Question Number	Scheme	Marks
3 (i)	$2\log_2(2-x)=4+\log_2(x+10)$	
	One correct log law $2\log_2(2-x)\to\log_2(2-x)^2$ or $4\to\log_2 16$	B1
	Correct attempt to combine two terms	M1
	Correct equation (not involving logs) E.g. $(2-x)^2=16(x+10)$	A1
	$x^2-20x-156=0$ $(x+6)(x-26)=0$	M1
	$x=-6$ only	A1
		(5)
(ii)	12	B1
		(1)
		(6 marks)

(i)

B1: One correct log law seen or used in relation to the equation e.g. $2\log_2 ...\to\log_2 ...^2$ or $4\to\log_2 16$ (which may appear as $\log_2 2^4$ or $\log_2 4^2$). May be seen anywhere and allow if on incorrect terms.

M1: **Correct** attempt to combine two of the **original** terms, condoning a slip with the 16.
E.g. $4+\log_2(x+10)=\log_2 16+\log_2(x+10)=\log_2 16(x+10)$
Do not allow if e.g. they incorrectly divide by 2 first and attempt to combine $\log_2(2-x)-\log_2(x+10)$

A1: Correct equation (not involving logs) from fully correct log work E.g.
$(2-x)^2=16(x+10)$ or $\dfrac{(2-x)^2}{x+10}=16$

M1: Correct attempt to solve a 3TQ in x achieving a real root (may be by calculator). B1 must have been scored but not all log work need be correct.

A1: $x=-6$ only following the award of all previous marks (all log work must have been correct). The $x = 26$ solution must be rejected if seen.

SC Allow max B1M0A0M1A0 for e.g. $\dfrac{\log_2(2-x)^2}{\log_2(x+10)}=4\to(2-x)^2=16(x+10)$ etc.

Allow the SC if no combination of logs is shown at all, but the correct quadratic if produced.

(ii)

B1: 12 clearly identified as the answer. Condone a =12 as long as 12 is clearly the answer being offered.

Question Number	Scheme	Marks
4.(a)	21	B1 **(1)**
(b)	Sets $f\left(\pm\frac{1}{2}\right)=0 \rightarrow$ equation in k	M1
	Eg. $\left(\frac{1}{2}-2\right)\left(2\times\frac{1}{4}+5\times\frac{1}{2}+k\right)+21=0$ $\Rightarrow 3+k=14 \Rightarrow k=11$ *	A1* **(2)**
(c)	(i) $f(x)=(x-2)(2x^2+5x+11)+21=2x^3+x^2+x-1$	M1
	$=(2x-1)(x^2+x+1)$	dM1, A1
	(ii) Attempts to find the number of roots of their (x^2+x+1)	M1
	• States (x^2+x+1) has no roots with reason	A1
	• Concludes $f(x)=0$ has 1 root (at $x=\frac{1}{2}$)	**(5)** **(8 marks)**

(a)

B1: States 21

(b) If division is attempted in (b), mark (b) and (c) as a whole.

M1: Sets $f\left(\pm\frac{1}{2}\right)=0 \rightarrow$ equation in k. The "= 0" may be implied. If division is used look for setting the remainder after dividing by $(2x - 1)$ equal to zero to form an equation in k.

A1*: Solves a correct equation in k showing at least one correct intermediate line (the "= 0" may be implied but must have been a correct equation preceding the answer). Condone missing brackets if clearly recovered.

May see $k=11$ embedded so $\left(-\frac{3}{2}\right)(3+11)+21=-21+21=0$ ✓ is acceptable.

(c) (i) Only allow work carried out in (b) to count in (c) if carried forward into (c).

M1: Attempts to multiply out $(x-2)(2x^2+5x+11)+21$ to achieve a cubic. If an incorrect value for k is used, allow two M's for equivalent work.

dM1: Attempts to divide by or factor out $(2x-1)$ or $\left(x-\frac{1}{2}\right)$ from their attempt at expanding $(x-2)(2x^2+5x+11)+21$.

Long division – look for the x^2 + extra terms and first subtraction

$$\begin{array}{r} x^2+\ldots \\ 2x-1\overline{)\,"2x^3+x^2+x-1"} \\ "2x^3"-"x^2" \\ \quad "2x^2"+\ldots \\ \quad \ldots. \end{array}$$

Inspection/comparing coefficients – look for correct magnitudes for first and last term in the brackets. $(2x-1)(x^2\pm\ldots\pm1)$