1			$u_2 = \frac{10}{2^2}, u_3 = \frac{10}{\text{their } 2.5^2}, u_4 = \frac{10}{\text{their } 1.6^2}$ isw	**M1***		NB 2.5, 1.6, 3.90625 or $\frac{10}{4}, \frac{8}{5}, \frac{125}{32}$
			$2 + u_2 + u_3 + u_4$ soi	**M1dep***	must be the sum of 4 terms only	may be implied by eg sight of 3.9 and answer of 10.0
			10.00625 or $\frac{1601}{160}$ or $10\,{}^{1}\!/_{80}$ cao isw	**A1** **[3]**	**B3** if unsupported	NB 2.5, 1.1, 0.625 scores **M0M0**

2	**(i)**		11.5, 11 and 10.5 oe arithmetic and/or divergent	**B1** **B1** **[2]**	allow AP ignore references to *a*, *d* or *n*	ignore labelling incorrect embellishments such as converging arithmetic…, diverging geometric… do not score. **B0** if a choice is given eg AP/GP.
2	**(ii)**		$n = 30$ identified as number of terms in relevant AP $S_{30} = \frac{30}{2}(2\times 11.5 + (30-1)\times -0.5)$ 127.5 oe	**B1** **M1** **A1** **[3]**	 or $S_{30} = \frac{30}{2}(11.5 + -3)$ allow recovery from slip in working (eg omission of minus sign)	eg 1 + 2 + 3 + …+ 30 is not a relevant AP condone one error in *a*, *d* or *n* but do not condone $l = -½$ **SC3** if each term calculated and summed to correct answer or for 127.5 unsupported

3	0.05, 2000, 1.25×10^{-6} or $\frac{1}{20}$, 2000, $\frac{1}{800\,000}$ o. divergent	**B2** **B1**	**B1** for two correct allow "alternate terms tend to zero and to infinity" o.e.	 do *not* allow "oscillating", "getting bigger and smaller", "getting further apart"

4	$t_1 = -\sin\theta$ $t_2 = \sin\theta$	**B1** **B1**	www www	e.g. $\sin(\theta + 360) = \sin\theta + \sin 360 = \sin\theta$ **B0**

5	(i)(A) 390	**B2**	**M1** for $500 - 11 \times 10$	
5	(i)(B) $S_{24} = \frac{24}{2}(2\times500+(24-1)\times-10)$ o.e. i.s. *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.	condone omission of final bracket or "(23)-10" if recovered in later work if they write the sum out, all the terms must be listed for 2 marks $12 \times (1000 - 230)$ or 12×770 on its own do not score
5	(ii)(A) 368.33(...) or 368.34	**B2**	**M1** for 460×0.98^{11}	
5	(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	values which are clearly wrongly attributed do not score
5	(ii)(C) 8837 to 8837.06	**B2**	**M1** for $S_{24} = \frac{460(1-0.98^{24})}{1-0.98}$ o.e.	
5	(ii)(D) $\frac{a(1-0.98^{24})}{(1-0.98)} = 9240$ o. 480.97 to 480.98	**M1** **A1**	f.t. their power of 24 from (ii)C	

6	[1], $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$	**2**	**B1** for [1], $\frac{1}{2}, \frac{1}{3}$
7 (i)	$2\frac{1}{12}$ or $\frac{25}{12}$ or 2.08(3…)	**2**	**M1** for $\frac{1}{1}+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}$
7 (ii)	$\sum_{r=2}^{6} r(r+1)$ o.e.	**2**	**M1** for [f(r) =] $r(r + 1)$ o.e. **M1** for [a =] 6

8	(i) 193 (ii)divergent + difference between terms increasing o.e.	2 1	M1 for 8 + 15 + …+ 63	3

9	(i) 27 or ft from their 11 (ii)	1 1 2	M1 for 1 × 2 + 2× 3 + 3 × 4 soi, or 2,6,12 identified, or for substituting n = 3 in standard formulae	4

10	**(i)**		converging + valid reason	1 **[1]**		eg converges to 0, $r = ½$, difference between terms decreasing, sum of terms converges to 6, G.P. with $\|r\| < 1$
10	**(ii)**		neither + valid reason	1 **[1]**		eg divergent oe, A.P., $d = 4$ oe, convergent and periodic ruled out with correct reasons
10	**(iii)**		periodic + valid reason	1 **[1]**		eg repeating cycle of terms

11			3 × (3+2) + 4 × (4+2) + 5 × (5+2) + 6 ×(6+2) 122 www	M1 A1 **[2]**	oe	B2 for 122 unsupported

12	11.4 o.e.	**2**	**M1** for 12/3 + 12/4 + 12/5 + 12/6 o.e.	**M0** unless four terms summed

13	**(i)**	5 with valid method	1	eg sequence has period of 4 nos.	
	(ii)	165 www	2	M1 for $13\times (1 + 3 + 5 + 3) + 1 + 3 + 5$ or for $14 \times (1 + 3 + 5 + 3) - 3$	3