Question	Scheme	Marks	AOs
7(a)	Any of $A+C=8.9$, $A-C=4.1$ or $A-B=3.3$	B1	2.2a
	Uses $t=0, H=8.9$ and $t=6, H=4.1$ leading to $A=$ and $C=$	M1	3.1b
	Uses their A and "$A-B=3.3$" to find a value for B	dM1	1.1b
	$H=6.5+3.2\sin\left(\frac{\pi t}{6}\right)+2.4\cos\left(\frac{\pi t}{6}\right)$	A1	3.3
		(4)	
(b)	$R=\sqrt{13}$	B1	1.1b
	$\tan^{-1}\frac{2}{3}\{=0.588\}$	M1	1.1b
	$\{D=\}6.8+\sqrt{13}\sin\left(\frac{\pi t}{6}+0.588\right)$	A1	1.1b
		(3)	
(c)(i)	$6.8-\sqrt{13}=3.19\,\text{m}$	B1ft	3.4
(ii)	$\frac{\pi t}{6}+0.588=\frac{3\pi}{2}\Rightarrow t=\{7.877\}$	M1	3.1b
	07:53	A1	3.2a
		(3)	
(d)	Decrease the coefficient of e.g. $\sin\left(\frac{\pi t}{6}\right)$	B1	3.5c
		(1)	
			(11 marks)

Notes:

(a)

B1: Deduces any of $A+C=8.9$, $A-C=4.1$ or $A-B=3.3$

M1: Uses $t=0, H=8.9$ and $t=6, H=4.1$ leading to $A=$ and $C=$

Expect to see e.g. $A+C=8.9$, $A-C=4.1\Rightarrow A=$ and $C=$

dM1: Uses $t=9, H=3.3$ with their A leading to $B=$

A1: Achieves $H=6.5+3.2\sin\left(\frac{\pi t}{6}\right)+2.4\cos\left(\frac{\pi t}{6}\right)$ o.e., e.g. $H=\frac{13}{2}+\frac{16}{5}\sin\left(\frac{\pi t}{6}\right)+\frac{12}{5}\cos\left(\frac{\pi t}{6}\right)$

but must be in this form and not as $...+R\sin\left(\frac{\pi t}{6}+\alpha\right)$ at this point.

(b)

B1: $R = \sqrt{13}$ (must be exact)

M1: Attempts to find α using $\tan\alpha = \pm\frac{2}{3}$ or $\tan\alpha = \pm\frac{3}{2}$ o.e.

A1: Achieves $\{D =\} 6.8 + \sqrt{13}\sin\left(\frac{\pi t}{6} + 0.588\right)$ There is no need to see a left hand side.

(c)(i)

B1ft: $\left(6.8 - \sqrt{13}\right)$m or awrt 3.19m (follow through on their value of *R* to awrt 3sf) Units required.

(c)(ii)

M1: Sets their $\frac{\pi t}{6} + 0.588 = \frac{3\pi}{2}$ leading to a value for *t*.

Condone an attempt at $\frac{\pi t}{6} + 0.588 = -\frac{\pi}{2}$ leading to a value for *t*.

A1: 07:53 or 7:53am

(d)

B1: Decrease the coefficient of (any of) $\sin\left(\frac{\pi t}{6}\right)$ or $\cos\left(\frac{\pi t}{6}\right)$ or $\sin\left(\frac{\pi t}{6} + \alpha\right)$

Accept also "decrease the 3", "decrease the 2" (but neither should be negative) or "decrease the $\sqrt{13}$ " but not "decrease the 6.8".