(ii)	$\dfrac{2x+11}{(2x+1)(2-x)} \equiv \dfrac{A}{(2x+1)} + \dfrac{B}{(2-x)} \Rightarrow A = ..., B = ...$	M1
	$= \dfrac{4}{(2x+1)} + \dfrac{3}{(2-x)}$	A1
	$\displaystyle\int \dfrac{2x+11}{(2x+1)(2-x)}\,\mathrm{d}x = 2\ln\lvert 2x+1\rvert - 3\ln\lvert 2-x\rvert$	dM1 A1ft
	$\displaystyle\int_4^7 \dfrac{2x+11}{(2x+1)(2-x)}\,\mathrm{d}x = (2\ln 15 - 3\ln 5) - (2\ln 9 - 3\ln 2)$	ddM1
	$= \ln\dfrac{8}{45}$	A1
		(6)
		(10 marks)

Notes:

(ii)

M1: Attempts partial fractions. Condone slips but should be of the correct form $\dfrac{A}{(2x+1)} + \dfrac{B}{(2-x)}$

A1: Correct **fractions** $\dfrac{4}{(2x+1)} + \dfrac{3}{(2-x)}$ seen.

It is not for correct "*A*" and "*B*" unless the correct fractions are seen or implied by later work.

dM1: Integrates to a correct form e.g. $...\ln\lvert 2x+1\rvert + ...\ln\lvert 2-x\rvert$ where … are non-zero constants.

Moduli are not required, brackets will suffice but condone missing brackets for this mark e.g.

$$\int \frac{2x+11}{(2x+1)(2-x)}\,\mathrm{d}x = 2\ln 2x+1 - 3\ln 2-x$$

A1ft: Correct integration but follow through on their *A* and *B*.

Moduli are not required, brackets will suffice <u>but must be present now</u> or implied by subsequent work e.g. when they substitute limits. Allow unsimplified e.g. $\dfrac{4}{2}\ln(2x+1) - 3\ln(2-x)$

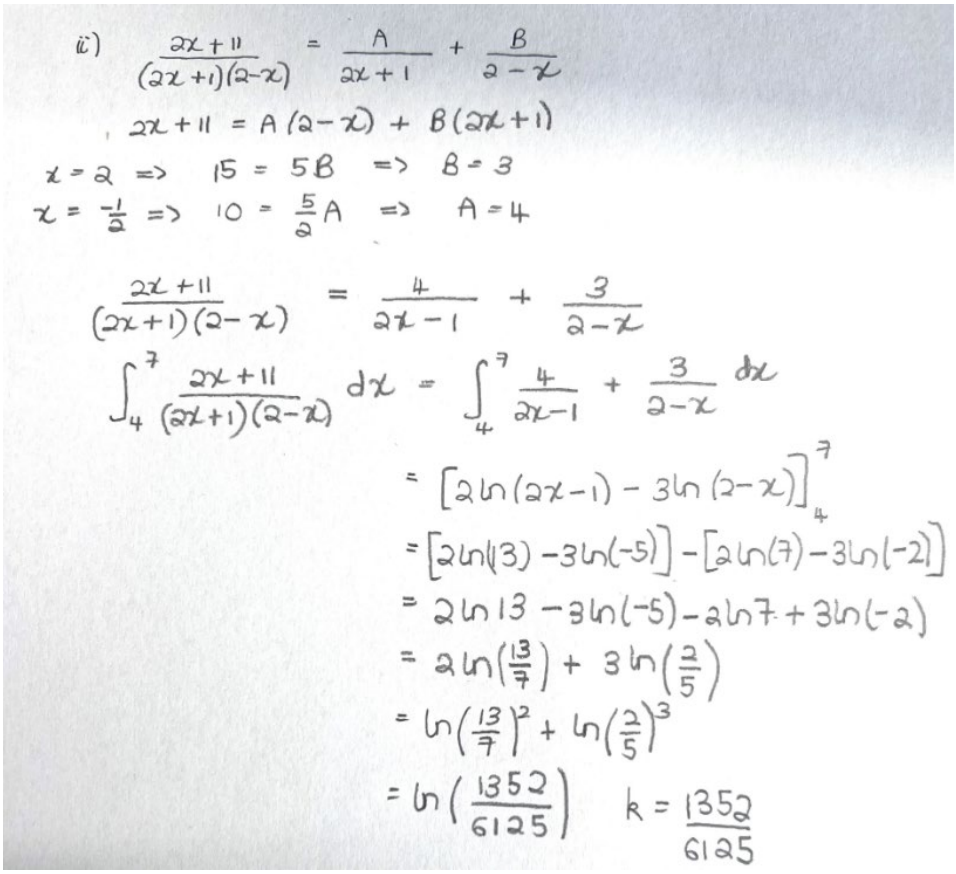
ddM1: Applies the limits 4 and 7 to a function of the correct form e.g. $...\ln\lvert 2x+1\rvert + ...\ln\lvert 2-x\rvert$ or $...\ln(2x+1) + ...\ln(2-x)$ and subtracts the right way round. Brackets around the $2x + 1$ and $2 - x$ must be present or implied but condone missing brackets around the expression for the lower limit e.g. condone $\displaystyle\int_4^7 \frac{2x+11}{(2x+1)(2-x)}\,\mathrm{d}x = 2\ln 15 - 3\ln 5 - 2\ln 9 - 3\ln 2$

and condone e.g. $\displaystyle\int_4^7 \frac{2x+11}{(2x+1)(2-x)}\,\mathrm{d}x = 2\ln 15 - 3\ln(-5) - (2\ln 9 - 3\ln(-2))$

May be implied by e.g. $\left[4\ln(2x+1)\right]_4^7 + \left[3\ln(2-x)\right]_4^7 = 4\ln\dfrac{15}{9} + 3\ln\dfrac{5}{2}$

A1: $\ln\dfrac{8}{45}$ cao. Do **not** allow $\ln\left\lvert -\dfrac{8}{45}\right\rvert$.

In (ii) condone slips in copying their PF's if the work is otherwise correct e.g.



ii) $\frac{2x+11}{(2x+1)(2-x)} = \frac{A}{2x+1} + \frac{B}{2-x}$

$2x+11 = A(2-x) + B(2x+1)$

$x=2 \Rightarrow 15 = 5B \Rightarrow B=3$

$x=-\frac{1}{2} \Rightarrow 10 = \frac{5}{2}A \Rightarrow A=4$

$\frac{2x+11}{(2x+1)(2-x)} = \frac{4}{2x-1} + \frac{3}{2-x}$

$\int_4^7 \frac{2x+11}{(2x+1)(2-x)}\,dx = \int_4^7 \frac{4}{2x-1} + \frac{3}{2-x}\,dx$

$= \left[2\ln(2x-1) - 3\ln(2-x)\right]_4^7$

$= \left[2\ln(13) - 3\ln(-5)\right] - \left[2\ln(7) - 3\ln(-2)\right]$

$= 2\ln 13 - 3\ln(-5) - 2\ln 7 + 3\ln(-2)$

$= 2\ln\left(\frac{13}{7}\right) + 3\ln\left(\frac{2}{5}\right)$

$= \ln\left(\frac{13}{7}\right)^2 + \ln\left(\frac{2}{5}\right)^3$

$= \ln\left(\frac{1352}{6125}\right)$ $k = \frac{1352}{6125}$

Would score M1A0M1A0M1A0 in part (ii)
If in doubt use review.

Question Number	Scheme	Marks
6	Assumption: e.g. (Assume) "n^2-4n+5 is even and n is even"	B1
	Sets e.g. $n=2k$ and attempts $(2k)^2-4(2k)+5$	M1
	$4k^2-8k+5$ (oe for their n)	A1
	Completes proof with: (i) Statement "which is odd" (ii) Reason odd E.g. $4(k^2-2k)+5$ or e.g. $4(k^2-2k+1)+1$ or e.g. $2(2k^2-4k+2)+1$ or e.g. $(2k-2)^2+1$ Condone $4k^2-8k+5=even-even+odd=odd$ (iii) A (minimal) conclusion e.g. "Hence contradiction", "so proven", "the statement is true" etc.	A1*
		(4 marks)

Notes:

Note that B0M1A1A1 is not possible.

If the same variable is used e.g. $n = 2n$ allow all but the final mark for otherwise correct work. But allow $n = 2N$ as a different variable.

B1: Sets up a suitable assumption. Must be in words.
Look for e.g. n^2-4n+5 is even and n is even or e.g. if n even then n^2-4n+5 is even.
The word "assume" is not required but there must be a statement referring to n^2-4n+5 is even and n is even.
Condone e.g. "if n^2-4n+5 is even then n is even".

M1: Uses algebra with $n = 2k$ or equivalent e.g. $n=2k+2$ or e.g. $n=4k$ and attempts n^2-4n+5

A1: $4k^2-8k+5$ or equivalent <u>for their n</u> such as $4(k^2-2k)+5$ or e.g. $4k^2+1$ for $n=2k+2$

A1*: Completes proof with

- a correct expression that is clearly odd
- an acceptable statement with reason
- minimal conclusion.

Note that attempts that consider a contradiction such as e.g.
(Assume) "n^2-4n+5 is odd and n is odd"
score no marks.

There will be valid approaches to the proof.
See below for some alternatives: