

Question			Answer	Marks	AO	Guidance	
9	(a)	(i)	0.8 m	B1 [1]	3.4	State 0.8 m, units required	Units may be given as m or metres Could be $\frac{4}{5}$ m Could be 80 cm
9	(a)	(ii)	$\cos(30t - 60) = -1$ $30t - 60 = 180$ $t = 8$ (hours)	M1 A1 [2]	3.4 3.4	Identify that minimum occurs when $\cos(30t - 60)$ is -1 , so need $30t - 60 = 180$ No units needed, as value of t is requested	M1 does not require attempt at solution for t No FT on an incorrect d being used from the previous part eg $d = 2.45$ from using $t = 0$ Condone 0800 or 8am Ignore additional values of t that are greater than 8, but A0 for a smaller positive value of t also given
9	(b)		$1.9 + 1.1\cos(30t - 60) = 1$ $\cos(30t - 60) = -0.8181\dots$ $30t - 60 = 144.903$ $30t = 204.90$ $t = 6.830\dots$ $30t - 60 = 215.097, 504.903, 575.097$ $30t = 275.097, 564.903, 635.097$ $t = 9.169\dots, 18.830\dots, 21.169\dots$	M1 A1 M1	3.3 1.1 3.4	Equate model to 1, rearrange and use $\cos^{-1}$ Obtain correct first value of t Attempt all further values of t within $0 < t < 24$	As far as $30t - 60 = k$, using correct order of operations Allow M1 if working in radians (gives $30t - 60 = 2.529$) Implied by first time of 0650 with no errors seen 3sf or better Ignore inequality signs if used Using a valid method M0 if using radians Values of t could also be found using the symmetry of the curve eg $8 + (8 - 6.83) = 9.17$

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				A1	1.1	Obtain the further 3 correct values and no others	Allow answers to 3sf Ignore inequality signs if used Correct time periods would imply t values
			River cannot be entered 0650 to 0910 and 1850 to 2110	A1	3.2a	Correct two periods, given as time intervals	Could also be given as 6:50am to 9:10am, and 6:50pm to 9:10pm Must be given as intervals and not just times eg A0 for '0650 and 0910' etc BOD if correct intervals given following any incorrect inequality signs Accept 0649 to 0911 and 1849 to 2111 www (from checking times and realising that rounded answers give depths of less than 1 metre) A0 if giving answers in minutes, or hours and minutes, after midnight and not times (eg '410 minutes to 550 minutes' or '6 hours 50 minutes to 9 hours 10 minutes') Condone attempt at interval notation / inequalities as long as intention is clear, and allow BOD if written as a strict inequality such as $0650 < t < 0910$ Special Case If M1A1M0 awarded, then allow SC B1 for giving a correct time period eg 0650 to 0910
				[5]			

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9	(c)		As p increases, e^{-cp} decreases so difference between max / min depths will decrease	B1 [1]	3.5c	Any sensible suggestion that suggests that amplitudes of the tides will be reduced due to the exponential term	Must refer to the effect of the exponential term in context in some way Condone reference to the exponential term having a ‘damping’ effect on the tides Cannot just restate the question eg ‘river gets shallower’