Question Number	Scheme	Marks
3(a)	$\left(2+\frac{kx}{8}\right)^7 = 2^7 + \binom{7}{1}2^6\left(\frac{kx}{8}\right) + \binom{7}{2}2^5\left(\frac{kx}{8}\right)^2 + \binom{7}{3}2^4\left(\frac{kx}{8}\right)^3 + ...$	M1
	$= 128 + 56kx + \frac{21}{2}k^2x^2 + \frac{35}{32}k^3x^3 + ...$	B1A1A1
		(4)
(b)	$\frac{35}{32}k^3 - \frac{21}{2}k^2 = \frac{21}{2}k^2 - 56k$	M1
	$5k^2 - 96k + 256 = 0 \Rightarrow k = ...$	dM1
	$k = 16, \frac{16}{5}$	A1
		(3)
		Total 7

(a)

M1 Attempts the binomial expansion **up to at least the third term** with an acceptable structure for either the **3rd or 4th term**. The correct binomial coefficient (allowing alternative notation) must be combined with the correct power of *x* and the correct power of 2 (oe) but condone if brackets are missing. Condone errors on the first or second term.
M0 for descending powers.
Alternatively writes e.g. $\left(2+\frac{kx}{8}\right)^7 = 2^7\left(1+\frac{kx}{16}\right)^7 = 2^7\left(1+\frac{7}{16}kx+\frac{7\times6}{2}\left(\frac{kx}{16}\right)^2+\frac{7\times6\times5}{6}\left(\frac{kx}{16}\right)^3\right)$ which can also score M1 for the expansion up to at least the third term with an acceptable structure for either the **3rd or 4th term**. They do not have to multiply out the brackets for this mark but the 2^7 cannot be omitted unless it is later recovered. Condone errors on the first or second term.
Condone missing brackets.

B1 $128+56kx$. May be listed but must be simplified. Allow $128\left(1+\frac{7}{16}kx+...\right)$ if the 2^7 is taken out first.

A1 $\frac{21}{2}k^2x^2$ **or** $\frac{35}{32}k^3x^3$. May be listed, **does not need to be simplified**, but the binomial coefficients must be numerical. Accept $\frac{21}{2}(kx)^2$ **or** $\frac{35}{32}(kx)^3$ oe e.g. $10.5(kx)^2$ or $1.09375(kx)^3$ for this mark only. Common acceptable terms seen are $\frac{672}{64}(kx)^2$, $\frac{560}{512}(kx)^3$

A1 $\frac{21}{2}k^2x^2$ **and** $\frac{35}{32}k^3x^3$ or exact simplified equivalent e.g. $10.5k^2x^2$ **and** $1.09375k^3x^3$. May be listed but must have k^nx^n terms.

Note: isw after correct terms are seen if they try to divide or multiply through or set = 0

(b)

M1 Uses the given information to usually form a cubic equation in k only (or quadratic if they have cancelled a k from each term) using their coefficients from (a) in the correct positions.

e.g. $"\frac{35}{32}k^3"-"\frac{21}{2}k^2"="\frac{21}{2}k^2"-"56k"$ or $"\frac{35}{32}k^3"+"56k"=2"\frac{21}{2}k^2"$

Implied by $5k^2-96k+256=0$ or equivalent. (The = 0 may be implied by later work)

e.g. $35k^2-672k+1792=0$ or $\frac{35}{32}k^2-21k+56=0$

Their equation should be able to be simplified to a 3TQ=0

Condone coefficients appearing as rounded decimals.

dM1 Achieves a 3 term cubic or a 3 term quadratic and solves (which may be directly via a calculator) to find a value of k (which may be unsimplified). Usual rules apply for solving a quadratic. Do not be concerned by their rearrangement and the = 0 may be implied.

Only allow real solutions.

It is dependent on the first method mark.

A1 16, $\frac{16}{5}$ oe If $k=0$ is stated then it must be rejected.

Do not isw if they proceed to a range of values e.g. $\frac{16}{5}<k<16$

Question Number	Scheme	Marks
4(i)	E.g. $2=\log_3 9$ Eg $\log_3(4x)-\log_3(5x+7)=\log_3\dfrac{4x}{5x+7}$	M1
	E.g. $36x=5x+7$ $\dfrac{4x}{5x+7}=\dfrac{1}{9}$	A1
	$x=\dfrac{7}{31}$	A1
		(3)
(ii)	$\left(\sum_{r=1}^{2}\log_a y^r=\right)\log_a y+\log_a y^2$ or $\left(\sum_{r=1}^{2}(\log_a y)^r=\right)\log_a y+(\log_a y)^2$	B1
	$\log_a y+\log_a y^2=\log_a y+(\log_a y)^2\Rightarrow 2\log_a y-(\log_a y)^2=0$ $\Rightarrow \log_a y(2-\log_a y)=0\Rightarrow \log_a y=2$	M1
	$y=a^2$	A1
		(3)
		Total 6

(i) Answer on its own with no working score 0 marks.

M1 Demonstrates at least one correct law of logarithms.

e.g. $2=\log_3 9$ or $\log_3(4x)=\log_3 4+\log_3 x$ or $\log_3(4x)-\log_3(5x+7)=\log_3\dfrac{4x}{5x+7}$

$\log_3(5x+7)-\log_3(4x)=\log_3\dfrac{5x+7}{4x}$

(Do not be concerned with slips on the 2 if manipulating the equation

e.g. $\log_3(4x)+2=\log_3(5x+7)\Rightarrow\log_3\dfrac{4x}{5x+7}=2$ scores M1)

A1 For a correct equation in any form with no logs eg $4x=\dfrac{5x+7}{9}$. Must have come from correct log work.

A1 $\dfrac{7}{31}$ only and follows a correct equation with no logs.

Note $\dfrac{\log_3 5x+7}{\log_3 4x}=-2\Rightarrow x=\dfrac{7}{31}$ will only score a maximum of M1A0A0 if they are able to demonstrate at least one correct law of logarithms.

(ii) Answer on its own with no working score 0 marks.

B1 For either (or both) summation correct $\log_a y+\log_a y^2$ or $\log_a y+(\log_a y)^2$ or equivalent

Can also be awarded for a correct equation:

e.g. $\log_a y^2=(\log_a y)^2$ or $2\log_a y=(\log_a y)^2$ or $3\log_a y=\log_a y+(\log_a y)^2$