

QUESTION NUMBER	SCHEME	MARKS
	<b>N.B.</b> Column vectors acceptable throughout apart from the answer to (b).	
7(a)	$\sqrt{12^2 + 16^2} = 20 \text{ (km h}^{-1}\text{)}$	M1 A1  (2)
7(b)	$(19\mathbf{i} + 22\mathbf{j}) + t(12\mathbf{i} - 16\mathbf{j})$	M1 A1  (2)
7(c) (i)	Displacement vector $\overrightarrow{LS} = (19 + 12t - 26)\mathbf{i} + (22 - 16t - 15)\mathbf{j}$ or $\overrightarrow{SL} = (26 - 19 - 12t)\mathbf{i} + (15 - 22 + 16t)\mathbf{j}$	M1
	Correct with $\mathbf{i}$ and $\mathbf{j}$ collected $\overrightarrow{LS} = (12t - 7)\mathbf{i} + (7 - 16t)\mathbf{j}$ or $\overrightarrow{SL} = (7 - 12t)\mathbf{i} + (16t - 7)\mathbf{j}$	A1
	Use of Pythagoras to find the distance $ \overrightarrow{LS}  = \sqrt{(12t - 7)^2 + (7 - 16t)^2}$	M1
	Correct 3TQ $400t^2 - 392t + 98$	A1
	Min occurs when $t = 0.49$	A1
	<b>Alternative for last 3 marks:</b> Closest when relative pv is perpendicular to relative velocity i.e $[(12t - 7)\mathbf{i} + (7 - 16t)\mathbf{j}] \cdot (12\mathbf{i} - 16\mathbf{j}) = 0$ $400t - 196 = 0$ Min occurs when $t = 0.49$	M1 A1 A1
(ii)	$\sqrt{1.96} = 1.4 \text{ (km)}$	M1
	1.4 > 1.3 so it is safe for S to continue its course.	A1 cso  (7)
	<b>Alternative for (c)(i) and (ii):</b>	
7(c)		
(i)	Path of S: $y - 22 = \frac{-16}{12}(x - 19)$	M1
	Normal through L: $y - 15 = \frac{12}{16}(x - 26)$	A1
	Solve for either x OR y	M1
	$x = 24.88 \text{ OR } y = 14.16$	A1
	$24.88 = 12t + 19 \text{ OR } 14.16 = 22 - 16t \Rightarrow t = 0.49$	A1
(ii)	$\sqrt{(26 - 24.88)^2 + (15 - 14.16)^2} = 1.4$	M1
	1.4 > 1.3 so it is safe for S to continue its course.	A1 cso  (7)