$ \begin{cases} (S_4 =) \frac{a(1-r^4)}{1-r} = 80 & \text{or} \qquad (S_\infty =) \frac{a}{1-r} = 81 & \text{or} a + ar + ar^2 + ar^3 = 80 \\ \frac{81(1-r)(1-r^4)}{1-r} = 80 \Rightarrow \left(81(1-r^4) = 80\right) & \text{or} \\ 81(1-r) = \frac{80(1-r)}{1-r^4} & \text{M1} \\ \left(\Rightarrow (81-81r)(1-r^4) = 80(1-r) \Rightarrow 81r^3 - 81r^4 - r + 1 = 0 \Rightarrow (81r^4-1)(r-1) = 0 \right) & \text{or} \\ 81(1-r) + 81(1-r)r + 81(1-r)r^2 + 81(1-r)r^3 = 80 & \text{M1} \\ r^4 = \frac{1}{81} & \text{M1} \\ r = \pm \frac{1}{3} & \text{A1} \\ [a = 54] & \text{S}_7 = \frac{r^2 4^n \left(1 - \left(\frac{n^1}{3}\right)^7\right)}{1-\frac{n^1}{3}} & \text{or} \frac{2186}{27} & \text{or} 81 \left(1 - \left(\frac{n^1}{3}\right)^7\right) \\ 81 - \frac{2186}{27} = \frac{1}{27} * & \text{dM1} \\ \text{ALT} & \text{FINAL THREE MARKS} \\ S_7 = \frac{r^5 4^n \left(1 - \left(\frac{n^1}{3}\right)^7\right)}{1-\frac{n^1}{3}} & \text{or} \frac{2186}{27} & \text{dM1} \\ 81 - \frac{1}{27} = \frac{2186}{27} & \text{dM1} \\ & \text{A1} & \text{A1} \end{cases} $	Question number	Scheme	Marks
or $81(1-r) = \frac{80(1-r)}{1-r^4}$ $(\Rightarrow (81-81r)(1-r^4) = 80(1-r) \Rightarrow 81r^5 - 81r^4 - r + 1 = 0 \Rightarrow (81r^4 - 1)(r - 1) = 0)$ or $81(1-r) + 81(1-r)r + 81(1-r)r^2 + 81(1-r)r^3 = 80$ $r^4 = \frac{1}{81}$ $r = \pm \frac{1}{3}$ $[a = 54]$ $S_7 = \frac{"54" \left(1 - \left(\frac{"\frac{1}{3}"}{3}\right)^7\right)}{1 - "\frac{1}{3}"} \text{ or } \frac{2186}{27} \text{ or } 81 \left(1 - \left(\frac{"\frac{1}{3}"}{3}\right)^7\right)$ $81 - "\frac{2186}{27}" = \frac{1}{27} *$ $ALT FINAL THREE MARKS$ $S_7 = \frac{"54" \left(1 - \left(\frac{"\frac{1}{3}"}{3}\right)^7\right)}{1 - "\frac{1}{3}"} \text{ or } \frac{2186}{27}$ $81 - \frac{1}{27} = \frac{2186}{27}$ $M1$ $M1$ $A1*$ CSO (7) $M1$ $A1 = \frac{1}{27} = $	4	$(S_4 =) \frac{a(1-r^4)}{1-r} = 80$ or $(S_{\infty} =) \frac{a}{1-r} = 81$ or $a + ar + ar^2 + ar^3 = 80$	B1
$81(1-r) = \frac{80(1-r)}{1-r^4}$ $(\Rightarrow (81-81r)(1-r^4) = 80(1-r) \Rightarrow 81r^5 - 81r^4 - r + 1 = 0 \Rightarrow (81r^4 - 1)(r - 1) = 0)$ or $81(1-r) + 81(1-r)r + 81(1-r)r^2 + 81(1-r)r^3 = 80$ $r^4 = \frac{1}{81}$ $r = \pm \frac{1}{3}$ $[a = 54]$ $S_7 = \frac{"54" \left(1 - \left(\frac{"1}{3}"\right)^7\right)}{1 - \frac{"1}{3}"} \text{ or } \frac{2186}{27} \text{ or } 81 \left(1 - \left(\frac{"1}{3}"\right)^7\right)$ $81 - \frac{2186}{27}" = \frac{1}{27} *$ ALT FINAL THREE MARKS $S_7 = \frac{"54" \left(1 - \left(\frac{"1}{3}"\right)^7\right)}{1 - \frac{"1}{3}"} \text{ or } \frac{2186}{27}$ $M1$ $81 - \frac{1}{27} = \frac{2186}{27}$ $M1$ $4dM1$ $81 - \frac{1}{27} = \frac{2186}{27}$ $ddM1$ 41		$\frac{81(1-r)(1-r^4)}{1-r} = 80 \Longrightarrow \left(81(1-r^4) = 80\right)$	
or $81(1-r)+81(1-r)r+81(1-r)r^{2}+81(1-r)r^{3}=80$ $r^{4} = \frac{1}{81}$ $m1$ $r = \pm \frac{1}{3}$ $[a = 54]$ $S_{7} = \frac{"54" \left(1-\left("\frac{1}{3}"\right)^{7}\right)}{1-"\frac{1}{3}"} \text{ or } \frac{2186}{27} \text{ or } 81\left(1-\left("\frac{1}{3}"\right)^{7}\right)$ $81-"\frac{2186}{27}" = \frac{1}{27} *$ $ALT FINAL THREE MARKS$ $S_{7} = \frac{"54" \left(1-\left("\frac{1}{3}"\right)^{7}\right)}{1-"\frac{1}{3}"} \text{ or } \frac{2186}{27}$ $81-\frac{1}{27} = \frac{2186}{27}$ $M1$ $dM1$ $A1*$ cso (7) $dM1$ $A1*$ $dm1$ $A1$			
or $81(1-r)+81(1-r)r+81(1-r)r^{2}+81(1-r)r^{3}=80$ $r^{4} = \frac{1}{81}$ $m1$ $r = \pm \frac{1}{3}$ $[a = 54]$ $S_{7} = \frac{"54" \left(1-\left("\frac{1}{3}"\right)^{7}\right)}{1-"\frac{1}{3}"} \text{ or } \frac{2186}{27} \text{ or } 81\left(1-\left("\frac{1}{3}"\right)^{7}\right)$ $81-"\frac{2186}{27}" = \frac{1}{27} *$ $ALT FINAL THREE MARKS$ $S_{7} = \frac{"54" \left(1-\left("\frac{1}{3}"\right)^{7}\right)}{1-"\frac{1}{3}"} \text{ or } \frac{2186}{27}$ $81-\frac{1}{27} = \frac{2186}{27}$ $M1$ $dM1$ $A1*$ cso (7) $dM1$ $A1*$ $dm1$ $A1$		$81(1-r) = \frac{80(1-r)}{1-r^4}$	M1
$r^{4} = \frac{1}{81}$ $r = \pm \frac{1}{3}$ $[a = 54]$ $S_{7} = \frac{"54" \left(1 - \left("\frac{1}{3}"\right)^{7}\right)}{1 - "\frac{1}{3}"} \text{ or } \frac{2186}{27} \text{ or } 81 \left(1 - \left("\frac{1}{3}"\right)^{7}\right)$ $81 - "\frac{2186}{27}" = \frac{1}{27} *$ $ALT FINAL THREE MARKS$ $S_{7} = \frac{"54" \left(1 - \left("\frac{1}{3}"\right)^{7}\right)}{1 - "\frac{1}{3}"} \text{ or } \frac{2186}{27}$ $81 - \frac{1}{27} = \frac{2186}{27}$ $M1$ $M1$ $M1$ $A1$		$(\Rightarrow (81 - 81r)(1 - r^4) = 80(1 - r) \Rightarrow 81r^5 - 81r^4 - r + 1 = 0 \Rightarrow (81r^4 - 1)(r - 1) = 0)$	
$r^{4} = \frac{1}{81}$ $r = \pm \frac{1}{3}$ $[a = 54]$ $S_{7} = \frac{"54" \left(1 - \left("\frac{1}{3}"\right)^{7}\right)}{1 - "\frac{1}{3}"} \text{ or } \frac{2186}{27} \text{ or } 81 \left(1 - \left("\frac{1}{3}"\right)^{7}\right)$ $81 - "\frac{2186}{27}" = \frac{1}{27} *$ $ALT FINAL THREE MARKS$ $S_{7} = \frac{"54" \left(1 - \left("\frac{1}{3}"\right)^{7}\right)}{1 - "\frac{1}{3}"} \text{ or } \frac{2186}{27}$ $81 - \frac{1}{27} = \frac{2186}{27}$ $M1$ $M1$ $M1$ $A1$		or	
ALT FINAL THREE MARKS $S_{7} = \frac{"54" \left(1 - \left("\frac{1}{3}"\right)^{7}\right)}{1 - "\frac{1}{3}"} \text{ or } \frac{2186}{27}$ $81 - \frac{1}{27} = \frac{2186}{27}$ $M1$ $M1$ $M1$		$81(1-r)+81(1-r)r+81(1-r)r^{2}=80$	
ALT FINAL THREE MARKS $S_{7} = \frac{"54" \left(1 - \left("\frac{1}{3}"\right)^{7}\right)}{1 - "\frac{1}{3}"} \text{ or } \frac{2186}{27}$ $81 - \frac{1}{27} = \frac{2186}{27}$ $M1$ $M1$ $M1$		$r^4 = \frac{1}{81}$	M1
ALT FINAL THREE MARKS $S_{7} = \frac{"54" \left(1 - \left("\frac{1}{3}"\right)^{7}\right)}{1 - "\frac{1}{3}"} \text{ or } \frac{2186}{27}$ $81 - \frac{1}{27} = \frac{2186}{27}$ $M1$ $M1$ $M1$		$r=\pm\frac{1}{3}$	A1
ALT FINAL THREE MARKS $S_{7} = \frac{"54" \left(1 - \left("\frac{1}{3}"\right)^{7}\right)}{1 - "\frac{1}{3}"} \text{ or } \frac{2186}{27}$ $81 - \frac{1}{27} = \frac{2186}{27}$ $M1$ $M1$ $M1$		[a = 54]	
ALT FINAL THREE MARKS $S_{7} = \frac{"54" \left(1 - \left("\frac{1}{3}"\right)^{7}\right)}{1 - "\frac{1}{3}"} \text{ or } \frac{2186}{27}$ $81 - \frac{1}{27} = \frac{2186}{27}$ $M1$ $M1$ $M1$		$S_7 = \frac{"54" \left(1 - \left("\frac{1}{3}"\right)^7\right)}{1 - "\frac{1}{3}"} \text{ or } \frac{2186}{27} \text{ or } 81 \left(1 - \left("\frac{1}{3}"\right)^7\right)$	M1
ALT FINAL THREE MARKS $S_{7} = \frac{"54" \left(1 - \left("\frac{1}{3}"\right)^{7}\right)}{1 - "\frac{1}{3}"} \text{ or } \frac{2186}{27}$ $81 - \frac{1}{27} = \frac{2186}{27}$ $ddM1$ A1			
ALT FINAL THREE MARKS $S_{7} = \frac{"54" \left(1 - \left("\frac{1}{3}"\right)^{7}\right)}{1 - "\frac{1}{3}"} \text{ or } \frac{2186}{27}$ $81 - \frac{1}{27} = \frac{2186}{27}$ $ddM1$ A1		27 27	
$S_{7} = \frac{"54" \left(1 - \left("\frac{1}{3}"\right)^{7}\right)}{1 - "\frac{1}{3}"} \text{ or } \frac{2186}{27}$ $81 - \frac{1}{27} = \frac{2186}{27}$ $ddM1$ A1	ALT	EINAL THREE MARKS	(7)
A1			
A1		$S_7 = \frac{"54" \left(1 - \left("\frac{1}{3}"\right)\right)}{1 - "1"} \text{ or } \frac{2186}{27}$	M1
A1		3	
A1		$81 - \frac{1}{27} = \frac{2186}{27}$	
		Total	

Marks	Notes		
B1	For $\frac{a(1-r^4)}{1-r} = 80$ or $\frac{a}{1-r} = 81$ or $a+ar+ar^2+ar^3 = 80$		
	For substituting S_{∞} into S_4 and eliminating a		
M1	Students may also rearrange to make <i>a</i> the subject of both and then substitute to eliminate		
IVII	a.		
	Allow one error in manipulation. Must use a valid method to eliminate.		
	Using their S_{∞} and S_4		
M1	For reaching $r^4 = \dots$		
	or for reaching $81r^5 - 81r^4 - r + 1 = 0$		
A1	For $r = \frac{1}{3} (\operatorname{accept} \pm)$		
M1	Correct substitution into $\frac{a(1-r^7)}{1-r}$ or $a+ar+ar^2+ar^3+ar^4+ar^5+ar^6$ or $81(1-r^7)$		
	- using their a and their r . r must be positive. Or $\frac{2186}{27}$		
dM1	For 81-"2186"		
	Dependant on previous method mark. Their <i>r</i> must be positive.		
	If a and r are correct, the evaluation of each part of these calculations need not be shown		
	(can be done on a calculator).		
	If either a or r are incorrect, their $\frac{2186}{27}$ must have been evaluated and 81 used.		
A1 cso*	Obtains the given answer. No incorrect work.		
ALT	Final 3 marks		
M1	Correct substitution into $\frac{a(1-r^7)}{1-r}$ or $a+ar+ar^2+ar^3+ar^4+ar^5+ar^6$ - using their a		
	and their r. r must be positive.		
dM1	Must state		
A1	$81 - \frac{1}{27} = \frac{2186}{27}$ (for this ALT, candidates must evaluate and get $\frac{2186}{27}$		
	It isn't possible to get dM1 A0 on the ALT		
	Dependent on previous method mark.		