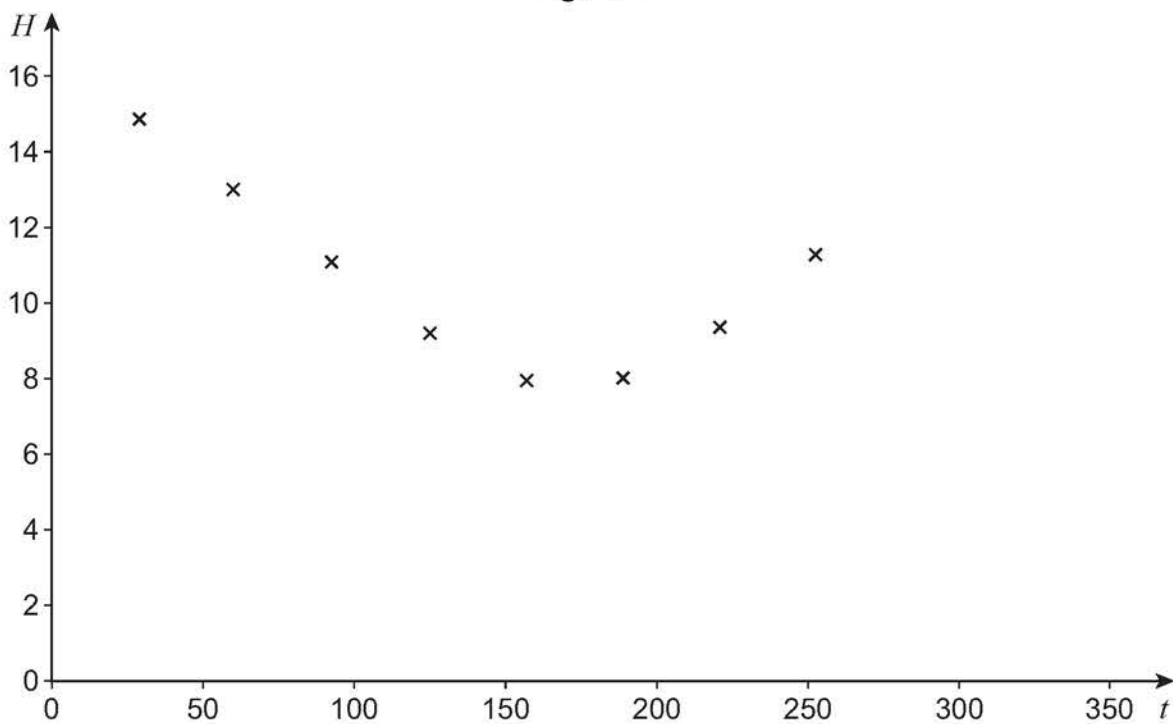


8 Mike, an amateur astronomer who lives in the South of England, wants to know how the number of hours of darkness changes through the year.

On various days between February and September he records the length of time, H hours, of darkness along with t , the number of days after 1 January.

His results are shown in **Figure 1** below.

Figure 1



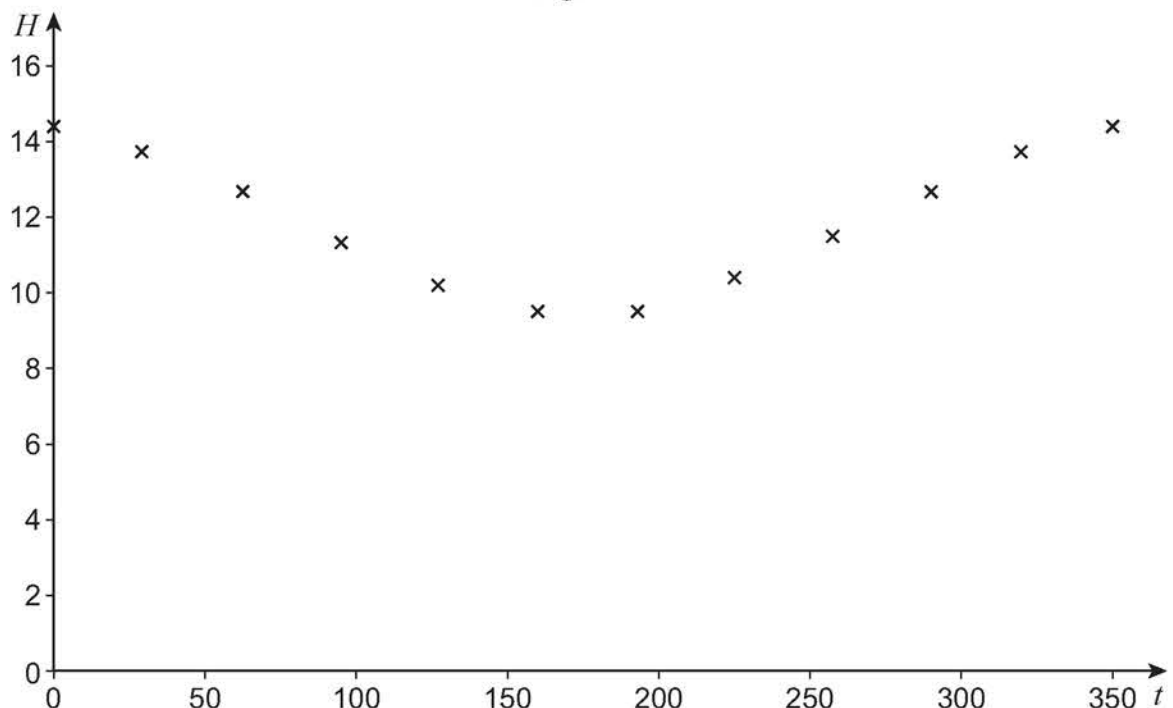
Mike models this data using the equation

$$H = 3.87 \sin\left(\frac{2\pi(t + 101.75)}{365}\right) + 11.7$$

- 8 (a) Find the minimum number of hours of darkness predicted by Mike's model. Give your answer to the nearest minute. [2 marks]
- 8 (b) Find the maximum number of consecutive days where the number of hours of darkness predicted by Mike's model exceeds 14 [3 marks]
- 8 (c) Mike's friend Sofia, who lives in Spain, also records the number of hours of darkness on various days throughout the year.

Her results are shown in **Figure 2** below.

Figure 2



Sofia attempts to model her data by refining Mike's model.

She decides to increase the 3.87 value, leaving everything else unchanged.

Explain whether Sofia's refinement is appropriate.

[2 marks]