Question Number	Scheme	Marks
8(a)	$a_2 = 2p^2 - 7$	B1
		(1)
(b)	$a_3 = 2(\text{"}2p^2 - 7\text{"} + 3)^2 - 7$	M1
	$p - 3 + 2p^2 - 7 + 8p^4 - 32p^2 + 25 = p + 15$ $\Rightarrow 8p^4 - 30p^2 = 0$	M1 A1
	Correct values of $p^2 = 0$ and $\frac{15}{4}$ (may be implied by $p = 0$ and $\pm\sqrt{\frac{15}{4}}$)	A1
	Uses their values of p to find a_2 using a correct method	dM1
	Possible values for a_2 are -7 and $\frac{1}{2}$	A1
		(6)
Alt (b)	$\sum_{n=1}^{3} a_n = p + 15 \Rightarrow p - 3 + a_2 + 2(a_2 + 3)^2 - 7 = p + 15$	M1
	$\Rightarrow a_2 + 2(a_2 + 3)^2 - 25 = 0$ $\Rightarrow 2a_2^2 + 13a_2 - 7 = 0$	M1A1 A1
	$\Rightarrow (2a_2 - 1)(a_2 + 7) = 0 \Rightarrow a_2 = ...$	dM1
	Possible values for a_2 are -7 and $\frac{1}{2}$	A1
		(6)
		(7 marks)

Question	Answer	Marks	Guidance
7(a)	Attempt use of quotient rule (or equivalent) to find $\frac{dx}{dt}$	**M1***	
	Obtain $\frac{1}{(t+2)^2}$	**A1**	or (unsimplified) equivalent.
	Equate $\frac{dy}{dx}$ to 1	**DM1**	Must be using *their* $\frac{dy}{dx}$.
	Obtain $(2t + a)(t + 2)^2 = 1$ and expand to confirm given result	**A1**	AG necessary detail required.
		4	
7(b)	Substitute $t = -1$, equate to zero and attempt solution for a	**M1**	Allow a complete method using algebraic long division or synthetic division.
	Obtain $a = 3$	**A1**	
		2	
7(c)	Divide their cubic by $t+1$ at least as far as the x term	**M1**	or equivalent (inspection, identity, …).
	Obtain $2t^2 + 9t + 11$	**A1**	
	Calculate discriminant, obtain -7 and conclude no further value of t	**A1**	OE
		3	

Question Number	Scheme	Marks
2.	$\left(2-\frac{x}{2}\right)^6 = 2^6 + \binom{6}{1}2^5.\left(-\frac{x}{2}\right)+\binom{6}{2}2^4.\left(-\frac{x}{2}\right)^2+\ldots$	M1
	$=64-96x+60x^2+\ldots$	B1A1A1
		(4)
		(4 marks)

Question Number	Scheme	Marks
1 (a)	Attempts $u_3 = 3u_2 - 2u_1 \Rightarrow 4 = 3u_2 - 2\times 7 \Rightarrow u_2 = \ldots$	M1
	$\Rightarrow u_2 = 6$	A1
		(2)
(b)	Attempts $u_4 = 3u_3 - 2u_2 = 3\times 4 - 2\times "6" = (0)$	M1
	$\sum_{r=1}^{4}(u_r + 2r) = (7+2\times 1)+("6"+2\times 2)+(4+2\times 3)+("0"+2\times 4)$	dM1
	$=37$	A1
		(3)
		Total 5

Question Number	Scheme	Notes	Marks
8(a)	$u_{20} = 100 + 19(-2) = 62*$	Correct method shown	B1*
			(1)
(b)	$S_{20} = \frac{1}{2}(20)\{2\times100 + 19(-2)\} = \ldots$ **or** $S_{20} = \frac{1}{2}(20)\{100 + 62\} = \ldots$	Applies a correct AP sum formula with n = 20, a = 100 and d = –2 **or** n = 20, a =100 and l = 62	M1
	$= 1620$ (mm)	Correct value	A1
			(2)
(c)	$62 \times r^2 = 60 \Rightarrow r^2 = \ldots$	Correct strategy to find r	M1
	$r^2 = \frac{60}{62} \Rightarrow r = \sqrt{\frac{60}{62}}$ = 0.983738...	r = awrt 0.984	A1
			(2)
(d)	Total distance from GS hits = $\frac{62\times0.983\ldots(1-0.983\ldots^n)}{1-0.983\ldots}$		M1
	$1620 + \frac{62\times0.983\ldots(1-0.983\ldots^n)}{1-0.983\ldots} > 3000$	Correct equation set up with their r and suitable a	M1
	$0.983\ldots^n < 0.63207\ldots \Rightarrow n = \frac{\log(0.63207\ldots)}{\log(0.983\ldots)}$	Fully correct processing to find n from an equation of suitable form,	M1
	$n = 27.98\ldots \Rightarrow N = 20 + 28 = 48$	N = 48 only	A1cso
			(4)
	(d) Alternative taking 20th hit as first term of GP		
	Total distance from GS hits = $\frac{62(1-0.983\ldots^n)}{1-0.983\ldots}$		M1
	$1620 - 62 + \frac{62(1-0.983\ldots^n)}{1-0.983\ldots} > 3000$	Correct equation set up with their r and suitable a	M1
	$0.983\ldots^n < 0.62179\ldots \Rightarrow n = \frac{\log(0.62179\ldots)}{\log(0.983\ldots)}$	Fully correct processing to find n from an equation of suitable form,	M1
	$n = 28.98\ldots \Rightarrow N = 19 + 29 = 48$	N = 48 only	A1cso
			Total 9

Question Number	Scheme	Marks
1(a)	$(u_2=)\ k-\frac{8}{1}$ and $(u_3=)\ k-\frac{8}{k-8}$ $\left(=\frac{k^2-8k-8}{k-8}\right)$ oe	M1A1
		(2)
(b)	$u_3=6\Rightarrow k-\frac{8}{k-8}=6\Rightarrow k^2-14k+40=0$	M1
	$(k-4)(k-10)=0\Rightarrow k=...$ or $(k=)\ \frac{14\pm\sqrt{14^2-4\times1\times40}}{2\times1}$	dM1
	$(k=)\ 4,\ 10$	A1
		(3)
		(5 marks)

Question Number	Scheme	Marks
4 (a)	$(3+2x)^6$	
	First term 3^6 or 729	B1
	Term in *x*, x^2 or x^3: Award for one of ${}^6C_5(3)^5(2x)^1$, ${}^6C_4(3)^4(2x)^2$ or ${}^6C_3(3)^3(2x)^3$	M1
	Two of $...+2916x+4860x^2+4320x^3+...$	A1
	$(3+2x)^6=729+2916x+4860x^2+4320x^3+...$	A1
		(4)
(b)	Attempts one correct term $2x^2\times"729"$ **or** $\pm\frac{1}{6x}\times"4320"x^3$	M1
	Attempts to combine the correct two terms $2x^2\times"729"\pm\frac{1}{6x}\times"4320"x^3=...x^2$	dM1
	738 but condone $738x^2$	A1
		(3)
		Total 7