Question	Scheme	Marks	AOs
5	States or uses the upper limit is $\sqrt{5}$	B1	1.1b
	$\displaystyle\int 4x^2+3\,\mathrm{d}x=\frac{4}{3}x^3+3x$	M1 A1	1.1b 1.1b
	Full method of finding the area of R e.g. $23\sqrt{5}-\left[\frac{4}{3}x^3+3x\right]_0^{\sqrt{5}}=\dots$ e.g. $\left[20x-\frac{4}{3}x^3\right]_0^{\sqrt{5}}=\dots$	M1	2.1
	$\Rightarrow \text{Area } R=\frac{40}{3}\sqrt{5}$	A1	1.1b
		(5)	

(5 marks)

Notes:

B1: States or uses the upper limit $\sqrt{5}$ Score when seen as the solution $x=\sqrt{5}$

M1: Attempts to integrate $4x^2+3$ **or** $\pm\left(23-\left(4x^2+3\right)\right)$ which may be simplified.

Look for one term from $4x^2+3$ with $x^n \to x^{n+1}$ It is not sufficient just to integrate 23.

A1: Correct integration. Ignore any $+c$ or spurious integral signs. Indices must be processed.

Look for $\displaystyle\int 4x^2+3\,\{\mathrm{d}x\}=\frac{4}{3}x^3+3x$ **or** $\pm\displaystyle\int 20-4x^2\,\{\mathrm{d}x\}=\pm\left(20x-\frac{4}{3}x^3\right)$ if (line –curve) or (curve – line) used.

M1: Full and complete method to find the area of R including the substitution of their upper limit.
The upper limit must come from an attempt to solve $4x^2+3=23$
The lower limit might not be seen but if seen it should be 0.
See scheme for two possible ways. Condone a sign slip if (line –curve) or (curve – line) used.

A1: $\frac{40}{3}\sqrt{5}$ following correct algebraic integration.

If using (curve – line) then allow recovery but they must make the $-\frac{40}{3}\sqrt{5}$ positive.

Alternative using $\int x\,\mathrm{d}y$

B1: States or uses limits 3 and 23. It must be for a clear attempt to integrate with respect to y

M1: Attempts to rearrange to x = and integrate $\sqrt{\frac{y-3}{4}}$ condoning slips on the rearrangement.

Look for $\dots\left(y\pm3\right)^{\frac{1}{2}}\to\dots\left(y\pm3\right)^{\frac{3}{2}}$

A1: Correct integration $\displaystyle\int\frac{\left(y-3\right)^{\frac{1}{2}}}{2}\{\mathrm{d}y\}=\frac{1}{3}\left(y-3\right)^{\frac{3}{2}}$ Ignore any $+c$ or spurious integral signs.

M1: Full and complete method to find the area of R including the substitution of their limits. In this case it would be for substituting 23 and 3 and subtracting either way round into their changed expression in terms of y

A1: $\frac{40}{3}\sqrt{5}$ following correct algebraic integration.