A level Mathematics Practice Paper – Arithmetic sequences and series – Mark scheme

Question	Scheme	Marks
1(a)	$206 = 140 + (12-1) \times d \Rightarrow d = ...$	M1
	$(d =) 6$	A1
		(2)
1(b)	$S_{12} = \frac{12}{2}(140 + 206)$ or $S_{12} = \frac{12}{2}(2 \times 140 + (12-1) \times "6")$ or $S_{11} = \frac{11}{2}(140 + 206 - "6")$ or $S_{11} = \frac{11}{2}(2 \times 140 + (11-1) \times "6")$	M1
	$S = 2076$ **WAY1** or $S = 1870$ **WAY 2**	A1
	$(52-12) \times 206 = ...$ or $(52-11) \times 206 = ...$	M1
	Total $= "2076" + "8240" = ...$ **(WAY 1)** or Total $= "1870" + "8446" = ...$ **(WAY 2)**	**dd**M1
	10316	A1
		(5)
		(7 marks)

A level Mathematics Practice Paper – Arithmetic sequences and series – Mark scheme

Question	Scheme	Marks
2(a)	Boy's Sequence: $10, 15, 20, 25, ...$	
	$\{a = 10,\ d = 5 \Rightarrow T_{15} =\}\ a + 14d = 10 + 14(5); = 80$ or $0.1 + 14(0.05); = £0.80$	M1 A1
		(2)
2(b)	$\{S_{60} =\}\ \frac{60}{2}\left[2(10) + 59(5)\right]$	M1 A1
	$= 30(315) = 9450$ or £94.50	A1
		(3)
2(c)	Boy's Sister's Sequence: $10, 20, 30, 40, ...$	
	$\{a = 10,\ d = 10 \Rightarrow S_m =\}\ \frac{m}{2}\left(2(10) + (m-1)(10)\right)$ $\left(\text{or } \frac{m}{2} \times 10(m+1) \text{ or } 5m(m+1)\right)$	M1 A1
	$63 \text{ or } 6300 = \frac{m}{2}\left(2(10) + (m-1)(10)\right)$	dM1
	$6300 = \frac{m}{2}(10)(m+1)$ or $12600 = 10m(m+1)$	
	$1260 = m(m+1)$	
	$35 \times 36 = m(m+1)$ **(*)**	A1 **cso**
		(3)
2(d)	$\{m =\}\ 35$	B1
		(1)
		(10 marks)

A level Mathematics Practice Paper – Arithmetic sequences and series – Mark scheme

Question	Scheme	Marks
3(a)	$S_{10} = \frac{10}{2}[2a + 9d]$ or $S_{10} = a + a + d + a + 2d + a + 3d + a + 4d + a + 5da + 6d + a + 7d + a + 8d + a + 9d$	M1
	$162 = 10a + 45d$ *	A1cso
		(2)
3(b)	$(u_n = a + (n-1)d \Rightarrow) 17 = a + 5d$	B1
		(1)
3(b)	$10 \times (b)$ gives $10a + 50d = 170$	M1
	(a) is $10a + 45d = 162$	
	Subtract $5d = 8$ so $d = \underline{1.6}$ o.e.	A1
	Solving for a $a = 17 - 5d$	M1
	so $a = \underline{9}$	A1
		(4)
		(7 marks)
4(a)	$600 = 200 + (N - 1)20 \Rightarrow N = ...$	M1
	$N = 21$	A1 cso
		(2)
4(b)	$S = \frac{21}{2}(2 \times 200 + 20 \times 20)$ or $\frac{21}{2}(200 + 600)$ or $S = \frac{20}{2}(2 \times 200 + 19 \times 20)$ or $\frac{20}{2}(200 + 580)$ (= 8400 or 7800)	M1A1
	$600 \times (52 - "N")$ (= 18600)	M1A1ft
	So total is 27000	A1 cao
		(5)
		(7 marks)

A level Mathematics Practice Paper – Arithmetic sequences and series – Mark scheme

Question	Scheme		Marks
5(a)	Lewis; arithmetic series, $a = 140,\ d = 20.$		
	$T_{20} = 140 + (20 - 1)(20); = 520$	Or lists 20 terms to get to 520	M1 A1
	OR 120 + (20)(20)		
			(2)
5(b)	Method 1	Method 2	
	Either: Uses $\frac{1}{2}n(2a + (n-1)d)$	**Or:** Uses $\frac{1}{2}n(a + l)$	M1
	$\frac{20}{2}(2\times140 + (20 - 1)(20))$	$\frac{20}{2}(140 + "520")$ ft 520	A1
	6600		A1
			(3)
5(c)	Sian; arithmetic series, $a = 300,\ l = 700,\ S_n = 8500$		
	Either: Attempt to use $8500 = \frac{n}{2}(a + l)$	**Or:** May use both $8500 = \frac{1}{2}n(2a + (n-1)d)$ and $l = a + (n-1)d$ **and eliminate** d	M1
	$8500 = \frac{n}{2}(300 + 700)$	$8500 = \frac{n}{2}(600 + 400)$	A1
		$\Rightarrow n = 17$	A1
			(3)
			(8 marks)

A level Mathematics Practice Paper – Arithmetic sequences and series – Mark scheme

Question	Scheme	Marks
6(a)	(a) Use $n^{th}\text{term} = a+(n-1)d$ with d = 10; a = 150 and n = 8, or a = 160 and n = 7, or a = 170 and n = 6 : = 150+7×10 or 160 +6 ×10 or 170 + 5 ×10	M1
	= 220* (Or gives clear list – see note)	A1*
		(2)
Or	If answer 220 is assumed and 150 + (n – 1) 10 =220 or variation is solved for n=	M1
	Then n = 8, so 2007 is the year (must conclude the year)	A1*
		(2)
6(b)	Use $S_n = \frac{n}{2}\{2a+(n-1)10\}$ or $S_n = \frac{n}{2}\{a+l\}$ **and** l= a + (n – 1)10	M1
	= 7(300 + 13 × 10) or 7(150 + 280)	A1
	= 7×430	
	= 3010	A1
		(3)
6(c)	Cost in year n = 900 + (n – 1) × –20	M1
	Sales in year n = 150 + (n – 1) × 10	
	Cost = 3 × Sales $\Rightarrow$ 900 + (n – 1) × –20 = 3 × (150 + (n – 1) × 10)	M1
	900 – 20n + 20 = 450 + 30n – 30	
	500 = 50n	
	n =10	M1
	Year is 2009	A1
	As n is not defined they may work correctly from another base year to get the answer 2009 and their n may not equal 10. If doubtful – send to review.	
		(4)
		(9 marks)

Question	Scheme	Marks
7(a)	$32000 = 17000 + (k-1)\times 1500 \Rightarrow k = ...$	M1
	$(k =)$ 11	A1
		(2)
7(b)	$S = \frac{k}{2}(2\times 17000 + (k-1)\times 1500)$ or $\frac{k}{2}(17000 + 32000)$ $S = \frac{k-1}{2}(2\times 17000 + (k-2)\times 1500)$ or $\frac{k-1}{2}(17000 + 30500)$	M1
	$S = \frac{11}{2}(2\times 17000 + 10\times 1500)$ or $\frac{11}{2}(17000 + 32000)$ $S = \frac{10}{2}(2\times 17000 + 9\times 1500)$ or $\frac{10}{2}(17000 + 30500)$ (= 269 500 or 237 500)	A1
	$32000\times\alpha$	M1
	288 000 + 269 500 = 557 500 or 320 000 + 237 500 = 557 500	ddM1A1
		(5)
		(7 marks)
8(a)	$S_{10} = \frac{10}{2}[2P + 9\times 2T]$ or $\frac{10}{2}(P + [P + 18T])$	M1
	e.g. $5[2P + 18T]$ = (£) $(10P + 90T)$ or (£) $10P + 90T$ **(*)**	A1cso
		(2)
8(b)	Scheme 2: $S_{10} = \frac{10}{2}[2(P + 1800) + 9T] = \{10P + 18000 + 45T\}$	M1A1
	$10P + 90T = 10P + 18000 + 45T$	M1
	$90T = 18000 + 45T$	
	$T = 400$ (only)	A1
		(4)
8(c)	Scheme 2, Year 10 salary: $[a + (n-1)d =](P + 1800) + 9T$	B1ft
	$P + 1800 +$ "3600" $= 29850$	M1
	$P =$ (£) 24450	A1
		(3)
		(9 marks)

A level Mathematics Practice Paper – Arithmetic sequences and series – Mark scheme

Question	Scheme		Marks
9(a)	Series has 50 terms		B1
	$S = \frac{1}{2}(50)(2+100) = 2550$ or $S = \frac{1}{2}(50)(4+49\times 2) = 2550$		M1 A1
			(3)
9(b)	$\frac{100}{k}$		B1
	Sum: $\frac{1}{2}\left(\frac{100}{k}\right)(k+100)$ or $\frac{1}{2}\left(\frac{100}{k}\right)\left(2k+\left(\frac{100}{k}-1\right)k\right)$		M1 A1
	$= 50 + \frac{5000}{k}$ (*)		A1 cso
			(4)
9(c)	50^{th} term = $a+(n-1)d$		
	$=(2k+1)+49"(2k+3)"$	Or $2k + 49(2k) + 1 + 49(3)$	M1
	$=100k+148$	$=100k+148$	A1
			(2)
			(9 marks)
10(a)	Attempts to use $a+(n-1)"d"$ with a=A and "d"=d+1 and n = 14		M1
	$A+13(d+1) = A+13d+13$ *		A1*
			(2)
10(b)	Calculates time for Yi on Day 14= $(A-13)+13(2d-1)$		M1
	Sets **times** equal $A+13d+13 = (A-13)+13(2d-1) \Rightarrow d = ...$		M1
	$d = 3$		A1 cso
			(3)
10(c)	Uses $\frac{n}{2}\{2A+(n-1)(D)\}$ with n =14, and with D=d or d + 1		M1
	Attempts to solve $\frac{14}{2}\{2A+13\times"(d+1)"\} = 784 \Rightarrow A = ...$		dM1
	$A = 30$		A1
			(3)
			(8 marks)