Question Number	Scheme	Marks
7. (i)	$10+8+6.4+...$	
(a)	Attempts $S_\infty = \frac{a}{1-r}$ with $a=10, r=\frac{8}{10}$	M1
	$S_\infty = 50$	A1 **(2)**
(b)	Sets $10\times 0.8^{k-1} < 0.0005 \Rightarrow 0.8^{k-1} < 0.00005$ e.g.	M1
	$\Rightarrow k-1 > \frac{\log(0.00005)}{\log(0.8)}$ or e.g. $k-1 > \log_{0.8} 0.00005$ (see notes)	M1
	$\Rightarrow k-1 > 44.38 \Rightarrow (k=)\ 46$	A1 **(3)**
(ii)	Sets $850+(n-1)\times -7 = 0 \Rightarrow n = 122.4$	M1
	States or implies that $n=122$	A1
	$S = \frac{122}{2}\{2\times 850 + 121\times -7\} = 52033$	dM1, A1 **(4)**
		(9 marks)

(i) (a)

M1: Attempts $S_\infty = \frac{a}{1-r}$ with $a=10, r=\frac{8}{10}$ but condone slips on an incorrectly evaluated "r" provided the method to finding it is correct and $-1<r<1$. The expression with the values substituted in is sufficient.

A1: $(S_\infty =)\ 50$

(b) Note that candidates may misread the number of 0s in 0.0005 but can still score M1M1A0

M1: Sets $10\times "0.8"^{k-1} < 0.0005$ and proceeds to $"0.8"^{k-1} < 0.00005$ (or they may manipulate correctly to $"0.8"^{k} < 0.00005\times 0.8$). If they take logs before this stage then they will need to proceed to e.g. $\log "0.8"^{k-1} < \log 0.0005 - \log 10$
Condone other signs being used e.g. = or >

M1: Uses a correct method to solve an equation or inequality of the type $p^k ... q$ or $p^{k-1} ... q$
It cannot be for just stating the value for *k*. They only need to proceed as far as $k-1$ on one side of an equation or inequality. Evidence of using logs is required which cannot be e.g. 44.38… otherwise M0A0
Do not be concerned with the direction of inequalities, if used, in their solution for this mark.

A1: $(k=)\ 46$ from correct working.
If inequalities are used in their method then the direction must be correct.

(ii) When using either formula condone missing brackets around (-7)

e.g. $850+(n-1)-7$ or e.g. $S_n=\frac{122}{2}\left[2\times 850+(122-1)-7\right]$

M1: Attempts to find the value of n that maximises S_n

May set $850+(n-1)\times -7=0\ (\Rightarrow -7n+857=0)\ \Rightarrow n=...$ or show trial calculations of $u_{122}=3$ and $u_{123}=-4$. May be implied by 122.

Alternatively sets $S_n=\frac{n}{2}\left[2\times 850+(n-1)\times -7\right]$ and either

- differentiates and sets = 0 : $S_n=\frac{1707}{2}n-\frac{7}{2}n^2\Rightarrow \frac{1707}{2}-7n=0\Rightarrow n=...$
- uses roots: $S_n=\frac{1707}{2}n-\frac{7}{2}n^2=0\Rightarrow n\left(\frac{1707}{2}-\frac{7}{2}n\right)=0\Rightarrow n=0,\ n=...$ and then finds the midpoint of the two roots
- completes the square: $S_n=\frac{1707}{2}n-\frac{7}{2}n^2=0\Rightarrow -\frac{7}{2}\left(n^2-\frac{1707}{7}n\right)\Rightarrow -\frac{7}{2}\left(n-\frac{1707}{14}\right)^2\pm ...\Rightarrow n=...$

to find the position of the turning point (approximately 121.9)
In all cases condone the use of n instead of $n-1$

A1: States or implies that $n=122$ (if there are multiple attempts using different values of n then the others must be rejected for this mark to be scored)

dM1: Attempts S_n using a correct formula (they may attempt to find the last term and use $S_n=\frac{n}{2}[a+L]$

It is dependent upon the previous M.
Condone the incorrect value of n being selected but it must be a positive integer.
May see multiple attempts using different values of n which is acceptable.

A1: 52033 only (i.e. if they have multiple attempts using different values then this answer must be clearly identified or the others all rejected)

Question Number	Scheme	Marks
8 (i)	$3\tan\left(2x+\frac{\pi}{5}\right)=\sqrt{3}\Rightarrow 2x+\frac{\pi}{5}=\arctan\left(\frac{\sqrt{3}}{3}\right)$	M1
	$\Rightarrow 2x+\frac{\pi}{5}=\frac{\pi}{6},\frac{7\pi}{6},\frac{13\pi}{6}\Rightarrow x=...$	dM1
	$\Rightarrow x=\frac{29\pi}{60},\frac{59\pi}{60}$	A1
		(3)
(ii)	$5\sin\theta\tan\theta=\cos\theta+4$	
	$\tan\theta=\frac{\sin\theta}{\cos\theta}\rightarrow\quad 5\sin\theta\times\frac{\sin\theta}{\cos\theta}=\cos\theta+4$	M1
	$\Rightarrow 5\left(1-\cos^2\theta\right)=\cos^2\theta+4\cos\theta$	dM1
	$\Rightarrow 6\cos^2\theta+4\cos\theta-5=0$	A1
	$\Rightarrow\cos\theta=\frac{-4\pm\sqrt{16+120}}{12}$ **(**$=0.63849...$**)** $\Rightarrow\theta=$	ddM1
	$\Rightarrow\theta=50.3°, 309.7°$	A1
		(5)
		(8 marks)

In both (i) and (ii) condone poor notation, omission of θ or x in their working provided the intention is clear or recovered/implied by further work.

(i)

M1: Correct order of operations $2x+\frac{\pi}{5}=\arctan\left(\frac{\sqrt{3}}{3}\right)$ implied by $2x+\frac{\pi}{5}=\frac{\pi}{6}$ or any correct angle.

Condone decimal values here e.g. $2x+0.628...=0.52....$
Allow to work consistently in degrees. e.g. $2x+36=30$

Alternatively, attempts to use $\tan\theta=\frac{\sin\theta}{\cos\theta}$, squares both sides , attempts to use $\pm\sin^2\theta\pm\cos^2\theta=\pm1$ and proceeds to a quadratic equation in sine or cosine

e.g.

$$\frac{3\sin\left(2x+\frac{\pi}{5}\right)}{\cos\left(2x+\frac{\pi}{5}\right)}=\sqrt{3}\Rightarrow 3\sin\left(2x+\frac{\pi}{5}\right)=\sqrt{3}\cos\left(2x+\frac{\pi}{5}\right)\Rightarrow 9\sin^2\left(2x+\frac{\pi}{5}\right)=3\left(1-\sin^2\left(2x+\frac{\pi}{5}\right)\right)$$

$$\Rightarrow 12\sin^2\left(2x+\frac{\pi}{5}\right)=3\Rightarrow\sin\left(2x+\frac{\pi}{5}\right)=(\pm)\frac{1}{2}\Rightarrow 2x+\frac{\pi}{5}=\frac{\pi}{6},...$$