Question Number	Scheme	Notes	Marks
3(a)	$\left(2-\frac{kx}{4}\right)^8 = 2^8+\binom{8}{1}2^7\left(-\frac{kx}{4}\right)+\binom{8}{2}2^6\left(-\frac{kx}{4}\right)^2+\binom{8}{3}2^5\left(-\frac{kx}{4}\right)^3+\ldots$ Or $\left(1-\frac{kx}{8}\right)^8 = 1+\binom{8}{1}\left(-\frac{kx}{8}\right)+\binom{8}{2}\left(-\frac{kx}{8}\right)^2+\binom{8}{3}\left(-\frac{kx}{8}\right)^3+\ldots$		M1
	$= 256-256kx+112k^2x^2-28k^3x^3+\ldots$	$256-256kx$	B1
		$112k^2x^2$ **or** $-28k^3x^3$ (unsimplified)	A1
		$112k^2x^2$ **and** $-28k^3x^3$ (simplified)	A1
			(4)
(b)	$\mathrm{f}(x) = (5-3x)\left(2-\frac{kx}{4}\right)^8 = (5-3x)\left(256-256kx+112k^2x^2-28k^3x^3+\ldots\right)$ Coefficient of x is $5\times -256k - 3\times 256$		M1
	$5\times 256 = 3(-1280k-768) \Rightarrow k = \ldots$	Sets 5×their constant term from (a) = 3×their coefficient of x from f(x) and solves for k	M1
	$k = -\frac{14}{15}$	Correct value.	A1
			(3)
			Total 7

Notes

(a)

M1: Attempts the binomial expansion on $\left(2\pm\frac{kx}{4}\right)^8$ or $\left(1\pm\frac{kx}{\beta}\right)^8$ up to at least the third (x^2) term with an acceptable structure. Look for the correct binomial coefficient (accept alternative notation ${}^nC_r$) combined with the correct power of x but allow if powers of 2 are incorrect and if brackets are missing. M0 for descending powers.

B1: for $256-256kx$, may be listed, must be simplified. Allow for $256(1-kx+\ldots)$ if the 2^8 is taken out first.

A1: Correct third or fourth term, may be listed. Need not be simplified but the binomial coefficients must be numerical. Allow for one term from $256\left(\ldots+\frac{28}{64}(kx)^2-\frac{56}{512}(kx)^3\ldots\right)$ if the 2^8 is taken out first. May have powers as $(kx)^n$ for this mark. Allow for the correct x^2 term if the sign was incorrect in their bracket.

A1: Correct simplified third and fourth terms as shown in scheme, may be listed. Must have k^nx^n terms.

Note: isw after correct terms are seen if they try to divide through.

(b)

M1: Correct strategy for the coefficient of x or the x term. E.g. 5×their $-256k$ – 3×their 256 or may be part of a full expansion – look for (5×their $-256k$ – 3×their 256)x but terms must have been combined.

M1: Sets 5×their constant term from (a) = 3×their coefficient of x from f(x) and solves for k. Should be an equation in k only, but allow recovery if they initially include the x but later cross it out to give a constant for the answer. The attempt at the x coefficient must have been an attempt at a sum of two terms from their expansion of f(x)

A1: Correct value, must be exact. Allow $-0.9\dot{3}$ but not a terminating decimal.

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.