

Question	Answer	Marks	Guidance
(a)	Commence integration and reach $ax^3 \ln x + b \int x^3 \cdot \frac{1}{x} dx$	*M1	OE Allow omission of dx.
	Obtain $\frac{1}{3}x^3 \ln x - \frac{1}{3} \int x^3 \cdot \frac{1}{x} dx$	A1	OE Allow omission of dx.
	Complete integration and obtain $\frac{1}{3}x^3 \ln x - \frac{1}{9}x^3$	A1	Allow $-\frac{1}{3} \left(\frac{1}{3}x^3 \right)$.
	Use limits correctly and equate to 4, having integrated twice	DM1	$\frac{1}{3}a^3 \ln a - \frac{1}{9}a^3 - (0 - \frac{1}{9}) = 4$ allow one sign error OR one numerical error, but 0 may be absent or expressed as $\frac{a^3}{3} \ln 1$. Allow $-\frac{1}{3} \left(\frac{1}{3}ax^3 \right)$ and $-\frac{1}{3} \left(\frac{1}{3} \right)$.
	Obtain given result correctly	A1	$a = \left(\frac{35}{3 \ln a - 1} \right)^{\frac{1}{3}}$ AG After substitution, any errors even if corrected A0. Need to see at least one line of working between substitution and the given answer.
		5	
(b)	Calculate the values of a relevant expression or pair of expressions at $a = 2.4$ and $a = 2.8$ All values must be correct for M1 (numerical question)	M1	
	Justify the given statement with correct calculated values	A1	$2.4 < 2.7(8)$ and $2.8 > 2.5(6)$ sign change here insufficient OR $-0.3(8)$ and $0.2(4) < 0, > 0$ or change of sign.
		2	

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(c)	Use the iterative process $a_{n+1} = \left(\frac{35}{3 \ln a_n - 1} \right)^{\frac{1}{3}}$ correctly at least twice	M1	
	Obtain final answer $a = 2.64$	A1	Must be 2 dp.
	Show sufficient iterations to 4 dp to justify 2.64 to 2 dp, or show there is a sign change in (2.635, 2.645)	A1	<div>2.635 $(35/(3 \ln a - 1))^{1/3} - a = 0.0029(4) > 0$</div> <div>2.645 $(35/(3 \ln a - 1))^{1/3} - a = -0.012 < 0$</div>
		3	

