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.

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

Q3.

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

Q4.

6	**(a)** $ar^2 = 20$	B1	co
	$\dfrac{a}{1-r} - 3a$	B1	co
	Soln of equations $\rightarrow$ ($r = ⅔$) $a = 45$	M1 A1 [4]	Complete method to find a. co
	(b) $a + 7d = 3(a + 2d)$	M1	Use of $a + (n-1)d$
	$\rightarrow 2a = d$	A1	co
	$S_8 = 4(2a + 7d) = 32d$ or $64a$	M1	correct use of S_n formula once.
	$S_4 = 2(2a + 3d) = 8d$ or $16a$	A1 [4]	ag

Q5.

7 (a)	$S_{10} = \frac{10}{2[2+9(\cos^2 x - 1)]}$	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 [3]	Or $a = 10$, $b = 45$
(b) (i)	$(0 <)\frac{1}{3}\tan^2\theta < 1$ oe	M1	Allow ‹
	$(0 <)\theta < \frac{\pi}{3}$	A1 [2]	cao Allow ‹
(ii)	$S_\infty = \frac{1}{1 - \frac{1}{3}\tan^2\frac{\pi}{6}}$	M1	
	$S_\infty = \frac{9}{8}$ or 1.125	A1 [2]	cao

Q6.

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

Q7.

4 (i)	$ar^2 = -108$, $ar^5 = 32$ $r^3 = \frac{32}{-108} = \left(-\frac{8}{27}\right)$ $r = \left(-\frac{2}{3}\right)$ or –0.666 or –0.667	B1 M1 A1 [3]	 Eliminating a $-\frac{2}{3}$ from little or no working → $\frac{3}{3}$ www
(ii)	$a = -243$	B1✓ [1]	ft on *their* r $\left(-\frac{108}{r^2}\text{ or }\frac{32}{r^5}\right)$
(iii)	$S_\infty = \frac{-243}{1 + \frac{2}{3}} = -\frac{729}{5}$ or –145.8	M1A1 [2]	Accept –146. For M1 $\lvert r\rvert$ must be < 1

Q8.

9	(a)	$S_n = 2n^2 + 8n$			
		$S_1 = 10 \ = a$	B1		
		$S_2 = 24 = a + (a + d)$ $d = 4$	M1 A1	[3]	correct use of S_n formula.
	(b)	GP $a = 64$ $ar = 48 \rightarrow r = ¾$	B1		
		$\rightarrow$3rd term is $ar^2 = 36$	M1		ar^2 numerical – for their r
		AP $a = 64$, $a + 8d = 48 \ \rightarrow \ d = -2$	B1		
		$36 = 64 + (n - 1)(-2)$	M1		correct use of $a+(n-1)d$
		$\rightarrow n = 15$.	A1	[5]	

Q9.

8	(i)	$8 + 4d = 8r$ $8 + 7d = 8r^2$ Eliminates one of the variables $\rightarrow 4r^2 - 7r + 3 = 0$ Solution $\rightarrow r = ¾ \rightarrow d = -½$	B1 B1 M1 DM1 A1 A1 [6]	co – but allow if a in place of 8. co – but allow if a in place of 8. Complete elimination of either r or d. Correct method of solution. nb answer for r given. co (assumes $r = ¾$, give B1B1 for equations, B1 for d)
	(ii)	$S_\infty = \dfrac{a}{1-r} \rightarrow 32$	M1 A1 [2]	Correct formula used.
	(iii)	$S_8 = 4(16 + 7d)$ $= 50$	M1 A1 [2]	Correct formula used. $64 + 28d$ ok co

Q10.

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

Q11.

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 $n = 0$

Q12.

6	**(a)** $a + 5d = 23$	B1		Solution of 2 linear equations
	$5(2a + 9d) - 200$	B1		
	Attempt solution, expect $d = 6$ $a = -7$	M1		
	29	A1	[4]	

	(b) $\frac{1}{1-r} (=) \frac{4}{1-\frac{1}{4}r}$	M1		Use of S_∞ formula twice
	$r = \frac{4}{5}$ oe $S = 5$	A1A1	[3]	

Q13.

2	**(i)** $5[8 + 9 \times 4]$	M1		Use correct formula with a=4, d=4
	220	A1	[2]	
	(ii) $\frac{4(2^{10} - 1)}{2 - 1}$	M1		Use correct formula with a=4, r=2 or ½
	4092	A1	[2]	4090 without 4092 A0

Q14.

1	$\frac{n}{2[122+(n-1)(-4)]}$ $n=\frac{n}{2[122+(n-1)(-4)]}$ $2n(n-31)=0$ $n=31$	**M1** **A1** **DM1** **A1** **[4]**	Attempt sum formula with $a=61$, $d=-4$ Equated to n cao Attempt to solve. Accept div. by n cao

Q15.

5	**(i)** $2\frac{1}{4}=5\frac{1}{3}r^3$ $r^3=\frac{9}{4}\times\frac{3}{16}=\frac{27}{64}$ $r=\frac{3}{4}$ or 0.75 **(ii)** $\frac{1}{3}$ (or 21 or 21.3)	M1 A1 A1 [3] M1 A1 [2]	 cao

Q16.

9	**(a)** $\frac{10}{2}(2a+9d)-400$ oe $\frac{20}{2}(2a+19d)-1400$ OR $\frac{10}{2}[2(a+10d)+9d]-1000$ $d=6$ $a=13$	**B1** **B1** **M1A1A1** **[5]**	$\rightarrow 2a+9d-80$ $\rightarrow 2a+19d-140$ or $2a+29d-200$ Solve sim. eqns both from S_n formulae
	(b) $\frac{a}{1-r}-6$ $\frac{2a}{1-r^2}-7$ $\frac{12(1-r)}{1-r^2}-7$ or $\frac{1-r^2}{1-r}-\frac{12}{7}$ $r-\frac{5}{7}$ or 0.714 $a-\frac{12}{7}$ or 1.71(4)	**B1B1** **M1** **A1** **A1√** **[5]**	 Substitute or divide Ignore any other solns for r and a

Q17.

5	**(a)** $\frac{a}{1-r}=8a\Rightarrow 1(a)-8(a)(1-r)$ $r=\frac{7}{8}$ oe	B1 B1 [2]	
	(b) $a+4d=197$ $\frac{10}{2}[2a+9d]=2040$ $d=14$	B1 B1 M1A1 [4]	Or $2a+9d=408$ Attempt to solve simultaneously