Q	Marking instructions	AO	Marks	Typical solution
17(a)	Separates variables to obtain an equation of the form $\int \frac{P}{h^2}\,\mathrm{d}h = \int \frac{1}{Q}\left(2+\sin\frac{t}{4}\right)\mathrm{d}t$ where $PQ = -400$ Must have integral signs and consistent dh and dt	3.1a	B1	$\frac{\mathrm{d}h}{\mathrm{d}t} = -\frac{h^2}{400}\left(2+\sin\frac{t}{4}\right)$ $\int \frac{400}{h^2}\,\mathrm{d}h = \int -\left(2+\sin\frac{t}{4}\right)\mathrm{d}t$ $-\frac{400}{h} = -2t + 4\cos\frac{t}{4} + c$ $t = 0, h = 10 \Rightarrow -40 = 4 + c$ $c = -44$ $h = \frac{400}{2t + 44 - 4\cos\frac{t}{4}} = \frac{200}{t + 22 - 2\cos\frac{t}{4}}$
	Integrates the $\frac{P}{h^2}$ term to obtain $-\frac{P}{h}$	1.1a	M1	
	Integrates $\sin\frac{t}{4}$ to obtain $R\cos\frac{t}{4}$	1.1a	M1	
	Completes integration to obtain $-\frac{400}{h} = -2t + 4\cos\frac{t}{4} + c$ OE Condone missing constant of integration	1.1b	A1	
	Uses t = 0 and h = 10 to determine constant of integration for their equation of the form $\frac{D}{h} = Et + F\cos\frac{t}{4} + c$ OE	3.4	M1	
	Obtains $-\frac{400}{h} = -2t + 4\cos\frac{t}{4} - 44$ OE	1.1b	A1	
	Completes reasoned argument to obtain $h = \frac{200}{t + 22 - 2\cos\frac{t}{4}}$ This mark can be scored without scoring B1 for missing dh etc at the start	2.1	R1	
	Subtotal		**7**	

Q	Marking instructions	AO	Marks	Typical solution
17(b)	Substitutes $t = 4$ into their model from part (a) of the form $h = \dfrac{A}{Bt + C - 2\cos\dfrac{t}{4}}$ to obtain a value for h PI by AWRT 8.03	3.4	M1	$\dfrac{200}{4 + 22 - 2\cos\dfrac{4}{4}} = 8.03$ 8.03 is approximately 8 so the model is valid
	Compares AWRT 8.03 to 8 or compares AWRT 1.97 to 2 AND comments that the model is valid.	3.5a	A1	
	Subtotal		**2**	

	Question 17 Total		**9**	