Question Number	Scheme	Marks
	N.B. Answers to (a) and (b) should be in terms of **i** and **j**, but only penalise once. Column vectors can be used in working.	
7(a)	$\mathbf{v}_B = (20\sin\alpha)\mathbf{i} + (20\cos\alpha)\mathbf{j}$ oe e.g. use of Pythagoras but must get to an answer	M1
	$= 16\mathbf{i} + 12\mathbf{j}$ (km h⁻¹)	A1 (2)
7(b)	$(\mathbf{s} =) (10\mathbf{i} + 5\mathbf{j}) + t(16\mathbf{i} + 12\mathbf{j})$ or $(10 + 16t)\mathbf{i} + (5 + 12t)\mathbf{j}$	M1 A1 **ft** (2)
7(c)	$\overrightarrow{AB} = \mathbf{s} - \mathbf{r} = (10\mathbf{i} + 5\mathbf{j}) + t(16\mathbf{i} + 12\mathbf{j}) - [20\mathbf{j} + 40t\mathbf{i}]$	M1
	$\overrightarrow{AB} = [(10 - 24t)\mathbf{i} + (12t - 15)\mathbf{j}]$ km *	A1* (2)
7(d)	$10 - 24t = 0$ and $12t - 15 = 0$ **OR** $40t = 10 + 16t$ and $20 = 5 + 12t$	M1
	$t = \dfrac{5}{12}$ and $\dfrac{5}{4}$ or one correct t value which is then used in the other equation **correctly** to show that the equation is not true.	A1
	Different t values oe so never collide*	A1* (3)
	ALT 1:	
	$(10 - 24t)^2 + (12t - 15)^2 = 0$ (i.e. $720t^2 - 840t + 325 = 0$) M1	
	$(-840)^2 - 4 \times 720 \times 325 \ (= -230,400) \ < 0$ A1 Or roots $\dfrac{7 \pm 4i}{12}$ (calculator)	
	No real roots oe so never collide* A1* **N.B.** Must see justification for 'no real roots' to score either of the A marks.	
	ALT 2:	
	Finds minimum value of $720t^2 - 840t + 325$ or its square M1 root using derivative or completing the square or calculator	
	80 or $\sqrt{80}$ or $\overrightarrow{AB} = -4\mathbf{i} - 8\mathbf{j}$ (at $t = \frac{7}{12}$) A1	
	so never collide* A1*	
7(e)	$10 - 24t = 12t - 15$ oe	M1
	$t = \dfrac{25}{36}$ or 0.69 or better	A1
	$\overrightarrow{AB} = \left[(10 - 24 \times \dfrac{25}{36})\mathbf{i} + (12 \times \dfrac{25}{36} - 15)\mathbf{j} \right]$ (km)	M1
	$AB = 20\dfrac{\sqrt{2}}{3}$, 9.4 or better (km)	A1 (4)
		(13)