Question	Scheme	Marks
9 (a)	$\left(\log_a 8 = \dfrac{3}{4} \Rightarrow\right) a^{\frac{3}{4}} = 8 \left(\Rightarrow a = \left(\sqrt[3]{8}\right)^4\right) = 16$	M1A1 [2]
(b)	$\left(3x\log_2 x - 4\log_{16} 8 + 6x\log_4 8 - \log_2 x =\right) 3x\log_2 x - \dfrac{4\log_2 8}{\log_2 16} + \dfrac{6x\log_2 8}{\log_2 4} - \log_2 x$	M1
	$\Rightarrow 3x\log_2 x - \log_2 8 + 3x\log_2 8 - \log_2 x$	M1
	$= (3x-1)\log_2 x + (3x-1)\log_2 8 \qquad$ or $\qquad 3x\log_2 8x - (1)\log_2 8x$	
	$\Rightarrow (3x-1)\log_2 8x \quad$ or $\quad \log_2 (8x)^{3x} + \log_2 (8x)^{-1} = \log_2 (8x)^{3x-1} \quad *$	M1A1 cso [4]
ALT	$\left(3x\log_2 x - 4\log_{16} 8 + 6x\log_4 8 - \log_2 x =\right) 3x\log_2 x - \dfrac{4\log_2 8}{\log_2 16} + \dfrac{6x\log_2 x}{\log_2 4} - \log_2 x$	M1
	$\Rightarrow 3x\log_2 x - \log_2 8 + 3x\log_2 8 - \log_2 x = \log_2 x^{3x} - \log_2 8 + \log_2 8^{3x} - \log_2 x$	M1
	$\left(\Rightarrow \log_2 (8x)^{3x} - \log_2 8x \Rightarrow\right) \log_2 \left(\dfrac{(8x)^{3x}}{8x}\right)$ or $\log_2 \left((8x)^{3x} \times (8x)^{-1}\right)$	
	or $\log_2 x^{3x-1} 8^{3x-1} = \log_2 (8x)^{3x-1} \quad *$	M1A1 cso [4]

"Box 3" of part b

We will see unanticipated methods once live marking begins.

If the answer is correct and **there is no incorrect working**, check the work carefully, to ascertain if they've shown enough steps to demonstrate use of the three main log laws this question tests and award full marks. If in any doubt at all – the response **MUST** be sent to review.

Other than this exception, please mark to the following rules.

Also use these rules if students don't gain the 2nd or 3rd M under the main or ALT schemes.
- M1 for any correct change of base to base 2
- M1 for any two correct applications of the power law $\qquad$ or for
  $ax\log_2 8x + b\log_2 8x \Rightarrow \log_2 (8x)^{ax+b}$ or $(ax+b)\log_2 8x \Rightarrow \log_2 (8x)^{ax+b} \quad a,b \neq 0$
- M1 for any two correct applications of the addition or subtraction law

In each case – ignore any incorrect working.

Poor or incorrect bracketing may not be recovered in this question. (general principle of marking is usually that it can).

(c)	$\left[\log_2 (8x)^{3x-1} = 0 \Rightarrow \log_2 (8x)^{3x-1} = \log_2 8^0 \quad \text{or} \quad (3x-1)\log_2 (8x) = 0\right]$	
	$\Rightarrow 3x-1 = 0 \Rightarrow x = \dfrac{1}{3}$	M1A1
	$\Rightarrow 8x = 1 \Rightarrow x = \dfrac{1}{8}$	A1 [3]
	Total 9 marks	

Part	Mark	Notes
(a)	M1	For undoing the log to obtain $a^{\frac{3}{4}} = 8$ or $(a =) 8^{\frac{4}{3}}$
	A1	For $a = 16$ M1 A1 may be awarded for just seeing $a = 16$ unless from a string of incorrect work. Poor notation may be seen.
(b)	M1	For correctly changing the base to base 2 on at least one log, anywhere in their work. This may be implied and the mark awarded for eg $4 \log_{16} 8 \Rightarrow \dfrac{4 \log_2 8}{\log_2 16}$ or $\dfrac{4 \log_2 8}{4}$ or $\log_2 8$ or $\dfrac{12}{4}$ or 3 or $6x \log_4 8 \Rightarrow \dfrac{6x \log_2 8}{\log_2 4}$ or $\dfrac{6x \log_2 8}{2}$ or $3x \log_2 8$ or $9x$
	M1	For $(3x - 1)\log_2 x + (3x - 1)\log_2 8$
	M1	For correctly applying the power log law to their expression of the form $(ax + b)\log_2 8x \quad a, b \neq 0$ In general, poor bracketing may be recovered, but as this question is a show question, it generally cannot be recovered eg do not accept $8x^{3x}$
	A1 cso	For the correct expression, **minimum steps as shown** with no errors or omissions.
ALT	M1	For correctly changing the base to base 2 on at least one log. This may be implied and the mark awarded for $4 \log_{16} 8 \Rightarrow \dfrac{4 \log_2 8}{\log_2 16}$ or $\dfrac{4 \log_2 8}{4}$ or $\log_2 8$ or $\dfrac{12}{4}$ or 3 or $6x \log_4 8 \Rightarrow \dfrac{6x \log_2 8}{\log_2 4}$ or $\dfrac{6x \log_2 8}{2}$ or $3x \log_2 8$ or $9x$
	M1	For $\log_2 x^{(3x)} - \log_2 8 + \log_2 8^{(3x)} - \log_2 x$
	M1	For correctly applying the subtraction law to an expression of the form (see the MS for minimum steps) $\log_2 x^{(ax)} - \log_2 8^b + \log_2 8^{(ax)} - \log_2 x^b$ The step in brackets doesn't need to be shown. Do not permit only eg $\log_2 (x^{3x} \div 8 \times 8^{3x} \div x)$ as a sufficient minimum step. In general, poor bracketing may be recovered, but as this question is a show question, it generally cannot be recovered eg do not accept $8x^{3x} \times 8x^{-1}$
	A1	For the correct expression, **minimum steps as shown** with no errors or omissions. .
	SC4	For working on both sides **with no errors** and achieving lhs = rhs Note, this is an exception to what we normally allow in a show that question (ie working on both sides until agreement)
(c)	M1	For setting $3x - 1 = 0$ or $8x = 1$ This mark may be implied by a correct answer.
	A1	For either $x = \dfrac{1}{3}$ or $\dfrac{1}{8}$
	A1	For both $x = \dfrac{1}{3}$ and $\dfrac{1}{8}$