QUESTION NUMBER	SCHEME	MARKS
6(a)	$\frac{(20\mathbf{i}+34\mathbf{j})-(15\mathbf{i}+36\mathbf{j})}{0.5}$ oe	M1
	$(10\mathbf{i}-4\mathbf{j})$ *	A1*
		(2)
6(b)	$(15\mathbf{i}+36\mathbf{j})+t(10\mathbf{i}-4\mathbf{j})$	M1 A1
		(2)
6(c)(i)	Verify using $t=1.5$ in **p or q** $\mathbf{p}=(15\mathbf{i}+36\mathbf{j})+1.5(10\mathbf{i}-4\mathbf{j})=30\mathbf{i}+30\mathbf{j}$ $\mathbf{q}=(42-8\times1.5)\mathbf{i}+(9+14\times1.5)\mathbf{j}=30\mathbf{i}+30\mathbf{j}$	M1 A1 A1
(ii)	$30\mathbf{i}+30\mathbf{j}$	A1 (B1)
	N.B. The A mark for (ii) is now to be treated as a B mark.	
		(4)
ALT1 (i)	Find *t* by equating **i or j** components of **p** and **q** Equate **i**'s $15+10t=42-8t \rightarrow t=1.5$ **j**'s $36-4t=9+14t \rightarrow t=1.5$	M1 A1 A1
(ii)	$30\mathbf{i}+30\mathbf{j}$	A1 (B1)
ALT2 (i)	Uses ratio: $\frac{15+10t}{36-4t}=\frac{42-8t}{9+14t}$ $\rightarrow t=1.5$ or -8.5 verifies that components are both 30 at $t=1.5$	M1 A1 A1
(ii)	$30\mathbf{i}+30\mathbf{j}$	A1 (B1)
		(4)
6(d)	Position of *P* at 14:30 is $40\mathbf{i}+26\mathbf{j}$	B1
	Position of *Q* when $t=0.5$ $\mathbf{q}=(42-8\times0.5)\mathbf{i}+(9+14\times0.5)\mathbf{j}$ $(=(38\mathbf{i}+16\mathbf{j}))$	M1
	$15\mathbf{j}$ seen or implied	B1
	New position of *Q* at time 14:30 $\mathbf{q}=(38\mathbf{i}+16\mathbf{j})+2(15\mathbf{j})$ **N.B**. M0 if 2.5 is used.	M1
	$\mathbf{q}=38\mathbf{i}+46\mathbf{j}$	A1
	$\lvert PQ\rvert=\sqrt{(40-38)^2+(26-46)^2}$	**d**M1
	$=\sqrt{404}$ or $2\sqrt{101}$ (km)	A1
		(7)
		(15)

	Notes for question 6	
	N.B. Allow use of column vectors throughout apart from the A marks in (a) and (b).	
(a)		
M1	Complete method to find an expression for the velocity. Allow if they use 30 minutes. Give M1A0, if there are missing brackets.	
A1*	Reaches the given answer from **fully correct** working.	
(b)		
M1	Finds an expression for **p** in terms of t with the correct structure	
A1	Correct answer in terms of **i**, **j** and t.	
(c)		
(i) M1	Substitutes $t = 1.5$ into the given **q or** their **p**	
A1	P equation correct	
A1	Q equation correct **N.B. p** or **q** = $30\mathbf{i}+30\mathbf{j}$ alone can imply a correct equation in each case.	
(ii) A1(B1)	$30\mathbf{i}+30\mathbf{j}$ seen	
	ALT 1	
(i) M1	Equates coefficients of **i or j** using the given **q** and their **p**	
A1	Correct equation for **i** leading to $t = 1.5$	
A1	Correct equation for **j** leading to $t = 1.5$ **N.B.** Allow both A marks if they only write $t = 1.5$ once.	
(ii) A1(B1)	$30\mathbf{i}+30\mathbf{j}$ seen	
	ALT 2	
(i) M1	Uses ratio of components to form equation.	
A1	Two t values	
A1	Verifies that components are both 30 at $t = 1.5$	
(ii) A1(B1)	$30\mathbf{i}+30\mathbf{j}$ seen	
(d)		
B1	Position of P at 14:30	
M1	Use $t = 0.5$ to find the new position of Q at 12:30	
B1	Correct expression seen for new velocity of Q	
M1	Complete method to find the new position of Q at 14:30, using their new **v** for Q.	
A1	Correct position,	
dM1	Use of Pythagoras to find the distance. Dependent on both previous M marks.	
A1	Correct **surd** answer	