Question Number	Scheme	Marks
5(a)	$(2+ax)^6 = 2^6 + \binom{6}{1}2^5(ax) + \binom{6}{2}2^4(ax)^2 + ...$	M1
	$= 64 + 192ax + 240a^2x^2 + ...$	A1A1
		(3)
(b)	$\left(3+\frac{1}{x}\right)^2 = 9 + \frac{6}{x} + \frac{1}{x^2}$ or $9 + \frac{3}{x} + \frac{3}{x} + \frac{1}{x^2}$	B1
	$f(x) = \left(9 + \frac{6}{x} + \frac{1}{x^2}\right)\left(64 + 192ax + 240a^2x^2 + ...\right) = ...$ Constant term is $9\times 64 + 6\times 192a + 240a^2$	M1
	$576 + 1152a + 240a^2 = 576 \Rightarrow 1152a + 240a^2 = 0$ $\Rightarrow 1152 + 240a = 0 \Rightarrow a = ...$	**d**M1
	$a = -\frac{24}{5}$	A1
		(4)
		Total 7

(a)

M1: Attempts the binomial expansion up to at least the second term to obtain the correct structure for the **2nd or 3rd term** i.e. the correct binomial coefficient (allow alternative notation) with the correct power of 2 and the correct power of ax.
The binomial coefficients do not have to be evaluated but must be correct if they are.
If awarding this mark for the x^2 term you can condone missing brackets e.g.
${}^6C_2 \times 2^4 \times ax^2$

Alternatively writes e.g. $(2+ax)^6 = 2^6\left(1+\frac{ax}{2}\right)^6 = 2^6\left(1+\frac{6}{2}ax + \frac{6\times 5}{2}\left(\frac{ax}{2}\right)^2 + ...\right)$

which can also score M1 for the expansion up to at least the second term with an acceptable structure for either the **2nd or 3rd term**. They do not have to multiply out the brackets for this mark but the 2^6 cannot be omitted unless it is later recovered.

Condone missing brackets e.g. $\frac{6\times 5}{2}\times\frac{ax^2}{2}$

A1: For any 2 correct simplified terms in any order (Allow a^2x^2 or $(ax)^2$ for the third term **for this mark**)
Allow terms to be listed.
Do **not** allow $64x^0$ for 64 or $192ax^1$ for $192ax$

A1: All correct and in any order. Allow terms to be listed. Must be a^2x^2 not $(ax)^2$ for the 3rd term but allow (ax) for ax.
Apply isw if they divide through by e.g. 2 or 4 or 16 or set their expression = 0

Ignore any extra terms if attempted.

(b)

B1: Correct expansion of $\left(3+\frac{1}{x}\right)^2$ unsimplified or simplified.

Note that this may be implied by the omission of the "9" as $9\times64=576$ and so the "9" is not required.

Note that $3^2\left(1+2\left(\frac{1}{3x}\right)+\frac{1}{(3x)^2}\right)$ is correct.

Condone missing brackets if recovered e.g. $\left(3+\frac{1}{x}\right)^2=9+\frac{6}{x}+\frac{1}{x}^2=9+\frac{6}{x}+\frac{1}{x^2}$

M1: Uses their expansion in part (a) and their expansion of $\left(3+\frac{1}{x}\right)^2$ to extract the constant term. This depends on having obtained $\left(3+\frac{1}{x}\right)^2=\alpha+\frac{\beta}{x}+\frac{\gamma}{x^2}$ oe with $\alpha,\ \beta,\gamma$ non-zero and an attempt at $\alpha\times"64"+\frac{\beta}{x}\times"192ax"+\frac{\gamma}{x^2}"240a^2x^2"$ oe

An expression of this form is sufficient i.e. with the x's still included.
Note that the 9×64 may not be seen as this cancels with the 576 so this mark may be implied.

dM1: Sets their constant term = 576 and proceeds to obtain a non-zero value for a.
You do not need to be concerned about the processing for this mark.
This may be implied by e.g. $6\times192a+240a^2=0\Rightarrow a=...$ as $9\times64=576$
May be implied by their value(s).
Condone $x=\ldots$ here.
Depends on the previous method mark.

A1: Correct value. Allow equivalents e.g. –4.8, $-\frac{48}{10}$

The questions asks for the value of a so just look for the correct value e.g. "$a=\ldots$" is not required but $x=-\frac{24}{5}$ scores A0.

If $a=0$ is also given and not rejected, score A0

Question Number	Scheme	Marks
6	$2\log_4(x+1)=\log_4(x+1)^2$	B1
	e.g. $\log_4(12-2x)-\log_4(x+1)^2=\log_4\dfrac{12-2x}{(x+1)^2}$	M1
	$\dfrac{12-2x}{(x+1)^2}=16$	A1
	$\Rightarrow 8x^2+17x+2=0\Rightarrow x=...$	M1
	$x=-\dfrac{1}{8}$ oe e.g. –0.125	A1
		(5)
		Total 5

B1: For $2\log_4(x+1)=\log_4(x+1)^2$ seen or implied.

M1: **Correct** attempt to combine two log terms.

E.g. $2+\log_4(x+1)^2=\log_4 16+\log_4(x+1)^2=\log_4 16(x+1)^2$

Condone if they make a slip **before** combining as long as they are combining two log terms correctly.

e.g.

$$\log_4(12-2x)=2+\log_4(x+1)^2\Rightarrow\log_4(12-2x)+\log_4(x+1)^2=2\Rightarrow\log_4(12-2x)(x+1)^2=...$$

or e.g.

$$\log_4(12-2x)=2+\log_4(x+1)^2=\log_4 2+\log_4(x+1)^2=\log_4 2(x+1)^2$$

A1: Obtains this equation in any form not involving logs **from correct work so must follow B1M1**.

M1: Solves a 3TQ by any acceptable method including a calculator to obtain at least one **real** value for *x*. May be implied by their value(s) and may follow incorrect log work **but the B1 must have been scored**. You may need to check.

Note that we are allowing the use of a calculator to solve the 3TQ here. This means that correct work leading to e.g.:

$$\frac{12-2x}{(x+1)^2}=16\Rightarrow 16x^2+34x+4=0$$

Followed by

$$\Rightarrow(8x+1)(x+2)=0\Rightarrow x=-\frac{1}{8}$$

Is acceptable for full marks as long as it is preceded by correct log work.

A1: This value only from correct work and all previous marks scored.
The other value (–2) must clearly be rejected or omitted.