	$x^2+\frac{412}{27}x-\frac{436}{27}=(0)$	
	For the correct 3TQ. Must have $= 0$. $27x^2+412x-436=0$ Must have integer coefficients. Accept a multiple of this.	A1 [6]
		Total 14 marks

Question	Scheme	Marks
9(a)	$ar^2=\frac{27}{2}$ $a+ar+\frac{27}{2}=\frac{57}{2}\left(\Rightarrow a+ar=15\Rightarrow a(1+r)=15\Rightarrow a=\frac{15}{1+r}\right)$ $\left(\frac{15}{1+r}\right)r^2=\frac{27}{2}\Rightarrow 30r^2-27r-27=0\Rightarrow\left(10r^2-9r-9=0\right)$	B1 M1 M1
	ALT $ar^2=\frac{27}{2}$ $\frac{57}{2}=\frac{a(r^3-1)}{r-1}$ $\frac{57}{2}=\frac{27}{2r^2}\times\frac{(r^3-1)}{r-1}\Rightarrow 30r^3-57r^2+27=0$ $\left(\Rightarrow 10r^3-19r^2+9=0\right)$	B1 M1 M1
	r: $10r^2-9r-9=0\Rightarrow(5r+3)(2r-3)=0\Rightarrow r=\frac{3}{2}$ a: $a=\frac{15}{1+\frac{3}{2}}=6$ $S_n=\sum_{r=1}^{n}\left('6'\div\frac{3}{2}\right)\left(\frac{3}{2}\right)^r\Rightarrow S_n=\sum_{r=1}^{n}4\left(\frac{3}{2}\right)^r$ *	M1A1 A1 M1A1 cso [8]
(b)	$\frac{6(1.5^k-1)}{1.5-1}>50\ 000$ $1.5^k>\frac{12\ 503}{3}\Rightarrow \lg 1.5^k>\lg\frac{12\ 503}{3}$ $k>\frac{\lg\frac{12\ 503}{3}}{\lg\frac{3}{2}}$ or $k>\frac{\lg\frac{12\ 503}{3}}{\lg 1.5}$ *	M1 M1 A1 [cso] [3]

(c)	For $k > 20.556...$ so $k = 21$	B1 [1]
		Total 12 marks

Question	Scheme	Marks
9(a)	For stating, $ar^2 = \frac{27}{2}$	B1
	For summing the first three terms; $a + ar + \frac{27}{2} = \frac{57}{2}\left(\Rightarrow a + ar = 15 \Rightarrow a(1+r) = 15 \Rightarrow a = \frac{15}{1+r}\right)$ OR $\frac{57}{2} = \frac{a(r^3-1)}{r-1}$	M1
	For attempting to form a 3TQ using their two expressions for U_3 and S_3 $\left(\frac{15}{1+r}\right)r^2 = \frac{27}{2} \Rightarrow 30r^2 - 27r - 27 = 0 \Rightarrow \left(10r^2 - 9r - 9 = 0\right)$ OR For attempting to form a cubic using their two expressions for U_3 and S_3 $\frac{57}{2} = \frac{27}{2r^2} \times \frac{(r^3-1)}{r-1} \Rightarrow 30r^3 - 57r^2 + 27 = 0$	M1
	For attempting to solve their 3TQ (see general guidance). $10r^2 - 9r - 9 = 0 \Rightarrow (5r+3)(2r-3) = 0 \Rightarrow r = ...$ OR If following the alt method then this mark is awarded for factorising the cubic into a linear expression and a 3TQ **and** attempting to solve their 3TQ. $(r-1)(10r^2 - 9r - 9) = 0 \Rightarrow (r-1)(5r+3)(2r-3) = 0$ $\Rightarrow r = \cdots$	M1
	For the correct value of $r = \frac{3}{2}$	A1
	For the correct value of $a = \frac{15}{1+\frac{3}{2}} = 6$	A1
	For attempting to use their a and r to find the correct expression for S_n	

	$S_n = \sum_{r=1}^{n}\left('6'\div\frac{3}{2}\right)\left(\frac{3}{2}\right)^r \Rightarrow S_n = ...$ OR For demonstrating that a particular value of r gives the correct term in the sequence.	M1
	For the correct expression $S_n = \sum_{r=1}^{n} 4\left(\frac{3}{2}\right)^r$ * OR For demonstrating that a particular value of r gives the correct term in the sequence and commenting on a correct common ratio.	A1 cso [8]
(b)	For using the summation formula > 50 000 $\frac{6\left(1.5^k - 1\right)}{1.5-1} > 50\ 000$	M1
	For rearranging the inequality to achieve, $1.5^k > \frac{12\ 503}{3}$ and takes logs base 10 of both sides $\lg 1.5^k > \lg\frac{12\ 503}{3}$	M1
	For using the laws of logs to make k the subject. $k > \frac{\lg\frac{12\ 503}{3}}{\lg\frac{3}{2}}$ or $k > \frac{\lg\frac{12\ 503}{3}}{\lg 1.5}$ *	A1 cso [3]
(c)	For $k > 20.556... \Rightarrow k = 21$	B1 [1]
		Total 12 marks