Recurrence Relations - Edexcel Past Exam Questions MARK SCHEME

Question 1

Question number	Scheme	Marks
	(a) $-3,\ -1,\ 1$ B1: One correct	B1 B1 (2)
	(b) 2 (ft only if terms in (a) are in arithmetic progression)	B1ft (1)
	(c) Sum $= \frac{1}{2}n\{2(-3)+(n-1)(2)\}$ or $\frac{1}{2}n\{(-3)+(2n-5)\}$	M1 A1ft
	$= \frac{1}{2}n\{2n-8\} = n(n-4)$ (*)	A1 (3)
		6

Question 2

Question number	Scheme	Marks
2.	(a) $u_2 = (-2)^2 = 4$	B1
	$u_3 = 1,\ u_4 = 4$ For u_3, ft $(u_2-3)^2$	B1ft, B1 (3)
	(b) $u_{20} = 4$	B1ft (1)
		Total 4 marks
	(b) ft only if sequence is "oscillating". Do not give marks if answers have clearly been obtained from wrong working, e.g. $u_2 = (3-3)^2 = 0$ $u_3 = (4-3)^2 = 1$ $u_4 = (5-3)^2 = 4$	

Question 3

Question number	Scheme	Marks
(a)	$a_2 = 4$ $a_3 = 3 \times a_2 - 5 = 7$	B1 B1f.t. (2)
(b)	$a_4 = 3a_3 - 5 (= 16)$ and $a_5 = 3a_4 - 5 (= 43)$	M1
	$3 + 4 + 7 + 16 + 43$	M1
	$= 73$	A1c.a.o. (3)
		5

(a)	2nd B1f.t.	Follow through their a_2 but it must be a value. $3 \times 4 - 5$ is B0 Give wherever it is first seen.
(b)	1st M1	For two further attempts to use of $a_{n+1} = 3a_n - 5$, wherever seen. Condone arithmetic slips
	2nd M1	For attempting to add 5 relevant terms (i.e. terms derived from an attempt to use the recurrence formula) or an expression. Follow through their values for $a_2 - a_5$
		Use of formulae for arithmetic series is M0A0 but could get 1st M1 if a_4 and a_5 are correctly attempted.

Question 4

Question number	Scheme	Marks
	(a) $(a_2 =) \underline{3k+5}$ [must be seen in part (a) or labelled $a_2 =$]	B1 (1)
	(b) $(a_3 =) 3(3k+5)+5$	M1
	$= \underline{9k+20}$ (*)	A1cso (2)
	(c)(i) $a_4 = 3(9k+20)+5 \quad (= 27k+65)$	M1
	$\sum_{r=1}^{4} a_r = k + (3k+5) + (9k+20) + (27k+65)$	M1
	(ii) $= 40k + 90$	A1
	$= \underline{10(4k+9)}$ (or explain why divisible by 10)	A1ft (4)
		7

Question 5

Question number	Scheme	Marks
	(a) $1(p+1)$ or $p+1$	B1 (1)
	(b) $((a))(p+(a))$ [(a) must be a function of p]. $[(p+1)(p+p+1)]$	M1
	$= 1+3p+2p^2$ (*)	A1cso (2)
	(c) $1+3p+2p^2 = 1$	M1
	$p(2p+3) = 0 \qquad p = \ldots$	M1
	$p = -\frac{3}{2}$ (ignore $p = 0$, if seen, even if 'chosen' as the answer)	A1 (3)
	(d) Noting that even terms are the same.	M1
	This M mark can be implied by listing at least 4 terms, e.g. $1, -\frac{1}{2}, 1, -\frac{1}{2}, \ldots$	
	$x_{2008} = -\frac{1}{2}$	A1 (2)
		8

Question 6

Question number	Scheme	Marks
(a)	$[x_2 =]\, a-3$	B1 (1)
(b)	$[x_3 =]\ ax_2 - 3$ or $a(a-3)-3$	M1
	$= a(a-3)-3$ } both lines needed for A1	
	$= a^2 - 3a - 3$ **(*)**	A1cso (2)
(c)	$a^2 - 3a - 3 = 7$	
	$a^2 - 3a - 10 = 0$ or $a^2 - 3a = 10$	M1
	$(a-5)(a+2) = 0$	dM1
	$a = 5$ or -2	A1 (3)
		6

Question 7

Question Number	Scheme	Marks
Q7 (a)	$(a_2 =) 2k - 7$	B1 (1)
(b)	$(a_3 =) 2(2k-7) - 7$ or $4k - 14 - 7, = 4k - 21$ (*)	M1, A1cso (2)
(c)	$(a_4 =) 2(4k-21) - 7 \quad (= 8k - 49)$	M1
	$\sum_{r=1}^{4} a_r = k + "(2k-7)" + (4k-21) + "(8k-49)"$	M1
	$k + (2k-7) + (4k-21) + (8k-49) = 15k - 77 = 43 \qquad k = 8$	M1 A1 (4) **[7]**

Question 8

Question Number	Scheme	Marks
(a)	$a_2 = \left(\sqrt{4+3}\right) = \sqrt{7}$ $a_3 = \sqrt{\text{"their } 7\text{"}+3} = \sqrt{10}$	B1 B1ft (2)
(b)	$a_4 = \sqrt{10+3}\left(=\sqrt{13}\right)$ $a_5 = \sqrt{13+3} = 4$ *	M1 A1 cso (2)
		4

Question 9

Question Number	Scheme	Marks
(a)	$(a_2 =)\ \ 6-c$	B1 (1)
(b)	$a_3 = 3(\text{their } a_2) - c \qquad (= 18 - 4c)$ $a_1 + a_2 + a_3 = 2 + \text{"}(6-c)\text{"} + \text{"}(18-4c)\text{"}$ $\text{“}26-5c\text{”} = 0$ So $c = 5.2$	M1 M1 A1ft A1 o.a.e (4) **5**
	Notes	
(b)	1st M1 for attempting a_3. Can follow through their answer to (a) but it must be an expression in c. 2nd M1 for an attempt to find the sum $a_1 + a_2 + a_3$ must see evidence of sum 1st A1ft for their sum put equal to 0. Follow through their values but answer must be in the form $p + qc = 0$ A1 – accept any correct equivalent answer	

Question 10

Question Number	Scheme	Marks
(a)	$(a_2 =)\ 5k+3$	B1 (1)
(b)	$(a_3 =)\ 5(5k+3)+3$ $= 25k+18$ (*)	M1 A1 cso (2)
(c) **(i)**	$a_4 = 5(25k+18)+3 \quad (=125k+93)$ $\sum_{r=1}^{4} a_r = k+(5k+3)+(25k+18)+(125k+93)$ $= 156k+114$	M1 M A ao
(ii)	$= 6(26k+19)$ (or explain each term is divisible by 6)	A : (4) **7**
	Notes (a) $5k+3$ must be seen in (a) to gain the mark (b) 1st M: Substitutes their a_2 into $5a_2+3$ - note the answer is given so working must be seen. (c) 1st M1: Substitutes their a_3 into $5a_3+3$ or uses $125k+93$ 2nd M1: for **their** sum $k+a_2+a_3+a_4$ - must see evidence of **four terms with plus signs and must not be sum of AP** 1st A1: All correct so far 2nd A1ft: Limited ft – previous answer must be divisible by 6 (eg $156k+42$) . This is dependent on second M mark in (c) Allow $\frac{156k+114}{6} = 26k+19$ without explanation. No conclusion is needed.	