Question Number	Scheme	Marks
1(i)(a)	$\int (2x+3)^{12}\mathrm{d}x = \dfrac{(2x+3)^{13}}{26}(+c)$	M1 A1
		(2)
(i)(b)	$\int \dfrac{5x}{4x^2+1}\mathrm{d}x = \dfrac{5}{8}\ln\left(4x^2+1\right)(+c)$	M1 A1
		(2)

(i) Notes

(a)

M1: Correct form for the integration. Look for $\lambda(2x+3)^{13}$ or e.g. $\mu\left(x+\dfrac{3}{2}\right)^{13}$

Allow the index unprocessed e.g. $\lambda(2x+3)^{12+1}$

May see substitution e.g. $u = 2x + 3$ leading to λu^{13} and this would imply this mark.

A1: Correct integration with or without the + c.

Allow any equivalent correct expression simplified or unsimplified and apply isw once a correct answer is seen.

Award for e.g. $\dfrac{(2x+3)^{13}}{26}$ or $\dfrac{(2x+3)^{13}}{2\times 13}$ or $\dfrac{2^{12}\left(x+\dfrac{3}{2}\right)^{13}}{13}$ or $\dfrac{4096\left(x+\dfrac{3}{2}\right)^{13}}{13}$

The index must be processed and any constants evaluated e.g. 13 not 12 + 1 but e.g. 2×13 is acceptable.

Ignore any spurious integral signs and/or dx's and just look for a correct expression.

(b)

M1: Correct form of integration. Look for $\ldots\ln\left(4x^2+1\right)$ or $\ldots\ln\left|4x^2+1\right|$ but condone missing brackets e.g. $\ldots\ln 4x^2+1$

Can also be awarded for $\ldots\ln k\left(4x^2+1\right)$ or $\ldots\ln k\left|4x^2+1\right|$

May see substitution e.g. $u = 4x^2+1$ leading to $\ldots\ln u$ and this would imply this mark.

A1: Correct integration with or without the + c.

Allow any equivalent correct expression simplified or unsimplified and apply isw once a correct answer is seen.

Brackets must be present and allow $\dfrac{5}{8}\ln\left(4x^2+1\right)(+c)$ or $\dfrac{5}{8}\ln\left|4x^2+1\right|(+c)$

Note that e.g. $\dfrac{5}{8}\ln\left(x^2+\dfrac{1}{4}\right)(+c)$ or $\dfrac{5}{8}\ln\left|x^2+\dfrac{1}{4}\right|(+c)$ are also correct.

Allow equivalents for $\dfrac{5}{8}$ e.g. 0.625 or e.g. $\dfrac{1}{1.6}$

Ignore any spurious integral signs and/or dx's and just look for a correct expression.

(ii)	$\int \frac{t+1}{t}\,\mathrm{d}t = \int\left(1+\frac{1}{t}\right)\mathrm{d}t = t+\ln t\,(+c)$	M1 A1
	$\left[t+\ln t\right]_a^{2a} = 2a+\ln 2a-(a+\ln a) = \ln 7$	**d**M1
	$a+\ln 2 = \ln 7 \Rightarrow a = \ln\frac{7}{2}$ or $\ln 7-\ln 2$	A1
		(4)
		(8 marks)

(ii) Notes

M1: Writes $\frac{t+1}{t}$ as $...+\frac{1}{t}$ where … $\neq 0$ and integrates $\frac{1}{t} \to \ln t$

A1: Correct integration with or without an arbitrary constant.

dM1: Applies the limits a and $2a$ the right way round, subtracts and sets equal to $\ln 7$

Condone poor bracketing e.g. $2a+\ln 2a-a+\ln a = \ln 7$

Depends on the first method mark.

A1: $a = \ln\frac{7}{2}$ or e.g. $\ln 3.5$

Condone $a = \ln 7-\ln 2$ but if this becomes $\ln 5$ score A0

Condone clear confusion with the variable if the intention is clear e.g.

$$\int_a^{2a}\frac{t+1}{t}\,\mathrm{d}t = \int_a^{2a}\left(1+\frac{1}{t}\right)\mathrm{d}t = \left[x+\ln t\right]_a^{2a} \to 2a+\ln 2a-(a+\ln a) = \ln 7 \text{ etc.}$$

Alternative attempts by parts for the first 2 marks:

I	$\int \frac{t+1}{t}\,\mathrm{d}t = \frac{1}{t}\left(\frac{t^2}{2}+t\right)-\int -\frac{1}{t^2}\left(\frac{t^2}{2}+t\right)\mathrm{d}t$	M1
	$= \frac{1}{t}\left(\frac{t^2}{2}+t\right)+\int\frac{1}{2}+\frac{1}{t}\,\mathrm{d}t = \frac{1}{t}\left(\frac{t^2}{2}+t\right)+\frac{t}{2}+\ln t\,(+c)$	A1

Notes

M1: Award for $\int \frac{t+1}{t}\,\mathrm{d}t = \frac{1}{t}\left(\frac{t^2}{2}+t\right)-\int -\frac{1}{t^2}\left(\frac{t^2}{2}+t\right)\mathrm{d}t$

Must be correct as shown.

A1: Fully correct integration. $\frac{1}{t}\left(\frac{t^2}{2}+t\right)+\frac{t}{2}+\ln t\,(+c)$ or equivalent.

II	$\int \frac{t+1}{t}\,\mathrm{d}t = (t+1)\ln t-\int \ln t\,\mathrm{d}t$	M1
	$\int \frac{t+1}{t}\,\mathrm{d}t = (t+1)\ln t-t\ln t+t\,(+c)$	A1

Notes

M1: Award for $\int \frac{t+1}{t}\,\mathrm{d}t = (t+1)\ln t-\int \ln t\,\mathrm{d}t$

Must be correct as shown.

A1: Fully correct integration. $(t+1)\ln t-t\ln t+t\,(+c)$ or equivalent.