Modelling with Trigonometric Functions - Edexcel Past Exam Questions MARK SCHEME

Question 1: Jan 09 Q8

Question Number	Scheme		Marks	
(a)	$R^2 = 3^2 + 4^2$		M1	
	$R = 5$		A1	
	$\tan\alpha = \frac{4}{3}$		M1	
	$\alpha = 53 \ldots °$	awrt 53°	A1	(4)
(b)	Maximum value is 5	ft their R	B1 ft	
	At the maximum, $\cos(\theta - \alpha) = 1$ *or* $\theta - \alpha = 0$		M1	
	$\theta = \alpha = 53 \ldots °$	ft their α	A1 ft	(3)
(c)	$f(t) = 10 + 5\cos(15t - \alpha)°$			
	Minimum occurs when $\cos(15t - \alpha)° = -1$		M1	
	The minimum temperature is $(10 - 5)° = 5°$		A1 ft	(2)
(d)	$15t - \alpha = 180$		M1	
	$t = 15.5$	awrt 15.5	M1 A1	(3)
				[12]

Question 2: June 10 Q7

Question Number	Scheme	Marks
(a)	$R = \sqrt{6.25}$ or 2.5	B1
	$\tan\alpha = \frac{1.5}{2} = \frac{3}{4} \Rightarrow \alpha =$ awrt 0.6435	M1A1
		(3)
(b) (i)	Max Value $= 2.5$	B1$\surd$
(ii)	$\sin(\theta - 0.6435) = 1$ or $\theta -$ their $\alpha = \frac{\pi}{2}; \Rightarrow \theta =$ awrt 2.21	M1;A1$\surd$
		(3)
(c)	$H_{Max} = 8.5$ (m)	B1$\surd$
	$\sin\left(\frac{4\pi t}{25} - 0.6435\right) = 1$ or $\frac{4\pi t}{25} =$ their (b) answer $; \Rightarrow t =$ awrt 4.41	M1;A1
		(3)
(d)	$\Rightarrow 6 + 2.5\sin\left(\frac{4\pi t}{25} - 0.6435\right) = 7; \Rightarrow \sin\left(\frac{4\pi t}{25} - 0.6435\right) = \frac{1}{2.5} = 0.4$	M1;M1
	$\left\{\frac{4\pi t}{25} - 0.6435\right\} = \sin^{-1}(0.4)$ or awrt 0.41	A1
	Either $t =$ awrt 2.1 or awrt 6.7	A1
	So, $\left\{\frac{4\pi t}{25} - 0.6435\right\} = \{\pi - 0.411517...$ or $2.730076...^{c}\}$	ddM1
	Times $= \{14:06, 18:43\}$	A1 (6)
		[15]

(a) B1: $R = 2.5$ or $R = \sqrt{6.25}$. For $R = \pm 2.5$, award B0.
M1: $\tan\alpha = \pm\frac{1.5}{2}$ or $\tan\alpha = \pm\frac{2}{1.5}$
A1: $\alpha =$ awrt 0.6435

(b) B1$\surd$: 2.5 or follow through the value of R in part (a).
M1: For $\sin(\theta -$ their $\alpha) = 1$
A1$\surd$: awrt 2.21 or $\frac{\pi}{2} +$ their α rounding correctly to 3 sf.

(c) B1$\surd$: 8.5 or 6 + their R found in part (a) as long as the answer is greater than 6.
M1: $\sin\left(\frac{4\pi t}{25} \pm$ their $\alpha\right) = 1$ or $\frac{4\pi t}{25} =$ their (b) answer
A1: For $\sin^{-1}(0.4)$ This can be implied by awrt 4.41 or awrt 4.40.

(d) M1: $6 +$ (their R)$\sin\left(\frac{4\pi t}{25} \pm$ their $\alpha\right) = 7$, M1:
$\sin\left(\frac{4\pi t}{25} \pm$ their $\alpha\right) = \frac{1}{\text{their } R}$
A1: For $\sin^{-1}(0.4)$. This can be implied by awrt 0.41 or awrt 2.73 or other values for different α's. Note this mark can be implied by seeing 1.055.
A1: Either $t =$ awrt 2.1 or $t =$ awrt 6.7
ddM1: either $\pi -$ their PV^{c}. Note that this mark is dependent upon the two M marks. This mark will usually be awarded for seeing either 2.730… or 3.373…
A1: Both $t = 14:06$ and $t = 18:43$ or both 126 (min) and 403 (min) or both 2 hr 6 min and 6 hr 43 min.