Question Number	Scheme	Marks	AOs
11 (a)	$2\log_2(x-4)+\log_2\left(\frac{4}{3}x\right)=2+\log_2(x+2)$		
	One correct log law e.g. $2\log_2(x-4)=\log_2(x-4)^2$ or $2=\log_2 4$	B1	1.1b
	Correct attempt to combine 2 log terms e.g. $2\log_2(x-4)+\log_2\left(\frac{4}{3}x\right)=\log_2\left(\frac{4}{3}x(x-4)^2\right)$	M1	1.1b
	e.g. $\frac{4}{3}x(x-4)^2=4(x+2)$ or e.g. $\frac{4x(x-4)^2}{3(x+2)}=4$	A1	1.1b
	$4x^3-32x^2+64x-12x-24=0\Rightarrow x^3-8x^2+13x-6=0$ *	A1*	2.1
		(4)	
(b)	$\{f(1)=\}\ 1^3-8\times1^2+13\times1-6=0\Rightarrow(x-1)$ is a factor	B1	2.4
		(1)	
(c)	$x^3-8x^2+13x-6=(x-1)\left(x^2-7x+6\right)$	M1	1.1b
	$x^2-7x+6=(x-1)(x-6)=0\Rightarrow x=...$	dM1	1.1b
	$x=1,6$	A1	1.1b
		(3)	
(d)	$x=6$ only	B1ft	2.2b
		(1)	
			(9 marks)
Notes:			

(a) **Condone the absence of a base on their log terms throughout.**

B1: States or uses one correct log law on either $2\log_2(x-4)=\log_2(x-4)^2$ or $2=\log_2 4$

(which may be implied by e.g. $\log_2(...)=2\rightarrow(...)=2^2$).

It is scored for use of either of the above, and not for addition or subtraction laws.

M1: Correct attempt to combine 2 log terms from the equation using the addition or subtraction laws.

Not scored for combining 2 log terms that have come from incorrect log work and not scored for just e.g. $\log_2\left(\frac{4}{3}x\right)\rightarrow\log_2(4x)-\log_2 3$

A1: Correct unsimplified equation with logs removed e.g. $\frac{4}{3}x(x-4)^2=4(x+2)$ (that is not the given answer). Note that some candidates are proceeding directly to e.g. $\frac{4}{3}x(x-4)^2=4(x+2)$ and will score B1M1A1 if there are no errors seen prior to this but will score A0* even if they then achieve the given answer as they have not shown all necessary steps involving the log work.

A1*: Proceeds to the given answer showing all necessary steps and no errors.

There must be at least one correct intermediate line between their $4x(x-4)^2 = 12(x+2)$ with brackets expanded and the given answer of $x^3 - 8x^2 + 13x - 6 = 0$

(b)

B1: Correct attempt showing $\{f(1) =\}\ 1^3 - 8\times1^2 + 13\times1 - 6 = 0$ with a conclusion.

Requires the = 0 (which may be separate) and a conclusion e.g. "(x – 1) is a factor".
The conclusion should refer to (x – 1) or "it" being a factor in some way. Either e.g. ✓ or "shown" would be insufficient conclusions.
There is no need to evaluate any of the individual terms.
If they use a preamble, e.g., "if (x – 1) (or "it") is a factor then x = 1 is a root" and then show $\{f(1) =\}\ 1^3 - 8\times1^2 + 13\times1 - 6 = 0$ they must have a minimal conclusion so e.g. ✓ and "shown" are acceptable as they have already referred to (x – 1) being a factor in some way.
Underlining = 0 is not a sufficient conclusion for either approach.

(c)

M1: Divides by $(x-1)$ to produce a quadratic factor. Look for $x^2 \pm 7x \pm ...$ via algebraic division or $x^2 \pm ...x \pm 6$ by inspection, where … may be 0. May be seen in part (b).

Note that they cannot just proceed directly to e.g. $(x-1)^2(x-6)$

dM1: Solves their 3TQ using the usual rules, but there must be a method.
Calculator use is not acceptable here. Dependent on the previous method mark.

A1: Both $x = 1$ and $x = 6$ from correct work, and no other solutions.

Note that some candidates are labelling their answers, sometimes including e.g. factorisation, as part (d). Allow these candidates to score the dM1A1 for the two correct answers (following correct work) seen in (d).

(d)

B1ft: Deduces that the correct solution is 6 only. Ignore any justification for rejecting other roots.
If awarding for x = 6 only, then they must have x = 6 in part (c) and have no other solutions larger than 4 in part (c).
Follow through on their solutions to part (c) if they select all solutions that are larger than 4.
So, if they have e.g. x = 1, 5, 7 in part (c) then they require x = 5, 7 in part (d).
and if they have e.g. x = 1, 2, 3 in part (c) then they should conclude "no solutions" o.e.