Question Number	Scheme	Marks
4(a)	$x=\dfrac{3}{5t-2}\Rightarrow 5tx-2x=3\Rightarrow t=\dfrac{2x+3}{5x}\Rightarrow y=\dfrac{\dfrac{2x+3}{5x}}{4-\dfrac{2x+3}{5x}}$ o.e.	M1A1
	$y=\dfrac{2x+3}{18x-3}$ oe	A1
		(3)
(b)	Assume that C and l do intersect	B1
	At intersection $\dfrac{2x+3}{18x-3}=-x+1\Rightarrow 2x+3=-18x^2+21x-3\Rightarrow 18x^2-19x+6\ (=0)$ or $y=-x+1\Rightarrow \dfrac{t}{4-t}=\dfrac{3}{2-5t}+1\Rightarrow 2t-5t^2=3(4-t)+(2-5t)(4-t)$ $\Rightarrow 10t^2-27t+20\,(=0)$	M1
	$b^2-4ac=19^2-4\times 18\times 6\,(=-71)$ or $b^2-4ac=27^2-4\times 10\times 20\,(=-71)$	M1
	$b^2-4ac<0$ so there are **no real (roots)** **So *C* and *l* do not intersect**	A1
		(4)
		Total 7

Notes

(a)

M1: Finds t in terms of x **and** substitutes into y

A1: Any correct equation connecting y and x which need not be simplified for this mark.

A1: Correct equation in the required form with no errors. Accept equivalent correct expressions.

(b)

B1: Sets up a correct assumption statement. This step **must** be seen.

M1: Sets their $\dfrac{2x+3}{18x-3}=-x+1$ and multiplies up to obtain a 3 term quadratic in x

or

Uses the parametric form and sets $\dfrac{t}{4-t}=-\left(\dfrac{3}{5t-2}\right)+1$ oe and multiplies up to obtain a 3 term quadratic in t

M1: Any correct strategy for establishing the contradiction e.g. attempts the discriminant on their 3TQ. This can be part of the quadratic formula.

Complex roots are: $\dfrac{19\pm\sqrt{71}i}{36}$

A1: Fully correct work including -71 seen evaluated, **and** conclusion stated that **roots are not (real)**, **so *C* and *l* do not intersect.** Mark the intention to write these statements and mark positively.

This is a formal proof. Only award the final A mark if B1M1M1 has been scored.

Question Number	Scheme	Marks
5	$u=\sqrt{2x-1} \Rightarrow \dfrac{\mathrm{d}u}{\mathrm{d}x}=\dfrac{1}{2}(2x-1)^{-\frac{1}{2}}\times 2 \Rightarrow \left(\dfrac{\mathrm{d}u}{\mathrm{d}x}=\dfrac{1}{2u}\times 2\right) \Rightarrow (\mathrm{d}x=u\mathrm{d}u)$ **or** e.g. $u^2=2x-1 \Rightarrow 2u\dfrac{\mathrm{d}u}{\mathrm{d}x}=2 \Rightarrow (\mathrm{d}x=u\mathrm{d}u)$ **or** e.g. $u=\sqrt{2x-1} \Rightarrow x=\dfrac{u^2+1}{2} \Rightarrow \dfrac{\mathrm{d}x}{\mathrm{d}u}=u \Rightarrow (\mathrm{d}x=u\mathrm{d}u)$	B1
	$\displaystyle\int \frac{x}{\sqrt{2x-1}}\mathrm{d}x=\int \frac{1}{2}\left(u^2+1\right)\frac{1}{u}\times u\ \mathrm{d}u$	M1
	$\displaystyle\int \frac{1}{2}\left(u^2+1\right)\frac{1}{u}\times u\ \mathrm{d}u=\int \frac{1}{2}\left(u^2+1\right)\mathrm{d}u=\frac{u^3}{6}+\frac{u}{2}(+k)$	M1
	$\displaystyle=\frac{(2x-1)^{\frac{3}{2}}}{6}+\frac{(2x-1)^{\frac{1}{2}}}{2}(+k)$	ddM1
	$\displaystyle=\frac{1}{3}(2x-1)^{\frac{1}{2}}(x+1)+k$	A1
		(5)
		Total 5

Notes

B1: Any correct equation involving $\dfrac{\mathrm{d}u}{\mathrm{d}x}$ or $\dfrac{\mathrm{d}x}{\mathrm{d}u}$ See the alternatives above.

M1: Makes a complete substitution to obtain an integral in terms of u including their dx in terms of u..du

M1: Integrates to the form $...u^3+...u(+k)$

ddM1: Reverses the substitution **correctly** into their integrated expression in the form au^3+bu+k where a and b are rational numbers. The minimum form required is $=\alpha(2x-1)^{\frac{3}{2}}+\beta(2x-1)^{\frac{1}{2}}(+k)$

Note: This mark is dependent on **both** previous M marks.

A1: Correct answer in the required form including the "+ k" allow + C for this mark.