Q1.

2 (i) *EITHER:* Expand *RHS* and obtain at least one equation for *a* — M1
Obtain $a^2 = 9$ and $2a = 6$, or equivalent — A1
State answer $a = 3$ only — A1

OR: Attempt division by $x^2 + ax + 1$ or $x^2 - ax - 1$, and obtain an equation in *a* — M1
Obtain $a^2 = 9$ and either $a^3 - 11a + 6 = 0$ or $a^3 - 7a - 6 = 0$, or equivalent — A1
State answer $a = 3$ only — A1

[Special case: the answer $a = 3$, obtained by trial and error, or by inspection, or with no working earns B2.] **[3]**

(ii) Substitute for *a* and attempt to find zeroes of one of the quadratic factors — M1
Obtain one correct answer — A1
State all four solutions $\frac{1}{2}(-3 \pm \sqrt{5})$ and $\frac{1}{2}(3 \pm \sqrt{13})$, or equivalent — A1

[3]

Q2.

3	(i)	Substitute x = 3 and equate to zero	M1	
		Obtain answer $\alpha = -1$	A1	2
	(ii)	At any stage, state that x = 3 is a solution	B1	
		EITHER: Attempt division by $(x-3)$ reaching a partial quotient of $2x^2 + kx$	M1	
		Obtain quadratic factor $2x^2 + 5x + 2$	A1	
		Obtain solutions $x = -2$ and $x = -\frac{1}{2}$	A1	
		OR: Obtain solution $x = -2$ by trial and error	B1	
		Obtain solution $x = -\frac{1}{2}$ similarly	B2	4

[If an attempt at the quadratic factor is made by inspection, the M1 is earned if it reaches an unknown factor of $2x^2 + bx + c$ and an equation in b and/or c.]

Q3.

4	(i)	Substitute $x = -1$ and equate to zero obtaining e.g. $(-1)^3 - (-1)^2 + a(-1) + b = 0$	B1	
		Substitute $x = 2$ and equate to 12	M1	
		Obtain a correct 3-term equation	A1	
		Solve a relevant pair of equations for *a* or *b*	M1	
		Obtain $a = 2$ and $b = 4$	A1	5
	(ii)	Attempt division by $x + 1$ reaching a partial quotient of $x^2 + kx$, or similar stage by inspection	M1	
		Obtain quadratic factor $x^2 - 2x = 4$	A1	2

[Ignore failure to repeat that $x + 1$ is a factor]

Q4.

4	(i)	Substitute $x = 1$ or $x = -2$ and equate to zero	M1	
		Obtain a correct equation, e.g. $a + b - 5 = 0$	A1	
		Obtain a second correct equation, e.g. $-8a + 4b + 4 = 0$	A1	
		Solve a relevant pair of equations for a or for b	M1	
		Obtain $a = 2$ and $b = 3$	A1	5
	(ii)	Substitute for a and b and either divide by $(x - 1)(x + 2)$ or attempt third factor by inspection	M1	
		Obtain answer $2x + 1$	A1	2

Q5.

4	(i)	Substitute $x = 2$, equate to zero, and state a correct equation, e.g. $16 - 12 + 2a + b = 0$	B1	
		Substitute $x = -2$ and equate to -20	M1	
		Obtain a correct equation, e.g. $-16 - 12 - 2a + b = -20$	A1	
		Solve for a or for b	M1	
		Obtain $a = -3$ and $b = 2$	A1	[5]
	(ii)	Attempt division by $x^2 - 4$ reaching a partial quotient of $2x - 3$, or a similar stage by inspection	B1	
		Obtain remainder $5x - 10$	B1√ + B1√	[3]

Q6.

4	Substitute $x = -1$, equate to zero and obtain a correct equation in any form	B1	
	Substitute $x = -2$ and equate to 5	M1	
	Obtain a correct equation in any form	A1	
	Solve a relevant pair of equations for a or for b	M1	
	Obtain $a = 2$ and $b = -3$	A1	[5]

Q7.

6	(i)		Substitute $x = 2$, equate to zero and state a correct equation, e.g. $8 + 4a + 2b + 6 = 0$	B1	
			Substitute $x = 1$ and equate to 4	M1	
			Obtain a correct equation. e.g. $1 + a + b + 6 = 4$	A1	
			Solve for a or for b	M1	
			Obtain $a = -4$ and $b = 1$	A1	[5]
	(ii)	*EITHER:*	Attempt division by $x - 2$ reaching a partial quotient of $x^2 + kx$	M1	
			Obtain remainder quadratic factor $x^2 - 2x - 3$	A1	
			State linear factors $(x - 3)$ and $(x + 1)$	A1	
		OR:	Obtain linear factor $(x + 1)$ by inspection	B1	
			Obtain factor $(x - 3)$ similarly	B2	[3]

Q8.

4	(i)	Commence division by $x^2 + x - 1$ obtaining quotient of the form $x + k$	M1	
		Obtain quotient $x + 2$	A1	
		Obtain remainder $3x + 4$	A1	
		Identify the quotient and remainder correctly	A1√	[4]
	(ii)	Substitute $x = -1$ and evaluate expression	M1	
		Obtain answer 0	A1	[2]

Q9.

7	(i)	Substitute $x = 3$ and equate to 30	M1	
		Substitute $x = -1$ and equate to 18	M1	
		Obtain a correct equation in any form	A1	
		Solve a relevant pair of equations for a or for b	M1	
		Obtain $a = 1$ and $b = -13$	A1	[5]
	(ii)	Either show that $f(2) = 0$ or divide by $(x - 2)$, obtaining a remainder of zero	B1	
		Obtain quadratic factor $2x^2 + 5x - 3$	B1	
		Obtain linear factor $2x - 1$	B1	
		Obtain linear factor $x + 3$	B1	
		[Condone omission of repetition that $x - 2$ is a factor.]		
		[If linear factors $2x - 1$, $x + 3$ obtained by remainder theorem or inspection, award B2 + B1.]		[4]

Q10.

4	(i)	Substitute –2 and equate to zero or divide by $x + 2$ and equate remainder to zero	M1	
		Obtain $a = 8$	A1	[2]
	(ii)	Attempt to find quotient by division or inspection or use of identity	M1	
		Obtain at least $3x^2 + 2x$	A1	
		Obtain $3x^2 + 2x + 4$ with no errors seen	A1	[3]

Q11.

7	(i)	Substitute $x = -2$ and equate to zero	M1	
		Substitute $x = -1$ and equate to 24	M1	
		Obtain $4a - 2b = 38$ and $a - b = 20$ or equivalents	A1	
		Attempt solution of two linear simultaneous equations (dependent on M1 M1)	M1	
		Obtain $a = -1$ and $b = -21$	A1	[5]
	(ii)	Attempt to find quadratic factor by division, inspection or use of identity	M1	
		Obtain $6x^2 - 13x + 5$	A1√	
		Conclude $(x + 2)(2x - 1)(3x - 5)$	A1	[3]

Q12.

3	(i)	Substitute 2 and equate to zero or divide and equate remainder to zero	M1	
		Obtain $a = 2$	A1	[2]
	(ii) (a)	Attempt to find quadratic factor by division, inspection or identity	M1	
		Obtain $2x^2 + x - 3$	A1	
		Conclude $(x-2)(2x+3)(x-1)$	A1	[3]
	(b)	Attempt substitution of -1 or attempt complete division by $x + 1$	M1	
		Obtain 6	A1	[2]

Q13.

3	(i)	Attempt division, or equivalent, at least as far as quotient $2x + k$	M1	
		Obtain quotient $2x - 3$	A1	
		Complete process to confirm remainder is 4	A1	[3]
	(ii)	State or imply $(4x^2 + 4x - 3)$ is a factor	B1	
		Obtain $(2x-3)(2x-1)(2x+3)$	B1	[2]

Q14.

4	(i)	Substitute $x = -\frac{3}{2}$, equate to zero	M1	
		Substitute $x = -1$ and equate to 8	M1	
		Obtain a correct equation in any form	A1	
		Solve a relevant pair of equations for a or for b	M1	
		Obtain $a = 2$ and $b = -6$	A1	[5]

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(ii)	Attempt either division by $2x + 3$ and reach a partial quotient of $x^2 + kx$, use of an identity or observation	M1	
	Obtain quotient $x^2 - 4x + 3$		
	Obtain linear factors $x - 1$ and $x - 3$	A1	
	[Condone omission of repetition that $2x + 3$ is a factor.]	A1	
	[If linear factors $x - 1$, $x - 3$ obtained by remainder theorem or inspection, award B2 + B1.]		[3]

Q15.

3	(i)	Substitute $x = -1$ and equate to zero	M1	
		Obtain answer $a = 7$	A1	[2]
	(ii)	Substitute $x = -3$ and evaluate expression	M1	
		Obtain answer 18	A1	[2]

Q16.

2	State or obtain $-2 + a + b = 0$, or equivalent	B1	
	Substitute $x = -2$ and equate to -5	M1	
	Obtain 3-term equation, or equivalent	A1	
	Solve a relevant pair of equations, obtaining a or b	M1	
	Obtain both answers $a = 3$ and $b = -1$	A1	5

Q17.

3 (i)	*EITHER*:	Substitute -1 for x and equate to zero	M1
		Obtain answer a=6	A1
	OR:	Carry out complete division and equate remainder to zero	M1
		Obtain answer a=6	A1
			[2]
(ii)		Substitute 6 for a and either show $f(x) = 0$ or divide by $(x - 2)$ obtaining a remainder of zero	B1
	EITHER:	State or imply $(x + 1)(x - 2) = x^2 - x - 2$	B1
		Attempt to find another quadratic factor by division or inspection	M1
		State factor $(x^2 + x - 3)$	A1
	OR:	Obtain $x^3 + 2x^2 - 2x - 3$ after division by $x + 1$, or $x^3 - x^2 - 5x + 6$ after division by x - 2	B1
		Attempt to find a quadratic factor by further division by relevant divisor or by inspection	M1
		State factor $(x^2 + x - 3)$	A1
			[4]

Q18.

4	State or obtain $16 - 20 + 2a + b = 0$	B1	
	Substitute $x = -1$ and equate to -6	M1	
	Obtain a 3-term equation in any correct form	A1	
	Solve a relevant pair of equations, obtaining a or b	M1	
	Obtain $a = 1$ and $b = 2$	A1	5

Q19.

2	(i) Substitute $x = 1$ and evaluate expression	M1	
	Obtain answer 8	A1	2
	(ii) Commence division by $x^2 + x - 1$ and obtain quotient of the form $x + k$	M1	
	Obtain quotient $x + 1$	A1	
	Obtain remainder $2x + 4$	A1	
	Correctly identify the quotient and remainder	A1√	4

Q20.

3	(i) Substitute $x = \frac{3}{2}$ and equate to zero	M1	
	Obtain answer $a = -3$	A1	2
	(ii) At any stage, state that $x = \frac{3}{2}$ is a solution	B1	
	EITHER: Attempt division by $2x - 3$ reaching a partial quotient of $2x^2 + kx$	M1	
	Obtain quadratic factor $2x^2 + 3x + 1$	A1	
	Obtain solutions $x = -1$ and $x = -\frac{1}{2}$	A1	
	OR: Obtain solution $x = -1$ by trial and error or inspection	B1	
	Obtain solution $x = -\frac{1}{2}$ similarly	B2	4
	[If an attempt at the quadratic factor is made by inspection, the M1 is earned if it reaches an unknown factor of $2x^2 + bx + c$ and an equation in b and/or c.]		

Q21.

5	(i) Substitute $x = -2$ and equate to zero	M1	
	Obtain answer $a = 3$	A1	[2]
	(ii) At any stage state that $x = -2$ is a solution	B1	
	EITHER: Attempt division by $x + 2$ and reach a partial quotient of $3x^2 + kx$	M1	
	Obtain quadratic factor $3x^2 + 2x - 1$	A1	
	Obtain solutions $x = -1$ and $x = \frac{1}{3}$	A1	
	OR: Obtain solution $x = -1$ by trial or inspection	B1	
	Obtain solution $x = \frac{1}{3}$ similarly	B2	[4]

Q22.

2	(i) Substitute $x = -2$ and equate result to zero, or divide by $x + 2$ and equate constant remainder to zero	M1	
	Obtain answer $a = -13$	A1	[2]
	(ii) Obtain quadratic factor $2x^2 - 5x - 3$	B1	
	Obtain linear factor $2x + 1$	B1	
	Obtain linear factor $x - 3$	B1	[3]
	[Condone omission of repetition that $x + 2$ is a factor.]		
	[If linear factors $2x + 1$, $x - 3$ obtained by remainder theorem or inspection, award B2 + B1.]		

Q23.

3	(i)	Substitute $x = -\frac{1}{2}$ and equate to zero	M1	
		Obtain $a = -11$	A1	[2]
	(ii)	*EITHER*: Attempt division by $2x + 1$ reaching a partial quotient $2x^2 - 5x$	M1	
		Obtain quadratic factor $2x^2 - 5x - 3$	A1	
		Obtain complete factorisation $(2x + 1)^2(x - 3)$	A1 + A1	
		OR: Obtain factor $(x - 3)$ by inspection or factor theorem	B2	
		Attempt division by $(x - 3)$ reaching a partial quotient $4x^2 + 4x$	M1	
		Obtain complete factorisation $(2x + 1)^2(x - 3)$	A1	[4]

Q24.

5	(i)	Substitute $x = -1$ or $x = 2$ and equate to zero	M1	
		Obtain a correct equation, e.g. $-a + b + 5 + 2 = 0$	A1	
		Obtain a second correct equation, e.g. $8a + 4b - 10 + 2 = 0$	A1	
		Solve for a or b	M1	
		Obtain $a = 3$ and $b = -4$	A1	[5]
	(ii)	Substitute for a and b and attempt division by $(x + 1)(x - 2)$ or attempt third factor by inspection	M1	
		Obtain answer $3x - 1$	A1	[2]

Q25.

7	(i)	Substitute $x = 1$, equate to zero and obtain a correct equation in any form	B1	
		Substitute $x = 2$ and equate to 10	M1	
		Obtain a correct equation in any form	A1	
		Solve a relevant pair of equations for a or for b	M1	
		Obtain $a = -17$ and $b = 12$	A1	[5]
	(ii)	At any stage, state that $x = 1$ is a solution	B1	
		EITHER: Attempt division by $x - 1$ and reach a partial quotient of $3x^2 + 5x$	M1	
		Obtain quotient $3x^2 + 5x - 12$	A1	
		Obtain solutions $x = -3$ and $x = \frac{4}{3}$	A1	
		OR: Obtain solution $x = -3$ by trial and error or inspection	B1	
		Obtain solution $x = \frac{4}{3}$	B2	
		[If an attempt at the quadratic factor is made by inspection, the M1 is earned if it reaches an unknown factor of $3x^2 + 5x + \lambda$ and an equation in λ]		[4]

Q26.

3	(i)	Substitute $x = -1$ **OR** $x = 2$ correctly	M1	
		Equate remainders to obtain correct equation $5 - a = 26 + 2a$ or equivalent	A1	
		Obtain $a = -7$	A1	[3]
	(ii)	Attempt division by $x - 1$ and reach a partial quotient of $x^2 + kx$	M1	
		Obtain quotient $x^2 + 5x - 2$	A1	
		EITHER Show remainder is zero **OR** substitute $x = 1$ to obtain zero	B1	[3]

Q27.

5	(i)	Substitute $x = \frac{1}{2}$ and equate to 10	M1	
		Obtain answer $a = -16$	A1	
		Either show that $f(3) = 0$ or divide by $(x - 3)$ obtaining a remainder of zero	B1	[3]
	(ii)	At any stage state that $x = 3$ is a solution	B1	
		Attempt division by $(x - 3)$ reaching a partial quotient of $4x^2 + kx$	M1	
		Obtain quadratic factor $4x^2 - 4x - 3$	A1	
		Obtain solutions $x = \frac{3}{2}$ and $x = -\frac{1}{2}$	A1	
		S.C. M1A1√ if value of 'a' incorrect		[4]

Q28.

7	(i)	Substitute $x = -2$, equate to zero and obtain a correct equation in any form	B1	
		Substitute $x = -1$ and equate to 12	M1	
		Obtain a correct equation in any form	A1	
		Solve a relevant pair of equations for a or b	M1	
		Obtain $a = 2$ and $b = 6$	A1	[5]
	(ii)	Attempt division by $x + 2$ and reach a partial quotient of $2x^2 - 7x$	M1	
		Obtain quotient $2x^2 - 7x + 3$	A1	
		Obtain linear factors $2x - 1$ and $x - 3$	A1	
		[Condone omission of repetition that $x + 2$ is a factor.)		
		[If linear factors $2x - 1$, $x - 3$ obtained by remainder theorem or inspection, award B2 + B1.]		
		S.C. M1A1√ if a, b not both correct		[3]

Q29.

6	(i)	Substitute $x = 1$ or $x = -2$ and equate to zero	M1	
		Obtain a correct equation in any form with powers of x values calculated	A1	
		Obtain a second correct equation in any form	A1	
		Solve a relevant pair of equations for a or for b	M1	
		Obtain $a = 3$ and $b = -5$	A1	[5]
	(ii)	Attempt division by $x^2 + x - 2$, or equivalent, and reach a partial quotient of $x^2 + kx$	M1	
		Obtain partial quotient $x^2 + 2x$	A1	
		Obtain $x^2 + 2x - 1$ with no errors seen	A1	
		S.C. M1A1√ if 'a' and/or 'b' incorrect		[3]

Q30.

7	(i)	Substitute $x = -1$, equate to zero and obtain a correct equation in any form	B1	
		Substitute $x = 3$ and equate to 12	M1	
		Obtain a correct equation in any form	A1	
		Solve a relevant pair of equations for a or for b	M1	
		Obtain $a = -4$ and $b = 6$	A1	[5]
	(ii)	Attempt division by $x^2 - 2$ and reach a partial quotient of $2x - k$	M1	
		Obtain quotient $2x - 4$	A1	
		Obtain remainder -2	A1	[3]

Q31.

3	(i)	Attempt division by $x^2 - 3x + 2$ or equivalent, and reach a partial quotient of $x^2 + kx$	M1	
		Obtain partial quotient $x^2 - x$	A1	
		Obtain $x^2 - x - 2$ with no errors seen	A1	[3]
	(ii)	Correct solution method for either quadratic e.g. factorisation	M1	
		One correct solution from solving quadratic or inspection	B1	
		All solutions $x = 2$, $x = 1$ and $x = -1$ given and no others	A1	[3]

Q32.

4	(i)	Substitute $x = 3$ and equate to 14 $(9a + 3b + 35 = 14)$	M1	
		Substitute $x = -2$ and equate to 24 $(4a - 2b = 24)$	M1	
		Obtain a correct equation in any form	A1	
		Solve a relevant pair of equations for a or for b	M1	
		Obtain $a = 1$ and $b = -10$	A1	[5]

(ii)	Attempt division by $x^2 + 2x - 8$ and reach a partial quotient of $x - k$	M1	
	Obtain quotient $x - 1$ with no errors seen (can be done by observation)	A1	
	Correct solution method for quadratic e.g. factorisation	M1	
	All solutions $x = 1$, $x = 2$ and $x = -4$ given and no others CWO	A1	[4]

Q33.

4	(i)	Substitute $x = 3$ or $x = -2$ and equate to zero	M1	
		Obtain a correct equation in any form	A1	
		Obtain a second correct equation in any form	A1	
		Solve a relevant pair of equations for a or for b	M1	
		Obtain $a = 4$ and $b = -3$	A1	[5]
	(ii)	Attempt division by $x + 2$ (or $x - 3$) and obtain partial quotient of $ax^2 + kx$	M1	
		Obtain linear factors $4x + 1$, $x + 2$ and $x - 3$	A1	
		[If linear factor $4x + 1$ obtained by remainder theorem or inspection, award B2]		
		[If linear factor $4x + 1$ obtained by division by $x^2 - x - 6$, award M1 A1]		[2]
		Alternative Method:		
		Attempt to form identity $(x^2 - x - 6)(rx + s) \equiv ax^3 + bx^3 - 25x - 6$	M1	
		Attempt to equate like terms	M1	
		Leads to $s = 1$ B1, $r = 4$ A1, $b = -3$ A1, $a = 4$	A1	
		Obtain linear factors $4x + 1$, $x + 2$ and $x - 3$	A1	

Q34.

3	(i)	Divide at least as far as x term in quotient, use synthetic division correctly or make use of an identity	M1	
		Obtain at least $6x^2 - x$	A1	
		Obtain quotient $6x^2 - x - 2$ and confirm remainder is 7 (AG)	A1	[3]
	(ii)	State equation in form $(x^2 - 4)(6x^2 + kx - 2) = 0$, any constant k (may be implied)	M1	
		Obtain two of the roots $-2,\ 2,\ -\frac{1}{2},\ \frac{2}{3}$	A1	
		Obtain remaining two roots and no others	A1	[3]

Q35.

6	(i)	Substitute -2 and equate to zero, or divide and equate remainder to zero	M1	
		Obtain $a = 12$	A1	[2]
	(ii)	Carry out division, or equivalent, at least as far as x^2 and x terms in quotient	M1	
		Obtain $x^2 - 2x + 6$	A1	
		Calculate discriminant of a 3 term quadratic quotient (or equivalent)	DM1	
		Obtain -20 (or equivalent)	A1	
		Conclude by referring to, or implying, root -2 and no root from quadratic factor	A1	[5]

Q36.

5	**(i)**	State $-40+4a+b=0$ or equivalent	B1	
		State $-135+9a+b=0$ or equivalent	B1	
		Solve a pair of linear simultaneous equations	M1	
		Obtain $a=19$ and $b=-36$	A1	[4]
	(ii)	Identify $5x-6$ as a factor	B1	
		State $(x+2)(x+3)(5x-6)$	B1	
		State or imply $5^y=\frac{6}{5}$, following a positive value from factorisation	B1√	
		Apply logarithms and use power law	M1	
		Obtain 0.113 only	A1	[5]

P3 (variant1 and 3)

Q1.

4	**(i)**	Verify that $-96+100+8-12=0$	B1	
		Attempt to find quadratic factor by division by $(x+2)$, reaching a partial quotient $12x^2+kx$, inspection or use of an identity	M1	
		Obtain $12x^2+x-6$	A1	
		State $(x+2)(4x+3)(3x-2)$	A1	[4]
		[The M1 can be earned if inspection has unknown factor Ax^2+Bx-6 and an equation in A and/or B or equation $12x^2+Bx+C$ and an equation in B and/or C.]		
	(ii)	State $3^y=\frac{2}{3}$ and no other value	B1	
		Use correct method for finding y from equation of form $3^y=k$, where $k>0$	M1	
		Obtain -0.369 and no other value	A1	[3]

Q2.

5	**(i)**	Substitute $x=\frac{1}{2}$ and equate to zero, or divide, and obtain a correct equation, e.g. $\frac{1}{8}a+\frac{1}{4}b+\frac{5}{2}-2=0$	B1	
		Substitute $x=2$ and equate result to 12, or divide and equate constant remainder to 12	M1	
		Obtain a correct equation, e.g. $8a+4b+10-2=12$	A1	
		Solve for a or for b	M1	
		Obtain $a=2$ and $b=-3$	A1	[5]
	(ii)	Attempt division by $2x-1$ reaching a partial quotient $\frac{1}{2}ax^2+kx$	M1	
		Obtain quadratic factor x^2-x+2	A1	[2]
		[The M1 is earned if inspection has an unknown factor Ax^2+Bx+2 and an equation in A and/or B, or an unknown factor of $\frac{1}{2}ax^2+Bx+C$ and an equation in B and/or C.]		

Q3.

3	(i)	Substitute $x = 2$ and equate to zero, or divide by $x - 2$ and equate constant remainder to zero, or equivalent	M1	
		Obtain $a = 4$	A1	[2]
	(ii) (a)	Find further (quadratic or linear) factor by division, inspection or factor theorem or equivalent	M1	
		Obtain $x^2 + 2x - 8$ or $x + 4$	A1	
		State $(x - 2)^2(x + 4)$ or equivalent	A1	[3]
	(b)	State any two of the four (or six) roots	B1√	
		State all roots ($\pm\sqrt{2}$, $\pm 2i$), provided two are purely imaginary	B1√	[2]

Q4.

1	Carry out division or equivalent at least as far as two terms of quotient	M1	
	Obtain quotient $2x - 4$	A1	
	Obtain remainder 8	A1	[3]

Q5.

5	(i)	Substitute $x = -\frac{1}{2}$, or divide by $(2x + 1)$, and obtain a correct equation, e.g. $a - 2b + 8 = 0$	B1	
		Substitute $x = \frac{1}{2}$ and equate to 1, or divide by $(2x - 1)$ and equate constant remainder to 1	M1	
		Obtain a correct equation, e.g. $a + 2b + 12 = 0$	A1	
		Solve for a or for b	M1	
		Obtain $a = -10$ and $b = -1$	A1	[5]
	(ii)	Divide by $2x^2 - 1$ and reach a quotient of the form $4x + k$	M1	
		Obtain quotient $4x - 5$	A1	
		Obtain remainder $3x - 2$	A1	[3]

Q6.

10	(i)	Attempt to solve for m the equation $p(-2) = 0$ or equivalent	M1	
		Obtain $m = 6$	A1	[2]
		Alternative:		
		Attempt $p(z) \div (z + 2)$, equate a constant remainder to zero and solve for m.	M1	
		Obtain $m = 6$	A1	
	(ii) (a)	State $z = -2$	B1	
		Attempt to find quadratic factor by inspection, division, identity, …	M1	
		Obtain $z^2 + 4z + 16$	A1	
		Use correct method to solve a 3-term quadratic equation	M1	
		Obtain $-2 \pm 2\sqrt{3}\mathrm{i}$ or equivalent	A1	[5]
	(b)	State or imply that square roots of answers from part **(ii)(a)** needed	M1	
		Obtain $\pm \mathrm{i}\sqrt{2}$	A1	
		Attempt to find square root of a further root in the form $x + \mathrm{i}y$ or in polar form	M1	
		Obtain $a^2 - b^2 = -2$ and $ab = (\pm)\sqrt{3}$ following their answer to part **(ii)(a)**	A1√	
		Solve for a and b	M1	
		Obtain $\pm\left(1 + \mathrm{i}\sqrt{3}\right)$ and $\pm\left(1 - \mathrm{i}\sqrt{3}\right)$	A1	[6]

Q7.

3	(i)	*EITHER*: Attempt division by $x^2 - x + 1$ reaching a partial quotient of $x^2 + kx$	M1	
		Obtain quotient $x^2 + 4x + 3$	A1	
		Equate remainder of form lx to zero and solve for a, or equivalent	M1	
		Obtain answer $a = 1$	A1	
		OR: Substitute a complex zero of $x^2 - x + 1$ in $p(x)$ and equate to zero	M1	
		Obtain a correct equation in a in any unsimplified form	A1	
		Expand terms, use $\mathrm{i}^2 = -1$ and solve for a	M1	
		Obtain answer $a = 1$	A1	[4]
		[SR: The first M1 is earned if inspection reaches an unknown factor $x^2 + Bx + C$ and an equation in B and/or C, or an unknown factor $Ax^2 + Bx + 3$ and an equation in A and/or B. The second M1 is only earned if use of the equation $a = B - C$ is seen or implied.]		
	(ii)	State answer, e.g. $x = -3$	B1	
		State answer, e.g. $x = -1$ and no others	B1	[2]

Q8.

7	(i) Substitute $x = \frac{1}{2}$ and equate to zero			
	or divide by $(2x - 1)$, reach $\frac{a}{2}x^2 + kx + ...$and equate remainder to zero			
	or by inspection reach $\frac{a}{2}x^2 + bx + c$ and an equation in b/c			
	or by inspection reach $Ax^2 + Bx + a$ and an equation in A/B	M1		
	Obtain $a = 2$	A1		
	Attempt to find quadratic factor by division or inspection or equivalent	M1		
	Obtain $(2x - 1)(x^2 + 2)$	A1cwo	[4]	
	(ii) State or imply form $\frac{A}{2x-1} + \frac{Bx+C}{x^2+2}$, following factors from part **(i)**	B1√		
	Use relevant method to find a constant	M1		
	Obtain $A = -4$, following factors from part **(i)**	A1√		
	Obtain $B = 2$	A1		
	Obtain $C = 5$	A1		

Q9.

3 **(i)** Substitute –2 and equate to zero or divide by $x + 2$ and equate remainder to zero or use –2 in synthetic division — M1
Obtain $a = -1$ — A1 [2]

(ii) Attempt to find quadratic factor by division reaching $x^2 + kx$, or inspection as far as $(x+2)(x^2 + Bx + c)$ and equations for one or both of B and C, or $(x+2)(Ax^2 + Bx + 7)$ and equations for one or both of A and B. — M1
Obtain $x^2 - 3x + 7$ — A1
Use discriminant to obtain –19, or equivalent, and **confirm one root** cwo — A1 [3]

Q10.

3 Substitute $x = -\frac{1}{3}$, equate result to zero or divide by $3x + 1$ and equate the remainder to zero and obtain a correct equation, e.g. $-\frac{1}{27}a + \frac{1}{9}b - \frac{1}{3} + 3 = 0$ — B1
Substitute $x = 2$ and equate result to 21 or divide by $x - 2$ and equate constant remainder to 21 — M1
Obtain a correct equation, e.g. $8a + 4b + 5 = 21$ — A1
Solve for a or for b — M1
Obtain $a = 12$ and $b = -20$ — A1 **[5]**

Q11.

3	**(i)**	Either	Equate p(−1) or p(−2) to zero or divide by $(x+1)$ or $(x+2)$ and equate constant remainder to zero.	M*1	
			Obtain two equations $a-b=6$ and $4a-2b=34$ or equivalents	A1	
			Solve pair of equations for a or b	DM*1	
			Obtain $a=11$ and $b=5$	A1	
		Or	State or imply third factor is $4x-1$	B1	
			Carry out complete expansion of $(x+1)(x+2)(4x-1)$ or $(x+1)(x+2)(Cx+D)$	M1	
			Obtain $a=11$	A1	
			Obtain $b=5$	A1	[4]
	(ii)	Use division or equivalent and obtaining linear remainder		M1	
		Obtain quotient $4x+a$, following their value of a		A1√	
		Indicate remainder $x-13$		A1	[3]