

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 $1+2+4+\dots+2^{10}$ or for $2^{11} - 1$ or (their 1024) + 512 + 256 + ... + 1 |
| (ii) (A) | no. of nodes = $1 + 2 + \dots + 2^{n-1}$ s.o.i. $\frac{7 \times (2^n - 1)}{2 - 1}$ | 1 1 | no. of leaves = $7 + 14 + \dots + 7 \times 2^{n-1}$ |
| (ii) (B) | $7(2^n - 1) > 200\,000$ $2^n > \frac{200\,000}{7} + 1$ or $\frac{200\,007}{7}$ $n \log 2 > \log \left(\frac{200\,007}{7} \right)$ 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)

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|------------|---|--|--|----------|
| 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 $= 1+3+9+ \dots + 3^{n-1}$ | 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 $3 + 5 + \dots + 21$ | 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. $S_{\infty} = \frac{\frac{1}{6}}{1 - \frac{5}{6}}$ o.e. | 1+1 | If not specified, must be in right order | |
| iii | $\left(\frac{5}{6}\right)^{n-1} < 0.006$ | 1 | | 3 |
| | $(n-1) \log_{10} \left(\frac{5}{6}\right) < \log_{10} 0.006$ | 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 | M1 | | |
| | $\log(1/6) + \log(5/6)^{n-1} < \log 0.001$ | M1 | | |
| | $(n-1) \log(5/6) < \log(0.001/(1/6))$ | M1 | | |

Q4, (Jun 2011, Q12)

| | | |
|--|------------------------|--|
| (i)(A) 390 | B2 | M1 for $500 - 11 \times 10$ |
| <p>(i)(B)</p> $S_{24} = \frac{24}{2}(2 \times 500 + (24 - 1) \times -10)$ o.e. i.s.w. <p>or $S_{24} = \frac{24}{2}(500 + 270)$ o.e. i.s.w. [=9240] (answer given)</p> | B2 | <p>nothing simpler than</p> $12(1000 + 23 \times -10)$ or $\frac{24}{2}(1000 - 230)$ or $12(2 \times 500 - 230)$ 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} |
| <p>(ii)(B)</p> $J_{20} = 310$ $M_{20} = 313.36(\dots), 313.4, 313.3,$ 313.37 or 313 $J_{19} = 320$ $M_{19} = 319.76(\dots), 319.8$ or 319.7 | B3 | <p>B3 for all 4 values correct or B2 for 3 values correct or B1 for 2 values correct</p> |
| (ii)(C) 8837 to 8837.06 | B2 | M1 for $S_{24} = \frac{460(1 - 0.98^{24})}{1 - 0.98}$ o.e. |
| <p>(ii)(D) $\frac{a(1 - 0.98^{24})}{(1 - 0.98)} = 9240$ o.e. 480.97 to 480.98</p> | M1 A1 | f.t. their power of 24 from (ii)C |

Q5, (Jun 2009, Q11)

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

Q6, (Jun 2015, Q11)

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

