1			$a + (10-1)d = 11.1$ and $a + (50-1)d = 7.1$	**M1**	may be implied by $40d = \pm 4$ or embedded in attempt to solve	condone one slip in coefficient of d
			$d = -0.1$	**A1**	if unsupported, **B2** for one of these and **B3** for both	
			$a = 12$	**A1**		
			$\dfrac{1}{2} \times 50(their\ a + 7.1)$ with $a > 11.1$	**M1**	or $\dfrac{50}{2}(2a + (50-1)d)$ with $a > 11.1$ and $d < 0$	
			477.5 or 477½ or $\dfrac{955}{2}$ cao	**A1**		if **M0**, **B2** for any form of correct answer www
				[5]		

2	**(i)**		3×3^7 oe	**M1**	condone 1×3^7	do not award if only seen in sum of terms of GP
			6561	**A1**	or **B2** if unsupported	if **0**, **SC1** for 2187 unsupported
				[2]		
2	**(ii)**		valid attempt to sum a GP with $r = 3$ and $n = 15$	**M1**	eg $3 + 3^2 + \ldots.+ 3^{15}$	must see at least first two terms and last term NB 7 174 453 implies **M1** from $1 + 3 + \ldots + 3^{14}$
			$\dfrac{3(3^{15}-1)}{3-1}$ oe	**M1**		
				A1	or **B2** if **M1M0** or **B3** if unsupported	
			21 523 359			
				[3]		

2	(iii)	$\dfrac{3(3^n - 1)}{3 - 1} > 1\,000\,000$ oe	M1*		M0 for working backwards M0 if = or < used
		eg $3^{n+1} > 2000003$ or $3^n > \dfrac{2000000}{3} + 1$ www correctly taking logs of both sides	M1dep*	eg $\log 3^{n+1} > \log 2000003$ www or $\log 3^n + \log 3 > \log 2000003$ www; may be implied by next stage of working	at least one previous progressive interim step needed with no wrong working; M0dep* for $\log(3^n - 1) > \dots$
		eg $(n + 1)\log 3 > \log 2000003$ or $n\log 3 > \log 2000003 - \log 3$			
		eg $n + 1 > \dfrac{\log 2000003}{\log 3}$ and completion to $n > \dfrac{\log 2000003}{\log 3} - 1$	A1	without any wrong working	do not allow recovery from bracket errors at any stage
		$n = 13$ seen	B1	B0 for $n \geq 13$ or $n > 13$	
			[4]		
2	(iv)	valid attempt to sum a GP with $r = 2$ and $n = 15$	M1*	if correct eg $2 + 2^2 + \dots + 2^{15} = 65\,534$	NB 32767 implies M1 from $1 + 2 + \dots + 2^{14}$
		their $21\,523\,359$ – their $65\,534$ $21\,457\,825$ isw	M1dep* A1	with their $65\,534$ < their $21\,523\,359$ allow B3 for $21\,457\,825$ unsupported	
			[3]		

3	(i)	$21\left(\dfrac{1}{1+2}+\dfrac{1}{2+2}+\dfrac{1}{3+2}+\dfrac{1}{4+2}+\dfrac{1}{5+2}\right)$ oe soi	M1	may be implied by correct answer	NB 7 + 5.25 + 4.2 + 3.5 + 3 M0 if extra terms or terms missing
		22.95 or $\dfrac{459}{20}$ or $22\dfrac{19}{20}$	A1 **[2]**		
3	(ii)	$a + 45$ cao	B1	mark the final answer must be explicitly stated	
		$\dfrac{10}{2}\,a + a + their\,45$	M1	or $\dfrac{10}{2}\,\left[2a + (10-1)\times 5\right]$	condone wrongly attributed answers
		$5(2a + 45)$ or $10a + 225$ cao isw	A1 **[3]**	ignore further work attempting to find a	B2 if correct answer derived from adding terms separately

4		$ar = 24$ (i)	B1*		allow $ar^{2-1} = 24$
		$\dfrac{a}{1-r} = 150$ (ii)	B1*		
		correct substitution to eliminate one unknown	M1dep*	eg subst. of $a = 150(1-r)$ or $r = \dfrac{150-a}{150}$ in (i) alternatively, subst. of $a = \dfrac{24}{r}$ or $r = \dfrac{24}{a}$ in (ii)	if M0, B1 for both values of r and B1 for both values of a, or B1 for each pair of correct values NB $150r^2 - 150r + 24\ [= 0]$ $a^2 - 150a + 3600\ [= 0]$
		$r = 0.8$ or 0.2	A1	or A1 for each correct pair of values	A0 if wrongly attributed
		$a = 30$ or $a = 120$	A1 **[5]**	ignore incorrect pairing if correct values already correctly attributed	A0 if wrongly attributed

Question			Answer	Marks	Guidance	
5	(i)		$2S$ cao	**B1** [1]		
5	(ii)		$\dfrac{a}{1-r^2}$	**M1**	if **M0, SC1** for $\dfrac{1-r}{1-r^2} \times S$ oe	
			$\dfrac{S}{1+r}$ or $\dfrac{1}{1+r}S$	**A1** [2]		

6			(5), 8, 11, (14),…isw	B1		
			$a = 5$ and $d = 3$ soi	B1		
			$S_{50} = \dfrac{50}{2}(2{\times}5 + (50 - 1) \times 3)$ oe	M1		if M0, award B2 if 3925 is obtained from summing individual terms or if unsupported
			3925	A1 [4]	if M0, SC1 for use of $a = 8$ and obtaining 4075	

Question			Answer	Marks	Guidance	
7	(i)		$ar = 6$ oe	B1	must be in a and r	
			$\dfrac{a}{1-r} = 25$ oe	B1	must be in a and r	
			$25 = \dfrac{a}{1 - 6/a}$	M1	or $\dfrac{6}{r} = 25(1-r)$	NB assuming $a = 10$ earns M0
			$a^2 - 25a + 150 \ [= 0]$	A1	or $25r^2 - 25r + 6 \ [= 0]$	All signs may be reversed
			$a = 10$ obtained from formula, factorising, Factor theorem or completing the square	A1	$r = 0.4$ and $r = 0.6$	
			$a = 15$	A1	$a = 15$	if M0, B1 for $r = 0.4$ **and** 0.6 and B1 for $a = 15$ by trial and improvement mark to benefit of candidate
			$r = 0.4$ and 0.6	A1	$a = \dfrac{6}{0.6} = 10$ oe	
				[7]		
7	(ii)		$10 \times (3/5)^{n-1}$ and $15 \times (2/5)^{n-1}$ seen	M1		
			$15 \times 2^{n-1} : 10 \times 3^{n-1}$ or $3 \times \dfrac{2^{n-1}}{5^{n-1}} : 2 \times \dfrac{3^{n-1}}{5^{n-1}}$	M1	may be implied by $3 \times 2^{n-1} : 2 \times 3^{n-1}$	condone ratio reversed
			$3 \times 2^{n-1} : 2 \times 3^{n-1}$	A1	and completion to given answer www	condone ratio reversed
				[3]		