Question number	Scheme	Marks
7 (a)	(i) $\frac{U_7}{U_3}=\frac{ar^6}{ar^2}=r^4 \Rightarrow \frac{16}{4}=r^4 \Rightarrow 4=r^4 \Rightarrow 2=r^2 \Rightarrow r=\sqrt{2}$ *	M1 A1cso
	(ii) $ar^2=4 \Rightarrow a=\frac{4}{\left(\sqrt{2}\right)^2}=2$	A1 [3]
Alternative		
(a)	(i) $ar^2=4$, $ar^6=16 \Rightarrow a\left(\frac{4}{a}\right)^3=16 \Rightarrow a^2=4 \Rightarrow a=2$	M1
	$r^2=\frac{4}{2} \Rightarrow r=\sqrt{2}$ *	A1cso
	(ii) $a=2$	A1
(b)	$500<2\times\sqrt{2}^{(n-1)} \Rightarrow 250<\sqrt{2}^{(n-1)}$ or $500<2^{\frac{1}{2}(n+1)}$	M1
	$\lg 250<(n-1)\lg\sqrt{2}$ or $\lg 500<\frac{1}{2}(n+1)\lg 2$	
	$n-1>\frac{\lg 250}{\lg\sqrt{2}} \Rightarrow n-1>15.93...$ or $\frac{1}{2}(n+1)>\frac{\lg 500}{\lg 2} \Rightarrow \frac{1}{2}(n+1)>8.96...$	M1 M1A1 [4]
	$n>16.93... \Rightarrow n=17$	
(c)	$S_{20}=\frac{2\left(\left(\sqrt{2}\right)^{20}-1\right)}{\sqrt{2}-1}=\frac{2046}{\sqrt{2}-1}$	M1A1
	$\frac{2046}{\left(\sqrt{2}-1\right)}\times\frac{\left(\sqrt{2}+1\right)}{\left(\sqrt{2}+1\right)}=2046\sqrt{2}+2046=2046\left(1+\sqrt{2}\right)$	M1A1 [4]
		Total 11 marks

(a)(i)	M1	$ar^2=4$ and $ar^6=16$
	A1 cso	Correct working to eliminate a and show that $r=\sqrt{2}$ (Answer given) Must see $r^4=4$.
(ii)	A1	$a=2$ (NB: This is not a B mark; must have scored the first M mark.)
Alternative		
(a)(i)	M1	$ar^2=4$ and $ar^6=16$
	A1 cso	Correct working to find a and use it to show that $r=\sqrt{2}$ (Answer given) Must see a correct substitution to eliminate r which is processed correctly to give $a=2$, and $r^2=\frac{4}{2}$ or $r^6=\frac{16}{2}$.
(ii)	A1	$a=2$ (Must have scored the first M mark.)

(b)	M1	$500 < 2\times\left(\sqrt{2}\right)^{(n-1)}$ Accept an equation or >. Accept $500 < 2\times\sqrt{2}^{n-1}$ ft their value for a
	M1	$n-1 > \dfrac{\lg 250}{\lg\sqrt{2}}$ or $\dfrac{1}{2}(n-1) > \dfrac{\lg 250}{\lg 2}$ or $\dfrac{1}{2}(n+1) > \dfrac{\lg 500}{\lg 2}$ or $\lg_{\sqrt{2}} 250 < n-1$ Accept equation or >, and logs with any base. ft $500 < 2\times\left(\sqrt{2}\right)^{n}$
	M1	Evaluate and divide logs and attempt to find a value (at least 1DP) or numerical expression for *n*. Ignore incorrect inequality sign. eg $n > 16.9$ or $n = 16.9$ or $n > 1+15.93$ or $n = 1+2\times 7.96$ ft $500 < 2\times\left(\sqrt{2}\right)^{n}$
	A1	$n = 17$ Do not award after incorrect inequalities e.g. $n < 16.9$
Alternative		
(b)	M1	$500 < 2\times\left(\sqrt{2}\right)^{(n-1)}$ Accept an equation or >. Accept $500 < 2\times\sqrt{2}^{n-1}$ ft their value for a
	M1	Attempt to use trial and improvement, showing two trials that can be used to confirm the required value of *n*, eg $\left(\sqrt{2}\right)^{15} = 181.0...$ and $\left(\sqrt{2}\right)^{16} = 256$ or $2\left(\sqrt{2}\right)^{15} = 362.0...$ and $2\left(\sqrt{2}\right)^{16} = 512$ or $2^8 = 256$ and $2^9 = 512$ ft $500 < 2\times\left(\sqrt{2}\right)^{n}$ if clearly stated
	M1	Use the higher power from these trials in an appropriate equation eg $n-1 = 16$ or $\dfrac{1}{2}(n+1) = 9$ and attempt to find a value for *n*. ft $500 < 2\times\left(\sqrt{2}\right)^{n}$ if clearly stated
	A1	$n = 17$
(c)	M1	Attempt to use $S_n = \dfrac{a(1-r^n)}{(1-r)}$ with their a, $r = \sqrt{2}$ and $n = 20$ Allow notation or sign errors if formula is stated, otherwise the substitution must be correct.
	A1	$S_{20} = \dfrac{2046}{\sqrt{2}-1}$ or $S_{20} = -\dfrac{2046}{1-\sqrt{2}}$ Correct expression with numerator evaluated.
	M1	Attempt to rationalise the denominator. Must use $\sqrt{2}+1$ and attempt to simplify the denominator.
	A1	$2046(1+\sqrt{2})$ or $2046(\sqrt{2}+1)$ Accept $p = 2046$. Award full marks for a correct answer if first M1 has been awarded.