

| Q | Marking instructions | AO | Marks | Typical solution |
|------|--|------|----------|---|
| 8(a) | Uses $\sin = -1$ in the model to obtain $-3.87 + 11.7$ If a t value is used then the sine must evaluate to -1 or Differentiates, sets the derivative equal to 0 and obtains a value for t which they substitute back into the formula | 3.4 | M1 | $\sin\left(\frac{2\pi(t + 101.75)}{365}\right) = -1$ $-3.87 + 11.7 = 7.83$ 7hours 50mins |
| | Obtains correct answer Accept 470 minutes, $\frac{47}{6}$ or $7\frac{5}{6}$ hours | 3.2a | A1 | |
| | Subtotal | | 2 | |
| 8(b) | Uses model to form equation or inequality with $H = 14$ Condone incorrect inequality | 3.4 | M1 | $3.87 \sin\left(\frac{2\pi(t + 101.75)}{365}\right) + 11.7 = 14$ $t = 300.22 \text{ or } t = 408.77$ $408 - 300 = 108$ |
| | Solves equation to obtain at least two correct values of t Can be rounded or truncated Eg $-64.77, 43.779, 300.22, 408.77$ | 1.1b | A1 | |
| | Subtracts an appropriate pair of t values to obtain number of consecutive days Condone any rounding to the nearest whole number or truncation of their pair of values Accept 109 or 107 Alternative method = $43 + (365 - 300) = 108$ | 3.2a | A1 | |
| | Subtotal | | 3 | |
| 8(c) | Explains that Sofia's refinement would increase the amplitude of the graph Accept The range of the graph would increase It would increase the fluctuation of the graph | 3.3 | M1 | Sofia's refinement would increase the range of the graph Sofia's graph suggests this is not the case, so the refinement is not appropriate |
| | Explains that Sofia's refinement is not appropriate as her data/graph suggests a lower amplitude OE | 3.5c | A1 | |
| | Subtotal | | 2 | |
| | Question Total | | 7 | |