Applied Sequences and Series Exam Questions MS (From OCR MEI 4752)

Q1, (Jun 2010, Q12)

(i) **(A)**	1024	**2**	**M1** for number of buds = 2^{10} s.o.i.
(i) **(B)**	2047	**2**	**M1** for $1+2+4+\ldots 2^{10}$ or for $2^{11} - 1$ or (their 1024) + 512 + 256 +…+ 1
(ii) **(A)**	no. of nodes = $1 + 2 + ..+ 2^{n-1}$ s.o.i. $\frac{7\times(2^n-1)}{2-1}$	**1** **1**	no. of leaves = $7 + 14 + \ldots + 7\times2^{n-1}$
(ii) **(B)**	$7(2^n - 1) > 200\,000$ $2^n > \frac{200\,000}{7} + 1$ or $\frac{200\,007}{7}$ $n \log 2 > \log(\frac{200\,007}{7})$ and completion to given ans $[n =]$ 15 c.a.o.	**M1** **M1** **M1** **B1**	or $\log 7 + \log 2^n > \log 200\,007$

Q2, (Jun 2005, Q11)

i	81	1		1
ii	$(1x)3^{n-1}$	1		1
iii	(GP with) $a = 1$ and $r = 3$ clear correct use GP sum formula	M1 M1	or M1 for = $1+3+9+ \ldots +3^{n-1}$	2
iv	(A) 6 www (B) 243	2 1	M1 for $364 = (3^n - 1)/2$	3
v	their (ii) > 900 $(y - 1)\log 3 > \log 900$ $y - 1 > \log 900 \div \log 3$ $y = 8$ cao	M1ft M1ft M1 B1	-1 once for = or < seen: condone wrong letter / missing brackets / no base	4

Q3, (Jun 2007, Q11)

ai	13	1		1
aii	120	2	M1 for attempt at AP formula ft their a, d or for $3 + 5 + \ldots + 21$	2
bi	$\frac{125}{1296}$	2	M1 for $\frac{1}{6}\times\left(\frac{5}{6}\right)^3$	2
ii	$a = 1/6$, $r = 5/6$ s.o.i.	1+1	If not specified, must be in right order	
	$S_\infty = \frac{\frac{1}{6}}{1-\frac{5}{6}}$ o.e.	1		3
iii	$\left(\frac{5}{6}\right)^{n-1} < 0.006$	M1		
	$(n-1)\log_{10}\left(\frac{5}{6}\right) < \log_{10} 0.006$	M1	condone omission of base, but not brackets	
	$n-1 > \frac{\log_{10} 0.006}{\log_{10}\left(\frac{5}{6}\right)}$	DM1		4
	$n_{\min} = 30$	B1	NB change of sign must come at correct place	
	Or $\log(1/6) + \log(5/6)^{n-1} < \log 0.001$ $(n-1)\log(5/6) < \log(0.001/(1/6))$	M1 M1		

Q4, (Jun 2011, Q12)

(i)(A) 390	**B2**	**M1** for $500 - 11 \times 10$
(i)(B) $S_{24} = \frac{24}{2}(2\times500+(24-1)\times-10)$ o.e. i.s.w. *or* $S_{24} = \frac{24}{2}(500+270)$ o.e. i.s.w. [=9240] (answer given)	**B2**	nothing simpler than $12(1000 + 23\times\text{-}10)$ or $\frac{24}{2}(1000-230)$ or $12(2\times500-230)$ if **B2** not awarded, then **M1** for use of a.p. formula for S_{24} with $n = 24$, $a = 500$ and $d = -10$ or **M1** for $l = 270$ s.o.i.
(ii)(A) 368.33(...) or 368.34	**B2**	**M1** for 460×0.98^{11}
(ii)(B) $J_{20} = 310$ $M_{20} = 313.36(...)$, 313.4, 313.3, 313.37 or 313 $J_{19} = 320$ $M_{19} = 319.76(...)$, 319.8 or 319.7	**B3**	**B3** for all 4 values correct or **B2** for 3 values correct or **B1** for 2 values correct
(ii)(C) 8837 to 8837.06	**B2**	**M1** for $S_{24} = \frac{460\left(1-0.98^{24}\right)}{1-0.98}$ o.e.
(ii)(D) $\frac{a(1-0.98^{24})}{(1-0.98)} = 9240$ o.e. 480.97 to 480.98	**M1** **A1**	f.t. their power of 24 from (ii)C

Q5, (Jun 2009, Q11)

iA	10+20+30+40+50+60	B1	or $\frac{6}{2}(2\times10+5\times10)$ or $\frac{6}{2}(10+60)$	1
iB	correct use of AP formula with $a = 10$ and $d = 10$	M1		
	$n(5 + 5n)$ or $5n(n + 1)$ or $5(n^2 + n)$ or $(5n^2 + 5n)$	A1		
	$10n^2 + 10n - 20700 = 0$	M1	Or better	
	45 c.a.o.	A1		4
iiA	4	1		1
iiB	£2555	2	M1 for $5(1 + 2 + \ldots 2^8)$ or $5(2^9 - 1)$ o.e.	2
iiC	correct use of GP formula with $a = 5$, $r = 2$	M1		
	$5(2^n - 1)$ o.e.= 2621435	DM1	"S" need not be simplified	
	$2^n = 524288$ www	M1		
	19 c.a.o.	A1		4

Q6, (Jun 2015, Q11)

(i)	3×3^7 oe	**M1**	condone 1×3^7	
	6561	**A1**	or **B2** if unsupported	
		[2]		
(ii)	valid attempt to sum a GP with $r = 3$ and $n = 15$	**M1**	eg $3 + 3^2 + \ldots\ldots + 3^{15}$	
	$\frac{3(3^{15}-1)}{3-1}$ oe	**M1**		
	21 523 359	**A1**	or **B2** if **M1M0** or **B3** if unsupported	
		[3]		

(iii)		$\frac{3(3^n-1)}{3-1} > 1000000$ oe	**M1***	
		eg $3^{n+1} > 2000003$ or $3^n > \frac{2000000}{3} + 1$ www		
		correctly taking logs of both sides eg $(n+1)\log 3 > \log 2000003$ or $n\log 3 > \log 2000003 - \log 3$	**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
		eg $n+1 > \frac{\log 2000003}{\log 3}$ and completion to $n > \frac{\log 2000003}{\log 3} - 1$	**A1**	without any wrong working
		$n = 13$ seen	**B1** **[4]**	**B0** for $n \geq 13$ or $n > 13$
(iv)		valid attempt to sum a GP with $r = 2$ and $n = 15$	**M1***	if correct eg $2 + 2^2 + \ldots\ldots + 2^{15} = 65\,534$
		their 21 523 359 – their 65 534 21 457 825 isw	**M1dep*** **A1** **[3]**	with their 65 534 < their 21 523 359 allow **B3** for 21 457 825 unsupported