Question Number	Scheme	Marks
4(a)	$a = 3$ (m)	B1
	$\frac{38}{3} = \frac{2\pi}{\omega} \Rightarrow \omega = \frac{3\pi}{19}$	M1A1
	$x = -a\cos\omega t \Rightarrow v = a\omega\sin\omega t$ or similar	M1
	$v = 3\times\frac{3\pi}{19}\sin\left(\frac{3\pi}{19}\times\frac{95}{60}\right)$	M1
	$= \frac{9\pi\sqrt{2}}{38}$, 1.1, 1.05,1.052,… ($\text{m h}^{-1}$)	A1 (6)
4(b)	$-1.5 = 3\cos\frac{3\pi t}{19}$	M1A1ft
	$t = \frac{38}{9}$ (h)	A1
	Time is 16:13 or 16:14	A1 (4)
		(10)
	Notes for question 4	
4(a)		
B1	$a = 3$ seen or implied	
M1	For use of $T = \frac{2\pi}{\omega}$ to give an equation in ω where $T = 2\times\frac{19}{3}$ (double the time between 12:00 and 18:20). Condone use of T = 760 min or 45600 seconds.	
A1	A correct equation using hrs, min or seconds.	
M1	Form a relevant equation in v and t using their a and ω Eg • $x = -a\cos(\omega t) \Rightarrow v = a\omega\sin(\omega t)$ • $x = a\cos(\omega t) \Rightarrow v = -a\omega\sin(\omega t)$ • $x = a\cos(\omega t) = (2.12\ldots) \Rightarrow v^2 = \omega^2(a^2 - x^2)$	
M1	Use correct equation with an appropriate value of t	
A1	Correct answer, must be positve and must be in metres per hour.	
4(b)		
M1	A complete method to find the required time eg • Use of $-1.5 = a\cos\omega t$ to find required time is $\frac{1}{\omega}\cos^{-1}\left(\frac{x}{a}\right)$ • Use of $1.5 = a\sin\omega t$ to find required time is $\frac{1}{4}\text{Period} + \frac{1}{\omega}\sin^{-1}\left(\frac{x}{a}\right)$ • Use of $1.5 = a\cos\omega t$ to find required time is $\frac{1}{\omega}\cos^{-1}\left(\frac{x}{a}\right)$ subtracted from 18:20	
A1ft	A correct equation, ft on their a and ω $\frac{1}{4}\left(\frac{38}{3}\right) + \frac{1}{\omega}\sin^{-1}\left(\frac{x}{a}\right)$	
A1	A correct t value in hours or minutes or seconds $t = \frac{38}{9}$ (h) , $t = \frac{760}{3}$ (min) $t = 15200$ (s)	
A1	For the correct time . Accept 4.13pm or 4.14 pm or 16:13 or 16:14	