

Question	Scheme	Marks	AOs
6(a)	$\int \frac{3}{7x+1} dx = \frac{3}{7} \ln(7x+1) + c$	M1 A1	3.1a 1.1b
		(2)	
(b)	$\int_2^p \frac{3}{7x+1} dx = \frac{6}{7} \Rightarrow \frac{3}{7} \ln(7p+1) - \frac{3}{7} \ln(15) = \frac{6}{7}$	M1	1.1b
	$\Rightarrow \ln \frac{7p+1}{15} = 2 \Rightarrow \frac{7p+1}{15} = e^2 \text{ oe}$	dM1	1.1b
	$\Rightarrow (p =) \frac{15e^2 - 1}{7}$	A1ft	2.1
		(3)	

(5 marks)

Notes

Mark (a) and (b) together

(a)

M1: Integrates to a form $A \ln(7x+1)$ $A \neq 0$ Condone missing brackets or modulus signs.
If the substitution $u = 7x+1$ is attempted, the mark can be awarded for $k \ln u$ $k \neq 0$
Please note that $A \ln(7ax+a)$ or $A \ln a(7x+1)$ where a is a positive constant is also correct.

A1: $\frac{3}{7} \ln(7x+1) + c$ including “+ c” Brackets or modulus signs must be present. Isw after a correct answer.

Also accept $\frac{3}{7} \ln(7ax+a) + c$ where a is also a positive constant.

Withhold this mark for spurious notation e.g. an integral sign or dx in their final expression.

(b)

M1: Substitutes $x = p$ and $x = 2$ into an expression of the form $A \ln(7x+1)$ $A \neq 0$, (or $A \ln a(7x+1)$) subtracts either way round and sets equal to $\frac{6}{7}$. Condone invisible brackets and arithmetical slips. May be implied by further work.
Likely to be rare but may change the limits if they are working in terms of u so they would be substituting in e.g. 15 and $7p+1$ into an expression of the form $k \ln u$ $k \neq 0$, subtracting either way round and sets equal to $\frac{6}{7}$

dM1: Proceeds correctly to an equation not involving logarithms e.g. $\frac{7p+1}{15} = e^{\frac{6}{7}}$ oe
Do not allow this mark to be scored if they evaluate $\ln 15$ as a decimal.

Condone $e^{\frac{6}{7}}$ to be a decimal which you may need to check on your calculator.

Do not allow e.g. $p = \frac{e^{2+\ln 15} - 1}{7}$ unless they correctly deal with $\ln 15$

A1ft: $(p =) \frac{15e^2 - 1}{7}$ oe which must be simplified e.g. $(p =) \frac{15e^2}{7} - \frac{1}{7}$ isw

You may ft on their $\frac{3}{7}$ from part (a) so score for $(p =) \frac{15e^{\frac{6}{7} \frac{3}{7}} - 1}{7}$
 „ $\frac{3}{7}$ “