Question	Scheme	Marks
6	$\log_2 x^3 + \log_4 x^2 - 3\log_x 2 = \log_2 x^3 + \dfrac{\log_2 x^2}{\log_2 4} - \dfrac{3\log_2 2}{\log_2 x} = 0$	M1
	$= 3\log_2 x + \dfrac{2\log_2 x}{\log_2 4} - \dfrac{\log_2 2^3}{\log_2 x} = 0$	M1
	$3\log_2 x + \dfrac{2\log_2 x}{2} - \dfrac{3}{\log_2 x} = 0$	B1
	$\Rightarrow 3(\log_2 x)^2 + (\log_2 x^2)^2 - 3 = 0$	M1
	$\Rightarrow 4(\log_2 x)^2 = 3 \Rightarrow (\log_2 x)^2 = \dfrac{3}{4} \Rightarrow \log_2 x = \pm\sqrt{\dfrac{3}{4}}$	M1
	$\Rightarrow x = 2^{\sqrt{\frac{3}{4}}} \approx 1.82$ or $x = 2^{-\sqrt{\frac{3}{4}}} \approx 0.549$	M1A1A1
		[8]
		Total 8 marks

Mark	Notes **NB: Candidates will frequently use a substitution for their chosen log.**
Working in log base 2 **Correct answer/s with no working scores no marks.**	
M1	For changing the base of the log correctly in at least one term $\log_2 x^3 + \log_4 x^2 - 3\log_x 2 = \log_2 x^3 + \dfrac{\log_2 x^2}{\log_2 4} - \dfrac{3\log_2 2}{\log_2 x} = 0$
M1	For using the power law in at least one term. $\log_2 x^3 = 3\log_2 x$ or $\log_2 x^2 = 2\log_2 x$ or $3\log_2 2 = \log_2 2^3$ $\Rightarrow 3\log_2 x + \log_2 x - \dfrac{\log_2 2^3}{\log_2 x} = 0$
B1	For either $\log_2 4 = 2$ or $\log_2 8 = 3$
M1	For multiplying through by $\log_2 x$ $3(\log_2 x)^2 + (\log_2 x)^2 - 3 = 0$
M1	For simplifying and obtaining two values for $\log_2 x$ using a valid method. **NB:** If they discard one value at any stage do not award this mark. $4(\log_2 x)^2 - 3 = 0 \Rightarrow \log_2 x = \pm\sqrt{\dfrac{3}{4}}$
M1	For removing the log to find at least one value for x $x = 2^{\sqrt{\frac{3}{4}}}$ or $x = 2^{-\sqrt{\frac{3}{4}}}$
A1	For either awrt $x = 1.82$ or 0.549
A1	For awrt both $x = 1.82$ and 0.549

Working in log base 4	
M1	For changing the base of the log correctly in at least one term $\log_2 x^3 + \log_4 x^2 - 3\log_x 2 = \dfrac{\log_4 x^3}{\log_4 2} + \log_4 x^2 - \dfrac{3\log_4 2}{\log_4 2} = 0$
M1	For using the power law in at least one term $\dfrac{3\log_4 x}{\log_4 2} + 2\log_4 x - \dfrac{3\log_4 2}{\log_4 2} = 0$
B1	For either $\log_4 2 = \dfrac{1}{2}$ or $\log_4 8 = \dfrac{3}{2}$
M1	For multiplying through by $\log_4 x$ $\quad 6(\log_4 x)^2 + 2(\log_4 x^2)^2 - \dfrac{3}{2} = 0$
M1	For simplifying and obtaining two values for $\log_4 x$ $8(\log_4 x)^2 = \dfrac{3}{2} \Rightarrow (\log_4 x)^2 = \dfrac{3}{16} \Rightarrow \log_4 x = \pm\sqrt{\dfrac{3}{16}}$ **NB:** If they discard one value at any stage do not award this mark.
M1	For removing the log to find at least one value for x using a valid method. $x = 4^{\sqrt{\frac{3}{16}}} \approx ....$ or $x = 4^{-\sqrt{\frac{3}{16}}} \approx ...$
A1	For either awrt $x = 1.82$ or 0.549
A1	For awrt both $x = 1.82$ and 0.549
Working in log base *x*	
M1	For changing the base of the log correctly in at least one term $\log_2 x^3 + \log_4 x^2 - 3\log_x 2 = \dfrac{\log_x x^3}{\log_x 2} + \dfrac{\log_x x^2}{\log_x 4} - 3\log_x 2 = 0$
M1	For using the power law in at least one term $\dfrac{3\log_x x}{\log_x 2} + \dfrac{2\log_x x}{2\log_x 2} - 3\log_x 2 = 0$
B1	For $\log_x x = 1$ $\quad \dfrac{3}{\log_x 2} + \dfrac{1}{\log_x 2} - 3\log_x 2 = 0 \Rightarrow \dfrac{4}{\log_x 2} - 3\log_x 2 = 0$
M1	For multiplying through by $\log_x 2$ $4 - 3(\log_x 2)^2 = 0$
M1	For obtaining two values of $\log_x 2$ using a valid method $\quad \left(\log_x 2 = \pm\sqrt{\dfrac{4}{3}}\right)$ **NB:** If they discard one value at any stage do not award this mark.
M1	For removing the log to find at least one value for x. $2 = x^{\sqrt{\frac{4}{3}}} \Rightarrow x = 2^{\sqrt{\frac{3}{4}}} \approx ....$ or $2 = x^{-\sqrt{\frac{4}{3}}} \Rightarrow x = 2^{-\sqrt{\frac{3}{4}}} \approx ....$
A1	For either awrt $x = 1.82$ or 0.549