Mark scheme

Remainder and factor theorem

Additional Mathematics 0606 · Questions from Paper 1 and Paper 2

Total marks

52

MARKS FOR EACH QUESTION

1	2	3	4	5	6	7	8	9	Total
4	5	6	6	6	6	6	6	7	**52**

Question 1 [4]

1	f(2) = 8 + 4k – 10 – 3 f(–1) = –1 + k + 5 – 3 (4k – 5) = 5(k + 1) leading to k = –10	M1 M1 M1 A1 [4]	M1 for use of x = 2 M1 for use of x = –1 M1 for attempt to link the two remainders

Question 2 [5]

2	27a − 63 − 3b + 9 = 0 oe	**B1**	
	−8a − 28 + 2b + 9 = −35 oe	**B1**	
	Eliminates one unknown and solves for a or b	**M1**	**FT** *their* equations provided both equations are linear with terms in a and b
	a = 2, b = 0 nfww	**A2**	**A1** for each

Question 3 [6]

3	**(i)** f(1) = 1 + 8 + p – 25 (= p – 16) f(–2) = –8 + 32 – 2p – 25 (= –2p – 1) p – 16 = 2p + 1 oe p = –17	B1 B1 M1 A1	
	(ii) Evaluates f(–3) or divides by (x + 3) to remainder 71 (= 20 – 3p)	M1 A1√	**[6]**

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Question 4 [6]

4	$f(-2): -2a + b = 84$	M1 A1	M1 for substitution of a correct value of x
	$f\left(\frac{1}{2}\right): \frac{1}{2}a + b = \frac{3}{2}$	A1	A1 for each correct equation (allow unsimplified)
	$a = -33,\ b = 18$	M1, A1	M1 for solution to obtain a and b
	$f(1) = -19$	√B1 [6]	√B1 on their a and b

Question 5 [6]

5 **(i)** f(1) = 0 — M1
$b = 5 - a$ only — A1

(ii) Finds f(2) and f(3) — M1
substitute $b = 5 - a$ or $a = 5 - b$ — M1
$2a - 22$ or $a - 11$ ($-2b - 12$ or $-b - 6$) — A1
both correct — A1 [6]

Question 6 [6]

6	$f\left(\frac{1}{2}\right) = \frac{a}{8} + 1 + \frac{b}{2} - 2$	M1	M1 for substitution of $x = \frac{1}{2}$ into f(x)
	leading to $a + 4b - 8 = 0$	A1	A1 for correct equation in any form
	f(2) = 2f(–1)	M1	M1 for attempt to substitute $x = 2$ **or** $x = -1$ into f(x) **and** use f(2) = ±2f(–1) or 2f(2) = ±f(–1)
	$8a + 16 + 2b - 2 = 2(-a + 4 - b - 2)$	A1	A1 for a correct equation in any form
	leading to $10a + 4b + 10 = 0$ or equivalent $\therefore a = -2,\ b = \frac{5}{2}$	DM1 A1 [6]	DM1 (on both previous M marks) for attempt to solve simultaneous equations to obtain either a or b A1 for both correct

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Question 7 **[6]**

7(i)	$\left(\text{p}\left(-\frac{1}{2}\right)=\right)\ -\frac{1}{4}+\frac{5}{4}-2+a=2$ $\left(\text{q}(-2)=\right)\ 16-6a+b=0$	**M1**	For either $\text{p}\left(-\frac{1}{2}\right)=2$ or $\text{q}(-2)=0$
	$a=3$	**A1**	
	$b=2$	**A1**	
7(ii)	$\text{r}(x)=2x^3+x^2-5x+1$	**M1**	For $\text{r}(x)$ using *their* $\text{p}(x)$ and $\text{q}(x)$
	$\text{r}\left(\frac{2}{3}\right)=\frac{16}{27}+\frac{4}{9}-\frac{10}{3}+1$	**M1**	For $\text{r}\left(\frac{2}{3}\right)$
	$=-\frac{35}{27}$	**A1**	Must be exact

Question 8 **[6]**

8	$\frac{m}{27}-\frac{29}{9}+\frac{39}{3}+n=0$ oe	**B1**	
	$m-29+39+n=6$ oe	**B1**	
	Eliminates one unknown correctly for a pair of linear equations in m and n and solves for one unknown	**M1**	
	$m=6,\ n=-10$	**A2**	**A1** for either
	[p(2) =] $48-116+78-10=0$ oe, nfww	**A1**	

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Question 9 **[7]**

9(i)	$\text{p}\left(\frac{1}{2}\right)$: $\frac{a}{8}+2+\frac{b}{2}+5=0$	**M1**	substitution of $x=\frac{1}{2}$ and equating to zero (allow unsimplified)
	$\text{p}(-2)$: $-8a+32-2b+5=-25$	**M1**	substitution of $x=-2$ and equating to –25 (allow unsimplified)
	leading to $a+4b+56=0$ $4a+b-31=0$ oe	**M1**	**M1dep** for solution of simultaneous equations to obtain a and b
	$a=12,\ b=-17$	**A2**	**A1** for each

9(ii)	$12x^3+8x^2-17x=0$ $x=0$	**B1**	for $x=0$
	$x=-\frac{1}{3}\pm\frac{\sqrt{55}}{6}$ oe	**B1**	

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