

Question	Scheme	Marks	AOs
4 (a)	$gf(x) = 3 \ln e^x$	M1	1.1b
	$= 3x, (x \in \mathbb{R})$	A1	1.1b
		(2)	
(b)	$gf(x) = fg(x) \Rightarrow 3x = x^3$	M1	1.1b
	$\Rightarrow x^3 - 3x = 0 \Rightarrow x =$	M1	1.1b
	$\Rightarrow x = (+)\sqrt{3}$ only as $\ln x$ is not defined at $x = 0$ and $-\sqrt{3}$	M1	2.2a
		(3)	
(5 marks)			

Notes:

(a)

M1: For applying the functions in the correct order

A1: The simplest form is required so it must be $3x$ and not left in the form $3 \ln e^x$
An answer of $3x$ with no working would score both marks

(b)

M1: Allow the candidates to score this mark if they have $e^{3 \ln x} =$ their $3x$

M1: For solving their cubic in x and obtaining at least one solution.

A1: For either stating that $x = \sqrt{3}$ **only** as $\ln x$ (or $3 \ln x$) is not defined at $x = 0$ and $-\sqrt{3}$
or stating that $3x = x^3$ would have three answers, one positive one negative and one zero but $\ln x$ (or $3 \ln x$) is not defined for $x \leq 0$ so therefore there is only one (real) answer.

Note: Student who mix up fg and gf can score full marks in part (b) as they have already been penalised in part (a)