Question Number	Scheme	Notes	Marks
4	$2\log_3(1-x)=\log_3(1-x)^2$ or $3=\log_3 3^3$	Correct power law used or implied	B1
	$\log_3(32-12x)-\log_3(1-x)^2=\log_3\dfrac{32-12x}{(1-x)^2}$ Combines 2 log terms correctly		M1
	$\dfrac{32-12x}{(1-x)^2}=27$	Obtains this equation in any form	A1
	$\Rightarrow 27x^2-42x-5=0\Rightarrow x=\ldots$	Solves 3TQ	M1
	$x=-\dfrac{1}{9}$	This value only i.e. the $\dfrac{5}{3}$ must clearly be discarded if seen.	A1
			(5)
			Total 5

Notes

(a)

B1: Correct use of implication of the power law. Award for sight any of $\log_3(1-x)^2$, $\log_3 3^3$, $\log_3 27$ or for $3\to 27$ moving from $\log_3(\ldots)=3$ or ...= 27 (oe)

Allow for $\log_3\left((1-x)+3\right)^2$ as a misread (the M will be lost)

Allow B1 for $2\log_3(1-x)+3\to\log_3 3(1-x)^2$ without first seeing the $\log_3(1-x)^2$ but again the M will be lost without further sufficient work seen.

M1: For correctly combining two of the terms $\log_3(32\pm 12x),\log_3(1\pm x)^2$ or $\log_3 A$ (where the latter is their attempt at writing 3 as a log term) into one log term. E.g. as shown in the scheme or may see $\log_3(1-x)^2+\log_3"27"\to\log_3\left("27"(1-x)^2\right)$ Allow for slips copying terms but must be combining terms of the correct form. $\dfrac{\log_3(32-12x)}{\log_3(1-x)^2}$ is M0

A1: For a correct equation with logarithms removed, any form. Allow with 3^3 in place of 27.

M1: For solving a quadratic equation that has come from a valid attempt to remove logarithms. A valid attempt is one that moves from $\log_3(f(x))=\log_3(g(x))$ to $f(x)=g(x)$ or from $\log_3(f(x))=A$ to $f(x)=3^A$, although allow "recovery" from $\dfrac{\log_3(32-12x)}{\log_3(1-x)^2}=3\to\dfrac{32-12x}{(1-x)^2}=3^3$ for this mark and the next A mark.

If no method of solution of the quadratic is shown then the method is implied by at least one correct solution for their quadratic.

A1: For $x=-\dfrac{1}{9}$ only. The $\dfrac{5}{3}$ must clearly be discarded if seen, e.g by "reject" stated, or crossed out or $x=-\dfrac{1}{9}$ underlined or boxed to in some way indicate it is the only solution.

Question Number	Scheme	Notes	Marks
5(a)	$3(1)^3+A(1)^2+B(1)-10=k$ **or** $3(-1)^3+A(-1)^2+B(-1)-10=-10k$	Attempts $f(\pm1)=k$ **or** $f(\pm1)=-10k$	M1
	$A+B-7=k,\ A-B-13=-10k$ $\Rightarrow -10A-10B+70=A-B-13$	Uses $f(\pm1)=k$ **and** $f(\mp1)=-10k$ to eliminate *k* and obtains an equation in *A* and *B* only	M1
	$\Rightarrow 11A+9B=83$*	Correct proof with no errors	A1*
			(3)
(b)	$3\left(\frac{2}{3}\right)^3+A\left(\frac{2}{3}\right)^2+B\left(\frac{2}{3}\right)-10=0$	Attempts $f\left(\frac{2}{3}\right)=0$	M1
	$11A+9B=83,\ 12A+18B=246$ $\Rightarrow A=...,B=...$	Solves $11A+9B=83$ simultaneously with *their* equation in *A* and *B*	M1
	$A=-8,\ B=19$	Correct values	A1
			(3)
(c)	$f(x)=(3x-2)(x^2+...x+...)$	Uses any appropriate method e.g. long division/inspection to obtain x^2+px+q where *p* and *q* are non-zero.	M1
	$g(x)=x^2-2x+5$	Correct expression	A1
			(2)
			Total 8

Notes

(a)

M1: Attempts to apply the remainder theorem for either term – so substitutes ±1 into f and equates to *k* or $-10k$. The powers of ±1 need not be seen. For attempts via long division look for reaching a quotient $3x^2+(A\pm3)x+...$ and remainder $\pm A\pm B-\alpha$ before setting equal to the remainder.

M1: Must have attempted remainder theorem on both terms with opposite sign (ie both f(1) and f(−1) attempted, but may be set to the wrong remainders). Uses their two equations to eliminate the *k* and form an equation in *A* and *B* only. Note: finding a value for *k* (incorrectly) and substituting is M0.

A1*: Correct equation reached from fully correct work.

(b)

M1: Applies the factor theorem with $f\left(\frac{2}{3}\right)=0$. Must be correct sign here, but no need to evaluate powers for the method mark. Allow if all that is wrong is a slip in one term. The "=0" may be implied by working. For attempts via long division look for quotient $x^2+\frac{1}{3}(A\pm2)x+...$ and then their remainder (in *A* and *B*) set to zero.

M1: Solves their equation and the one from (a) simultaneously. Not dependent so may be scored from an attempt at $f\left(-\frac{2}{3}\right)=0$. Must have produced a second equation in *A* and *B.* Look for an attempt to match coefficients and add/subtract, or an attempt to substitute for a variable, reaching values for *A* and *B*. If no method is shown, values reached must match their equations.

A1: Correct values found.

(c)

M1: Attempts inspection, factorisation or long division to try and find the factor. Must produce a three-term quadratic. Implied by the correct answer if no incorrect method seen. For inspection look