Series 2 MS

Q1.

3	9^{th} term $= 22$, $S_4 = 49$		
	(i) $a + 8d = 22$	B1	co
	$2(2a + 3d) = 49$	B1	co
	Soln of sim eqns $\rightarrow d = 1.5, a = 10$	M1 A1 [4]	Solution of two linear sim eqns. co
	(ii) $a + (n-1)d = 46$ Substitutes for a and d $\rightarrow n = 25$	M1 A1 [2]	Correct formula needed and attempt to solve. co.

Q2.

7	**(a)** $a = 100$, $d = 5$, $n = 41$ $\rightarrow S = 8200$	B1 M1 A1 [3]	co Use of correct sum formula. co
	(b) **(i)** $a + ar + ar^2$ or $a\frac{(1-r^3)}{1-r}$ $= 35 \rightarrow a = 45$	B1 M1 A1 [3]	co Solution of equation. co
	(ii) $S_\infty = \frac{a}{1-r} = 27$	M1 A1√ [2]	Correct use of formula. √ for his a.

Q3.

1	**(i)** $a = 12$, $ar = -6 \rightarrow r = -½$ $ar^9 = \frac{-3}{128}$	M1 M1 A1 [3]	Attempt at r from "ar" ar^9 must be correct. co
	(ii) $S_\infty = \frac{a}{1-r}$ used $\rightarrow 8$	M1 A1 [2]	Correct formula used. M1 needs $\lvert r \rvert < 1$

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Q4.

6	**(a)** $a + 4d = 18$	B1		co or $75 = 5/2(a + 18) \rightarrow a = 12$ etc
	$\frac{5}{2}(2a + 4d) = 75$	B1		co
	Solution $\rightarrow a = 12,\ d = 1½$	M1 A1	 [4]	Solution of sim equations co for both
	(b) $a = 16$ and $ar^3 = \frac{27}{4}$	B1		Needs both of these
	$r = \frac{3}{4}$			
	Sum to infinity = 64	M1 A1	[3]	Correct formula and $\lvert r \rvert < 1$

Q5.

5	**(a)** $d = -7$ used	B1		co
	$(m/2)[322 + (m - 1)(-7)] = 0$	M1		Condone omission of $(m/2)$. Statement
	47	A1	[3]	co (condone $m = 0$)
	(b) $\frac{a(1-r^n)}{1-r} < \frac{0.9a}{1-r}$	M1		Allow for $=, <, >, \leq, \geq$
	$1 - r^n < 0.9$	M1		Needs inequality sign correct
	$r^n > 0.1$	A1	[3]	**co**

Q6.

9	**(a)** $\frac{100}{1-r} = 2000$	M1		Correct formula and attempt to solve
	$r = 19/20$	A1		
	$ar = 95$	A1√	[3]	For $100 \times r$
	(b) **(i)** $a + 2d = 90,\ a + 4d = 80$			
	$d = -5,\ a = 100$	B1B1	[2]	
	(ii) $a + md = 0$	M1		Or use correct sum formula
	$m = 20$	A1	[2]	$m = 20$ with no working scores 2
	(iii) $\frac{n}{2}[200 + (n - 1)(-5)] = 0$	M1		
	$n = 41$	A1	[2]	$n = 41$ with no working scores 2 Do not penalise $n = 0$

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Q7.

8	**(i)** 1000, 2000, 3000... or 50, 100, 150... $\frac{40}{2(1000+40000)}$ or $\frac{40}{2(2000+39000)}$ × 5% of attempt at valid sum 41000	M1 M1 M1 A1 [4]	Recognise series, correct *a/d* (or 3 terms) Correct use of formula Can be awarded in either **(i)** or **(ii)** cao
	(ii) 1000, 1000 × 1.1, 1000 × 1.1^2 + ... or with $a = 50$ $\frac{1000(1.1^{40}-1)}{1.1-1}$ 22100	M1 M1 A1 [3]	Recognise series, correct *a/r* (or 3 terms) Correct use of formula. Allow e.g. $r = 0.1$ Or answers rounding to this

Q8.

10	**(a)** $a = -15$, $n = 25$		
	(i) Use of S_n → $d = 3$.	M1 A1 [2]	Must be correct formula. co
	(ii) Last term = $a + 24d$ → 57 (or 525 = ½ × 25 × (−15 + *l*) → *l* = 57)	M1 A1√ [2]	Must be $a + 24d$ √ for his *d*.
	(iii) Positive terms are 3,6, ...57 Either $a = 0$ or 3, $n = 19$ or 20 Use of S_{19} or S_{20} → 570	M1 A1 [2]	Correct use of formula for S_n. co
	(b) $r = 1.05$	B1	In either part **(i)** or **(ii)**.
	(i) 11th term = ar^{10} = \$6516 or \$6520	B1 [2]	co
	(ii) $S_{11} = \frac{4000\times(1.05^{11}-1)}{.05}$ = \$56800 or (56827)	M1 A1 [2]	Correct sum formula with their *r*. co

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Q9.

7 **(a)** $S_{10} = \dfrac{10}{2[2+9(\cos^2 x - 1)]}$	**M1**		Correct formula with $d = \pm(\cos^2 x - 1)$
$S_{10} = 5[2 - 9\sin^2 x]$	**M1**		Use of $c^2 + s^2 = 1$ in a correct S_{10}
$S_{10} = 10 - 45\sin^2 x$	**A1**		Or $a = 10$, $b = 45$
		[3]	
(b) **(i)** $(0 <)\dfrac{1}{3}\tan^2\theta < 1$ oe	**M1**		Allow ‹
$(0 <)\theta < \dfrac{\pi}{3}$	**A1**		cao Allow ‹
		[2]	
(ii) $S_\infty = \dfrac{1}{1 - \frac{1}{3}\tan^2\frac{\pi}{6}}$	**M1**		
$S_\infty = \dfrac{9}{8}$ or 1.125	**A1**		cao
		[2]	

Q10.

7 **(a)** $S_n = n^2 + 8n$.			
$S_1 = 9 \rightarrow a = 9$	B1		co
$S_2 = 20 \rightarrow a + d = 11 \rightarrow d = 2$ (or equating $n^2 + 8n$ with S_n and comparing coefficients)	M1 A1	[3]	Realises that S_2 is $a + (a + d)$. co
(b) $a - ar = 9$	B1		co
$ar + ar^2 = 30$	B1		co
Eliminates $a \rightarrow 3r^2 + 13r - 10 = 0$	M1		Complete elimination of r or a
or $\rightarrow 2a^2 - 57a + 81 = 0$			Correct quadratic.
$\rightarrow r = ⅔$	A1		
$\rightarrow a = 27$	A1		co (condone 27 or 1.5)
		[5]	

Q11.

6 **(i)** Uses S_n			
$\dfrac{9}{2}(24 + 8d) = 135 \rightarrow d = ¾$	M1		Uses correct formula
	A1		co
		[2]	
(ii) 9th term of AP = 12 + 8×¾ = 18	B1√		√ on "d"
GP 1st tern 12, 2nd term 18			
Common ratio = r = 18 ÷ 12 = 1½	M1		Uses "ar"
3rd term of GP = ar^2 = 27	M1		Uses ar^2 or "ar" × r
nth term of AP is 12 + (n − 1)¾			
12 + (n − 1)¾ = 27 → n = 21	M1A1		Links AP with GP. co
		[5]	

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Q12.

8	**(a)** **(i)** $ar = 24,\ ar^3 = 13\frac{1}{2}$ Eliminates a (or r) $\rightarrow$ $r = \frac{3}{4}$ $\rightarrow$ $a = 32$	B1 M1 A1 [3]	Both needed Method of Solution. co
	(ii) sum to infinity $= 32 \div \frac{1}{4} = 128$	M1A1√ [2]	Correct formula used. √ on value of r
	(b) $a = 3,\ d = 2$ $\frac{n}{2}(6 + (n-1)2)$ $(= 360)$ $\rightarrow$ $2n^2 + 4n - 720 = 0$ $\rightarrow$ $n = 18$	B1 M1 A1 A1 [4]	Correct value for d Correct S_n used. no need for 360 here. Correct quadratic co