Question	Answer	Marks	Guidance
5(c)	$\overrightarrow{PQ} = \begin{pmatrix} 12 \\ 6 \end{pmatrix} + \begin{pmatrix} -5 \\ 8 \end{pmatrix} t - \begin{pmatrix} -4 \\ 3 \end{pmatrix} t$	**M1**	For $their(b) - their(a)$, or $their(a) - their(b)$ Allow unsimplified. Both vectors must be in terms of t
	$\begin{pmatrix} 12-t \\ 6+5t \end{pmatrix}$ soi	**B1**	
	$\left\lvert \left(\overrightarrow{PQ}\right)^2 \right\rvert = (12-t)^2 + (6+5t)^2$ $\left\lvert \left(\overrightarrow{PQ}\right)^2 \right\rvert = 26t^2 + 36t + 180$	**A1**	Allow **FT** for use of modulus with $\begin{pmatrix} t-12 \\ -6-5t \end{pmatrix}$ and simplification to obtain the given result.
5(d)	Attempt to solve or consider the discriminant of $26t^2 + 36t + 180 = 0$	**M1**	Must be using the equation from part (c) as 'Hence'.
	Conclusion from either $36^2 - 4(26)(180) < 0$ or $t > 0$	**A1**	Must have stated somewhere that $\left\lvert \left(\overrightarrow{PQ}\right)^2 \right\rvert = 0$ oe has been considered not just $\left\lvert \left(\overrightarrow{PQ}\right)^2 \right\rvert$.
6(a)(i)	$a = 10, \ 6 = \frac{a}{1-r}$ $10 = 6 - 6r$	**M1**	For use of first term and sum to infinity to obtain an equation in r only
	$r = -\frac{2}{3}$	**A1**	
6(a)(ii)	$S_7 = 10\frac{\left(1-(their\ r)^7\right)}{1-\ their\ r}$	**M1**	For sum formula with $\lvert their\ r \rvert < 1$.
	$S_7 = 6.35$	**A1**	
6(b)(i)	$\log_x 3$	**B1**	
6(b)(ii)	$S_n = \frac{n}{2}\left(2\log_x 3 + (n-1)\log_x 3\right)$	**M1**	For use of sum formula with *their* (i)
	$\frac{n}{2}(n+1)\log_x 3, \ \frac{n}{2}\log_x 3^{n+1}, \ \frac{n+1}{2}\log_x 3^n$	**A1**	Allow other similar equivalents
6(b)(iii)	$\frac{n}{2}(n+1) = 3081$	**M1**	For a correct attempt to solve *their* (ii) $= 3081\log_x 3$ to obtain an answer for n. Must be a 3 term quadratic in n only.
	$n = 78$	**A1**	

Question	Answer	Marks	Guidance
6(b)(iv)	$1027 = \frac{78}{2}(79)\log_x 3$ or $3081\log_x 3$	**M1**	For using *their* 78 in a sum equation or using 3081 to obtain x
	$x = 27$	**A1**	
7(a)	$AE^2 = \left(\sqrt{17}-1\right)^2 + \left(\sqrt{17}+1\right)^2$ $= 18 + 2\sqrt{17} + 18 - 2\sqrt{17}$	**M1**	For attempt to find AE. Must see at least 3 terms in an expansion that is not the difference of two squares to be convinced a calculator is not being used.
	$AE = 6$	**A1**	
	Perimeter $= 4\sqrt{17} + 8 + \textit{their } AE$ $= 4\sqrt{17} + 14$	**B1**	**FT** on *their* AE
7(b)	Area $= \frac{1}{2}\left(3\sqrt{17}+7\right)\left(\sqrt{17}+1\right)$ oe $= \frac{1}{2}\left(51 + 3\sqrt{17} + 7\sqrt{17} + 7\right)$ oe	**M1**	For attempt at a trapezium or triangle and rectangle. Must see at least 3 terms in an expansion that is not the difference of two squares to be convinced a calculator is not being used. Allow one arithmetic slip.
	Area $= 29 + 5\sqrt{17}$	**A1**	
7(c)	$\tan AED = \frac{\sqrt{17}+1}{\sqrt{17}-1} \times \frac{\sqrt{17}+1}{\sqrt{17}+1}$	**M1**	For attempt at rationalisation.
	$\frac{9+\sqrt{17}}{8}$	**A1**	Must come from $\frac{18+2\sqrt{17}}{16}$ to be convinced a calculator is not being used.
7(d)	$\sec^2 AED = \tan^2 AED + 1$ $= \frac{\left(9+\sqrt{17}\right)^2}{64} + 1$ $\frac{81+17+18\sqrt{17}+64}{64}$ oe if $\frac{\left(9+\sqrt{17}\right)^2}{64}$ and 1 are considered separately.	**M1**	For use of *their* **(c)** in the correct identity and attempt to simplify to obtain a single fraction. Must see at least 3 terms in an expansion that is not the difference of two squares to be convinced a calculator is not being used. Allow one arithmetic slip
	$\frac{81+9\sqrt{17}}{32}$ oe	**A1**	cao