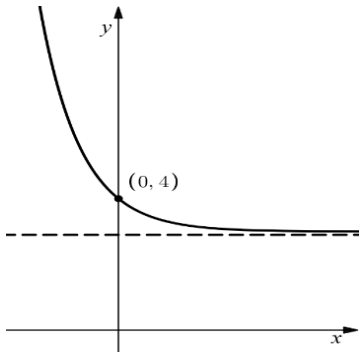
Question	Scheme		Marks
6(i)(a)		Correct shape or correct y intercept	M1
		Correct shape, position and y intercept	A1
		Correct equation of the asymptote	B1
			(3)
(b)	$\log\frac{1}{5^x} = \log 20 \Rightarrow x = -\frac{\log 20}{\log 5}$ or e.g. $x = \log_{\frac{1}{5}} 20$		M1
	$= -1.86$		A1
			(2)
(ii)	(a) Addition law $\log_4 64x = \log_4 64 + \log_4 x$		M1
	$3 + a$		A1
			(2)
	(b) $\log_4 \frac{2}{x^2} = \log_4 2 - \log_4 x^2$		M1
	$\log_4 \frac{2}{x^2} = \log_4 2 - 2\log_4 x$		dM1
	$\frac{1}{2} - 2a$		A1
			(3)
			(10 marks)

(i)(a)

M1: For **either** of

- an exponential decay type shape, in any position. Be tolerant with "pen flicks" at each end
- the correct y intercept either stated as (0, 4) or labelled on the graph at 4. The graph must cross (not touch) the y - axis at this point. Condone (4, 0) as long as it is in the correct place

A1: Fully correct shape and position. Requires

- curve in quadrants 1 and 2 only
- Allowable gradients. Look at Practice and the Exemplar sheet
- y intercept labelled on graph as 4, (0, 4) or (4, 0) which is condoned

B1: For stating that $y = 3$ is the asymptote to their graph. The curve must be asymptotic at $y = 3$

It must be an equation, not just the line labelled at 3. It must be the only asymptote and the graph must appear to level out below the intercept

(b)

M1: Look for the following

- first of all, attempts to make $\frac{1}{5^x}$ or 5^x the subject
- then takes logs (to any base) leading to a value or expression that equates to $\pm x$.

For example, $\frac{1}{5^x}+3=23 \Rightarrow \frac{1}{5^x}=20 \Rightarrow (\pm)x=\frac{\log 20}{\log 5}$ or $\frac{\log 20}{\log \frac{1}{5}}$

$$\frac{1}{5^x}+3=23 \Rightarrow \frac{1}{5^x}=20 \Rightarrow 5^x=\frac{1}{20} \Rightarrow x=\log_5 \frac{1}{20}$$

$$\frac{1}{5^x}+3=23 \Rightarrow \frac{1}{5^x}=20 \Rightarrow 5^x=\frac{1}{20} \Rightarrow x\log 5=\log \frac{1}{20} \Rightarrow x=-1.86$$

A1cao: Correct answer and must be to 3 s.f and must follow M1.

(ii) (a)

M1: Evidence of the addition law of logs on the given expression. Condone missing bases

E.g. writes $\log_4 64x=\log_4 64+\log_4 x$

A1: Correct answer in terms of *a*. Allow this to be written down for both marks. Do not ISW here

Withold this mark if they go on to solve an equation = 0 to find the value of *a*

(ii) (b)

M1: Correct application of subtraction law of logs on $\log_4 \frac{2}{x^2}$. E.g. $\log_4 \frac{2}{x^2}=\log_4 2-\log_4 x^2$ o.e.

They may use the addition law on $\log_4 2x^{-2}$ E.g. $\log_4 2x^{-2}=\log_4 2+\log_4 x^{-2}$

Also allow for correct use of power law of logs. E.g. for $2\log_4 \frac{\sqrt{2}}{x}$. Condone missing bases

dM1: Uses both power and subtraction/addition laws **correctly** to reach either of the following

Look for $\log_4 \frac{2}{x^2}=\log_4 2-2\log_4 x$ or $\log_4 \frac{2}{x^2}=2\log_4 \sqrt{2}-2\log_4 x$. Bases must be present

A1: Correct answer, as in scheme. The answer may be written down for all 3 marks. Do not ISW here

Withold this mark if they go on to solve an equation = 0 to find the value of *a*

Question	Scheme	Marks
7(a)	$\left(1+\frac{5}{16}x\right)^{10} = 1+10\left(\frac{5}{16}x\right)+\frac{10\times 9}{2}\left(\frac{5}{16}x\right)^2+\ldots$	M1 A1
	$\frac{25}{8}x$ or $\frac{1125}{256}x^2$	A1
	$=1+\frac{25}{8}x+\frac{1125}{256}x^2$	A1
		(4)
(b)	$x=\frac{1}{10} \Rightarrow \left(1+\frac{5}{16}x\right)^{10} = \left(1+\frac{5}{16}\times\frac{1}{10}\right)^{10} = \left(\frac{33}{32}\right)^{10}$	B1
	So $\left(\frac{33}{32}\right)^{10} \approx 1+\frac{25}{80}+\frac{1125}{25600}$	M1
	$=\frac{1389}{1024}$	A1
		(3)
(c)	$\left(\frac{33}{32}\right)^{10} \approx \frac{1389}{1024} \Rightarrow \sqrt[10]{1389} \approx \frac{33}{32}\times \sqrt[10]{1024}$	M1
	$=\frac{33}{16}$	A1
		(2)
		(9 marks)

(a)

M1: Correct binomial coefficient linked with correct power of $\frac{5}{16}x$ for the second or third term of their expansion. Accept alternative notation, such as ${}^{10}C_1$ or just 10 etc, for the coefficients. (The power 1 need not be seen.) Allow if the brackets are omitted. Condone a misread on $\frac{5}{16}x$, e.g. $\frac{5}{6}x$

Look for either of the following

- a second term of $10\times\frac{5}{16}x$ or unsimplified version such as $\binom{10}{1}\times\frac{5}{16}x$
- a third term of $\frac{10\times 9}{2}\times\left(\frac{5}{16}x\right)^2$ condoning unsimplified versions with bracketing slips such as ${}^{10}C_2\times\frac{5}{16}x^2$

A1: A correct unsimplified expansion with correct bracketing and no combination notation. See main scheme. Condone a list for this mark.

A1: Correct simplified second or third term.

A1: Fully correct and **simplified expansion**. A list is insufficient but award this mark if the