

Question	Scheme	Marks	AOs
16 (a)	$(30t - 70) = 0 \Rightarrow t = \dots$	M1	3.1a
	Time is 02:20	A1	3.2a
		(2)	
(b)	(i) $2 = 0.8 + k \Rightarrow k =$	M1	3.1a
	$H = 0.8 + 1.2 \cos(30t - 70)^\circ$	A1	3.3
	(ii) -0.4 m or alternative such as 40 cm below the level of the path	B1 ft	3.4
		(3)	
(c)	$-0.1 = 0.8 + 1.2 \cos(30t - 70)^\circ \Rightarrow \cos(30t - 70)^\circ = \beta$	M1	3.4
	$(30t - 70)^\circ = \arccos \beta \Rightarrow t = \dots$	dM1	1.1b
	$t = \text{awrt } 6.95$ or $t = \text{awrt } 9.71$	A1	1.1b
	Correct method to find a second value for t for their $\cos(30t - 70)^\circ = \beta$	ddM1	2.1
	Safe to cross between 06: 57(58) and 09:42(43)	A1	3.2a
		(5)	
(10 marks)			
Notes:			

(a)

M1: Uses the key fact that the max value of cosine occurs at 0° and solves $(30t - 70) = 0$

Condone for this mark an attempt at solving $(30t - 70) = 360$

A1: Converts the answer $t = \frac{7}{3}$ into a time of day.

Accept 02:20, 2:20 am or 2hours 20 mins after midnight. Accept any of these for both marks

(b)(i)

M1: Uses the fact that $\cos(30t - 70)$ has a maximum value of 1 to find the value of k .

A1: Equation of model is $H = 0.8 + 1.2 \cos(30t - 70)^\circ$.

Both sides of the equation must be seen. It is not scored for a correct value of k .

(b)(ii)

B1ft: For finding $0.8 - "k"$ and writing as a height with correct units

(c)

M1: Sets $H = -0.1$ and proceeds to $\cos(30t - 70)^\circ = \beta$ Score for an equivalent inequality

dM1: Correct order of operations to find one value for t

A1: One correct value for t

ddM1: Correct method to find a second value for t for their $\cos(30t - 70)^\circ = \beta$

A1: Safe to cross between 06: 57(58) and 09:42(43)

Answers with minimal working in (c)

$\cos(30t - 70)^\circ = -\frac{3}{4} \Rightarrow t = \text{awrt } 6.95 \text{ and } t = \text{awrt } 9.71 \Rightarrow \text{Safe to cross between } 06:57(58) \text{ and } 09:42(43)$

Score SC 1110