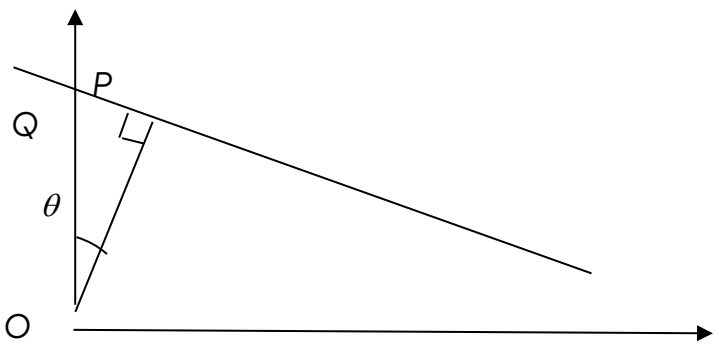
Question Number	Answer	Mark
7(a)	$(\mathbf{r} =)\ (a\mathbf{i}+b\mathbf{j}) + t(-2\mathbf{i}+\mathbf{j})$	M1
	$(11\,\mathbf{i}+3.5\mathbf{j}) = (a\mathbf{i}+b\mathbf{j}) + 1.5(-2\mathbf{i}+\mathbf{j})$ oe	M1
	ALT for first two marks: $(11\,\mathbf{i}+3.5\mathbf{j})+(t-1.5)(-2\mathbf{i}+\mathbf{j})$	(M1 M1)
	$(\mathbf{r} =)\ (14\mathbf{i}+2\mathbf{j}) + t(-2\mathbf{i}+\mathbf{j}) = (14-2t)\mathbf{i}+(2+t)\mathbf{j}$ (km) *	A1* (3)
7(b)	$(14-2t)^2+(2+t)^2=9^2$ oe	M1
	$t = 7$ or 3.4	A1
	Subtract roots (which must both be positive)	M1
	3.6 (hours) oe	A1 (4)
7(c)	$14-2t=-(2+t)$	M1
	$t = 16$	A1 (2)
7(d)	$\dfrac{14-2t}{2+t}=\dfrac{1}{2}$ **ALT 1** $[(14-2t)\mathbf{i}+(2+t)\mathbf{j}].(-2\mathbf{i}+\mathbf{j})=0$ $-2(14-2t)+(2+t)=0$ **ALT 2** $2(14-2t)\times(-2)+2(2+t)=0$ (derivative) i.e. $10t-52=0$ **ALT 3** Equn of path is $y-2=-\dfrac{1}{2}(x-14)$ and OP is $y=2x$ so at P $2x-2=-\dfrac{1}{2}(x-14)$	M1 A1
	$t = 5.2$ or $x = 3.6$	A1
	$(\overrightarrow{OP}) = (3.6\mathbf{i}+7.2\mathbf{j})$ (km) or (3.6,7.2)	**dM**1
	$OP=\sqrt{3.6^2+7.2^2}$	M1
	$=\dfrac{18\sqrt{5}}{5}$ km*	A1* (6)
	SC:  	
	At Q, $14-2t=0\Rightarrow t=7$	M1A1
	so, OQ = 2 + 7 = 9	A1

	$\tan\theta = \frac{1}{2}$ oe	**dM**1
	$OP = OQ\cos\theta = 9\times\frac{2}{\sqrt{5}} = \frac{18\sqrt{5}}{5}$ km *	M1A1* (6)
		(15)
	Notes	
	N.B. Column vectors can be used throughout apart from in the answer to (a)	
7(a)	M1: Correct structure seen or implied	
	M1: Use of given information to give correct vector equation M0 for $(11\,\mathbf{i}+3.5\mathbf{j}) + 1.5(-2\mathbf{i}+\mathbf{j}) = (a\mathbf{i}+b\mathbf{j})$	
	A1*: Given answer correctly obtained with clear working including $(\mathbf{r} =)\ (14\mathbf{i}+2\mathbf{j}) + t(-2\mathbf{i}+\mathbf{j})$ or equivalent in column vector form. **N.B.** Allow **i** and/or **j** in front of a bracket in the final answer. **N.B.** Simple verification using the given answer is M0M0 unless $(\mathbf{r} =)\ (a\mathbf{i}+b\mathbf{j}) + t(-2\mathbf{i}+\mathbf{j})$ is seen first. If they start with:: $(\mathbf{r} =)\ (14\mathbf{i}+2\mathbf{j}) + t(-2\mathbf{i}+\mathbf{j})$, M0M0A0	
7(b)	M1: Correct equation or inequality, allow with square root. **N.B.** Condone inequality the wrong way round.	
	A1: Two correct roots	
	M1: Correct method	
	A1: oe	
7(c)	M1: Complete method to obtain an equation in *t* only including negative sign	
	A1: cao	
7(d)	M1: Complete method to obtain **an equation in t** or *x* **only**, allow a sign error but not reciprocal. May use a derivative.	
	A1: Correct equation in *t* or *x* only	
	A1: cao	
	dM1: Use their calculated *t* or *x* to find **OP,** dependent on previous M mark	
	M1: Use of Pythag, with square root, must have found a single value of *t* and used it to find *OP*	
	A1*: Correct answer from correct working A0* if they use decimals	