Question Number	Scheme	Marks
5	$\log_2 16x + \log_2(x+1) = 3 + \log_2(x+6)$	
	$\log_2 a = b \Rightarrow 2^b = a$	B1
	$\log_2 16x(x+1) = \log_2 8(x+6)$	M1
	$2x^2 + x - 6 = 0$	A1
	$(2x-3)(x+2) = 0$	dM1
	$x = \frac{3}{2}$ only	A1cso
		(5 marks)

Note a correct answer with no working is 0 marks

B1 Correct use of $\log_2 a = b \Rightarrow 2^b = a$ This will usually result from either $\log_2 8 = 3$ or $\log_2 16 = 4$ being stated or seen applied.

e.g. $\log_2\left(\frac{16x(x+1)}{x+6}\right) = 3 \Rightarrow \frac{16x(x+1)}{x+6} = 8$

May be implied by e.g. $\log_2 16x(x+1) = \log_2 8(x+6)$ or $\log_2\left(\frac{x(x+1)}{x+6}\right) = -1$ o.e.

M1 Applies the addition (or subtraction) laws of logs at least once correctly. Condone invisible brackets. e.g. $\log_2 16x^2 + 16x$

This mark can be scored for expressions where the law has been applied correctly and does not need to be a full equation e.g. $\log_2\left(\frac{x+6}{x+1}\right)$ scores M1. Do not withhold this mark if they subsequently apply a law incorrectly.

e.g. $\log_2 16x(x+1) = 3 + \log_2 x + \log_2 6$ still scores M1

Also allow the mark to be scored despite an error dealing with the 3 when writing it as a log

e.g. $3 + \log_2(x+6) = \log_2 6 + \log_2(x+6) = \log_2 6(x+6)$

A1 $2x^2 + x - 6 = 0$ or equivalent 3TQ (quite often $16x^2 + 8x - 48 = 0$) Terms must be collected but do not need to be collected on the same side. Condone the omission of = 0 . Can only be scored from correct working.

dM1 Attempts to solve their 3TQ via any valid method including via a calculator (you may need to check this). Condone complex roots. It is dependent on the previous method mark.

A1cso $\frac{3}{2}$ o.e. only (-2 must be rejected if found)

This mark can only be scored if a correct quadratic is achieved (following correct log work)

Question Number	Scheme	Marks
6a	$\frac{k}{2k-15}=\frac{k+4}{k}\Rightarrow k^2=2k^2+8k-15k-60\Rightarrow k^2-7k-60=0$ *	M1A1*
		(2)
b	$k=12$	B1
	$\Rightarrow \frac{"12"}{2\times"12"-15}\ \left(=\frac{4}{3}\right)$	M1
	e.g. $("12"+4)\times\frac{4}{3}=...$ or $(2\times"12"-15)\times\left("\frac{4}{3}"\right)^3=...$	M1
	$=21300$	A1
		(4)
c	e.g. $\frac{9\left(1-\left(\frac{4}{3}\right)^N\right)}{1-\frac{4}{3}}>3000\Rightarrow\left(\frac{4}{3}\right)^N>\frac{1009}{9}$	M1
	$\log\left(\frac{4}{3}\right)^N>\log\left(\frac{1009}{9}\right)\Rightarrow N>\frac{\log\left(\frac{1009}{9}\right)}{\log\left(\frac{4}{3}\right)}$	dM1
	$N>16.405...\Rightarrow N=17$	A1
		(3)
		(9 marks)

(a)

M1 Forms a correct equation linking the three terms and attempts to rearrange to the given quadratic (it cannot be awarded for just proceeding in one step from the starting equation to the given answer and usually will involve attempting to multiply out brackets or dealing with any fractions). Must proceed as far as a quadratic with terms collected.
Condone slips in their rearrangement and invisible brackets.
Possible starting equations will involve using the *n*th term formula or the sum of a geometric series. The ones below are not exhaustive.

$\frac{k}{2k-15}=\frac{k+4}{k}$ or $k^2=(k+4)(2k-15)$ $\left((u_2)^2=u_1\times u_3\right)$ or $(2k-15)\left(\frac{k+4}{k}\right)=k$ or

$k\left(\frac{k}{2k-15}\right)=k+4$ or $2k-15+k+k+4=\frac{(2k-15)\left(1-\left(\frac{k}{2k-15}\right)^3\right)}{1-\frac{k}{2k-15}}$ (sum of 3 terms)

A1* Rearranges to achieve $k^2-7k-60=0$ with no errors seen including brackets. There must be at least some intermediate working (e.g. brackets multiplied out or multiplying to remove any fractions) between their starting equation and the given answer.

(b) **Note a candidate who uses *k* as *r* can only score maximum B1 in (b) and no marks in (c)**

B1 12 (ignore -5) seen or used in (b) (may be implied by the value of the second term)

M1 Substitutes their 12 (must be positive) into the expressions for two of the terms and attempts to find a value for *r*. Condone arithmetical slips but they the division the correct way round.