Question Number	Scheme	Marks
1(a)	$\dfrac{2}{\sqrt{r}+\sqrt{r-2}}\times\dfrac{\sqrt{r}-\sqrt{r-2}}{\sqrt{r}-\sqrt{r-2}}$	M1
	$\dfrac{2\left(\sqrt{r}-\sqrt{r-2}\right)}{r-\left(r-2\right)}=\sqrt{r}-\sqrt{r-2}$ *	A1*
		(2)
(b)	$r=2:\ \sqrt{2}-\sqrt{2-2}\ \left(=\sqrt{2}-0\right)$ ... $r=n-2:\ \sqrt{n-2}-\sqrt{n-4}$ $r=3:\ \sqrt{3}-\sqrt{3-2}\ \left(=\sqrt{3}-1\right)$ $r=n-1:\ \sqrt{n-1}-\sqrt{n-3}$ $r=4:\ \sqrt{4}-\sqrt{4-2}\ \left(=2-\sqrt{2}\right)$ $r=n:\ \sqrt{n}-\sqrt{n-2}$	M1
	$\left[\sum_{r=2}^{n}\dfrac{2}{\sqrt{r}+\sqrt{r-2}}=\right]\sqrt{n}+\sqrt{n-1}-1$	A1 A1
		(3)
(c)	$\left[\sum_{r=4}^{50}\dfrac{2}{\sqrt{r}+\sqrt{r-2}}=\right]\mathrm{f}\left(50\right)-\mathrm{f}\left(3\right)=\sqrt{50}+\sqrt{49}-1-\left(\sqrt{3}+\sqrt{2}-1\right)$	M1
	$\left(=5\sqrt{2}+7-1-\sqrt{3}-\sqrt{2}+1\right)=7+4\sqrt{2}-\sqrt{3}$	A1
		(2)
		Total 7

Notes

(a)

M1: Indicates intention to multiply either side by a correct fraction, may use $\dfrac{\sqrt{r-2}-\sqrt{r}}{\sqrt{r-2}-\sqrt{r}}$. The "2" may be missing. May work in reverse from right hand side to left, and this is fine.

Alternatively, may multiply the initial expression through by $\sqrt{r}+\sqrt{r-2}$ and use a sequence of equivalences (though accept with $\Rightarrow$ or nothing between lines).

A1: Fully correct proof. A result from rationalisation that is not the given answer must be seen. If using a sequences of equivalences there must be a minimal conclusion.

(b)

M1: Correct process of differences evidenced in their work, e.g. attempts any three of the 6 expression shown. There should be enough evidence of at least one pair of cancelling terms. Ignore any attempts at any of $r = 0$ or 1 if they start earlier than $r = 2$.

A1: Correct algebraic terms **or** correct constant term(s) extracted. Accept unsimplified expressions such as "$-\sqrt{1}-\sqrt{0}$"

A1: Fully correct simplified expression. Must have simplified the $\sqrt{1}$ to 1

(c)

M1: Attempts f(50) – f(3) using **their answer to (b)**. Must be indication of subtraction. The $'-1'$s may be omitted, and allow if a slip is made. They may subtract the sum of their results from $r = 2$ and $r = 3$ from (b) or by using (a) again to obtain f(3) but their answer to (b) must be used for f(50). Allow from attempts starting at $r = 1$ in their summations. f(50) −f(4) is M0.

A1: Correct expression or $A = 7$, $B = 4$, $C = -1$ **following a correct answer to (b)**.

The decimal answer 10.92480344… without evidence of the M mark is 0/2