Mark scheme

Series

Additional Mathematics 0606 · Questions from Paper 1 and Paper 2

Total marks

86

MARKS FOR EACH QUESTION

1	2	3	4	5	6	7	8	9	10	Total
5	5	6	6	7	9	10	11	12	15	**86**

Question 1 **[5]**

1	**(i)** $1 + 18x + 135x^2 \ldots$	B1,B1 [2]	B2, 1, 0 –1 for each error
	(ii) $(1 \times -5) + (18 \times -3) + (135 \times 1)$ $= 76$	M1,A1ft A1 [3]	M1 for a correct method using their **(i)** A1ft on their 3 terms unsimplified

Question 2 **[5]**

2	**(i)** $\left(x+\frac{2}{x^2}\right)^6 = x^6 + 12x^3 + 60 \ldots$	B3 [3]	B1 for each correct term
	(ii) Independent term = $(2 \times '60') + (-4 \times '12') = 72$	M1 A1 [2]	M1 for sum of 2 products (2 × their 60)+(–4 × their 12) A1 for 72

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Question 3 **[6]**

3(a)	$a+6d=158$ $a+9d=149$	**B1**	For both equations, may be implied by a correct a and d
	$d=-3,$	**B1**	
	$a=176$	**B1**	

3(b)	$\frac{n}{2}\left(352+(n-1)(-3)\right) \quad (<0)$	**M1**	For correct attempt at sum formula with *their a* and *their d*,
	$\frac{355}{3}$ or 118.3 oe	**A1**	
	119	**A1**	

Question 4 **[6]**

4 **(i)**	${}^6C_2\,(2^4)\,(px)^2$ or $\binom{6}{2}2^4\,(px)^2$	B1	Seen or implied, unsimplified
	$240p^2=60$ $p=\frac{1}{2}$	M1 A1 [3]	M1 for their coefficient of $x^2 = 60$ and attempt to solve
(ii)	coefficients of the terms needed	M1	M1 for realising that 2 terms are involved
	$(-1)\,{}^6C_1\,(2)^5\,p + (3\times 60)$	B1	B1 for $(-1)\,{}^6C_1\,(2)^5\,p$ or $-192p$, using their p.
	$= 84$	A1 [3]	

Question 5 **[7]**

5	$a^5+5a^4bx+10a^3b^2x^2$	**2**	**B1** for powers or for coefficients
	$a^5+\left(a^5+5a^4b\right)x+\left(10a^3b^2+5a^4b\right)x^2$	**2**	**M1** for multiplying to obtain 5 terms **A1** for all correct
	$a^5=32\rightarrow a=2$	**A1**	
	$32+80b=-208\rightarrow b=-3$	**A1**	
	$10\times8\times9+5\times16\times-3=c\rightarrow c=480$	**A1**	

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Question 6 **[9]**

6	$n = 6$ stated; nfww	**B2**	**B1** for first term: $\left(3x^2\right)^n$ or $\left(3x^2\right)^6$ soi
	$-6\left(3x^2\right)^5 a + 2\left(729x^{10}\right) = 972x^{10}$ oe and $\frac{6\times 5\left(3x^2\right)^4(-a)^2}{2} + 6\left(3x^2\right)^5 \times \frac{2}{x^2}(-a) + 729x^8 = bx^8$ oe	**B3**	**B2** for one correct equation **OR** **B1** for second term: $n(-a)\left(3x^2\right)^{n-1}$ or $6(-a)\left(3x^2\right)^5$ or $-1458ax^{10}$ soi **B1** for third term: $\frac{n(n-1)(-a)^2\left(3x^2\right)^{n-2}}{2}$ or $\frac{6(5)(-a)^2\left(3x^2\right)^4}{2}$ or $1215a^2x^8$ soi **B1** for $1 \ [+] \ \frac{2}{x^2} \ [+] \ \frac{1}{x^4}$ soi
	$a = \frac{1}{3}$	**B2**	**B1** for $-1458a + 1458 = 972$ soi
	$b = -108$	**B2**	**B1** for $1215a^2 - 2916a + 729$ soi

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Question 7 **[10]**

7(a)	Correct pair of simplified linear equations in a and d with terms collected, e.g., $3a+3d=-36$ isw or $a+d=-12$ isw $3a+30d=72$ isw or $a+10d=24$ isw	**B3**	**B2** for one correct simplified equation or **B1** for $a+a+d+a+2d=-36$ or $\frac{3}{2}\{2a+(3-1)d\}=-36$ or $a+9d+a+10d+a+11d=72$ or $\frac{12}{2}\{2a+(12-1)d\}-\frac{9}{2}\{2a+(9-1)d\}=72$ or $12a+66d-9a-36d=72$ or $\frac{3}{2}\{2(a+9d)+(3-1)d\}=72$
	Solves two linear equations for d or a e.g. $27d=108 \rightarrow d=\ldots$ or $9d=36 \rightarrow d=\ldots$ or $a+10(-12-a)=24 \rightarrow a=\ldots$ $27a=-432 \rightarrow a=\ldots$	**M1**	**FT** *their* linear equations in a and d providing at least **B1** earned and the equations have a solution
	$d=4$ and $a=-16$ nfww	**A1**	
7(b)	1.2^n *101	**B3**	where * is any inequality sign or =; **B2** for $\frac{[1](1.2^n-1)}{(1.2-1)}*500$ or **B1** for $r=1.2$ soi
	$n$log1.2*log101 or $\log_{1.2}101$ soi	**M1**	**FT** 1.2^n * *their* 101 providing **B2** has been awarded and (*their* 101) > 0
	$n=26$	**A1**	**dep** on all previous marks awarded

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Question 8 **[11]**

8(a)(i)	$\frac{1}{8}$ or 0.125	**2**	**M1** for $64(0.5)^9$ oe
8(a)(ii)	$\frac{1023}{8}$ or 127.875	**2**	**M1** for $\frac{64(1-0.5^{10})}{1-0.5}$ oe
8(a)(iii)	128	**1**	
8(b)	$\frac{20}{2}\{2a+19d\}-400=2\times\frac{10}{2}\{2a+9d\}$ oe, soi	**M2**	**M1** for $\frac{20}{2}\{2a+19d\}$ or $\frac{10}{2}\{2a+9d\}$ soi
	$5a = a + 5d$ soi	**M1**	
	$d = 4$	**A1**	
	$a = 5$	**A1**	
	27 nfww	**B1**	must have earned all previous marks

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Question 9 **[12]**

9(a)	Attempts to solve $a + 2d = 13$ and $a + 9d = 41$ oe	**M2**	**M1** for $a + 2d = 13$ and $a + 9d = 41$ soi
	$d = 4$ and $a = 5$	**A2**	**A1** for $d = 4$ or $a = 5$
9(b)	$\frac{n}{2}\{2(5)+(n-1)4\}$ soi	**M1**	**FT** *their a* and *their d*
	$2n^2 + 3n - 2555\,[*0]$	**A1**	where * could be = or any inequality sign
	Solves *their* 3-term quadratic of the form $ax^2 + bx + c$ [*0] by factorising or formula or *their* 3-term quadratic of the form $ax^2 + bx * c$ or better if completing the square	**M1**	
	35	**A1**	

9(c)	May work ***consistently*** in n throughout but must conclude in k to earn the final mark		
	$S_{2k} = \frac{2k}{2}\{10+(2k-1)4\}$ soi	**B1**	**FT** *their a* and *their d*
	$\frac{2k}{2}\{10+(2k-1)4\} - \frac{k}{2}\{10+(k-1)4\}$ soi	**M1**	**FT** *their a* and *their d* ; condone at most one error
	Simplifies as far as e.g. $8k^2 + 6k - (3k + 2k^2)$ or $8k^2 + 6k - 3k - 2k^2$	**A1**	
	Correct completion to given answer: $6k^2 + 3k = 3k(1 + 2k)$	**A1**	
	Alternative method		
	$\frac{2k}{2}\{2a+(2k-1)d\}$ **and** a = *their* 5 and d = *their* 4 substituted at some point	**(B1)**	
	$ak - \frac{d}{2}k + \frac{3}{2}dk^2$ oe	**(M1)**	condone at most one error
	$5k - \frac{4}{2}k + \frac{3}{2}\times 4\times k^2$	**(A1)**	
	Correct completion to given answer: $6k^2 + 3k = 3k(1 + 2k)$	**(A1)**	

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Question 10 **[15]**

10(a)(i)	$a + d$, $a + 13d$, $a + 16d$ soi	**B1**	
	$\frac{a+13d}{a+d}=\frac{a+16d}{a+13d}$ oe	**M2**	**FT** *their* 3 distinct terms providing of the form $a + kd$ where $k \neq 0$ and at least one is correct **M1** for either $[r=]\frac{a+13d}{a+d}$ or $[r=]\frac{a+16d}{a+13d}$ or $[r=]\sqrt{\frac{a+16d}{a+d}}$
	Clears fractions and expands oe: $a^2+26ad+169d^2$ $=a^2+17ad+16d^2$	**A1**	
	$9ad + 153d^2 = 0$ or $9ad = -153d^2$	**A1**	
	Convincingly derives $a = -17d$ e.g. $9d(a + 17d) = 0$ [therefore] $a = -17d$ oe	**A1**	
10(a)(ii)	$r = 0.25$ oe	**2**	**M1** $\frac{-17d+13d}{-17d+d}$ or $\frac{-17d+16d}{-17d+13d}$ or $-16d$, $-4d$, $-d$
10(b)	$\frac{q}{1-0.25}=\frac{256}{3}$ oe	**M1**	**FT** *their* 0.25 providing it is between –1 and 1
	$q = 64$	**A1**	
	$[a + d =$ *their* 64 $]$ $-17d + d =$ *their* 64 or $a-\frac{a}{17}=$ *their* 64	**DM1**	**dep** on previous **M1**
	$d = -4$ and $a = 68$ oe OR $d = -4$ and $S_{20} = -150d$ oe	**A2**	**A1** for either correct
	$S_{20}=\frac{20}{2}\{2(\textit{their}68)+19(\textit{their}(-4))\}$ or $S_{20} = -150(\textit{their } d)$	**M1**	**FT** *their* a and d
	600	**A1**	

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