## **Question 9**

The approximate length of the day in Galway, measured in hours from sunrise to sunset, may be calculated using the function

$$f(t) = 12 \cdot 25 + 4 \cdot 75 \sin\left(\frac{2\pi}{365}t\right),$$

where *t* is the number of days after March 21<sup>st</sup> and  $\left(\frac{2\pi}{365}t\right)$  is expressed in radians.

(a) Find the length of the day in Galway on June 5<sup>th</sup> (76 days after March 21<sup>st</sup>). Give your answer in hours and minutes, correct to the nearest minute.



(b) Find a date on which the length of the day in Galway is approximately 15 hours.



(d) Hence, or otherwise, find the length of the longest day in Galway.

(e) Use integration to find the average length of the day in Galway over the six months from March 21<sup>st</sup> to September 21<sup>st</sup> (184 days). Give your answer in hours and minutes, correct to the nearest minute.

