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.

Question Number	Scheme	Marks
6(a)	$x^2 - xy + y^2 + 4x = 12$ $\Rightarrow 2x - x\frac{dy}{dx} - y + 2y\frac{dy}{dx} + 4 = 0$	M1A1
	$\frac{dy}{dx}(2y - x) = y - 2x - 4 \Rightarrow \frac{dy}{dx} = ...$	M1
	$\Rightarrow \left(\frac{dy}{dx}\right) = \frac{y - 2x - 4}{2y - x}$ oe	A1
		(4)
(b)	$(-4, -6) \rightarrow \frac{dy}{dx} = \frac{-6 + 8 - 4}{-12 + 4} = \frac{1}{4} \Rightarrow m_N = -4$	M1
	$y + 6 = -4(x + 4)$	M1
	$y = -4x - 22$	A1
		(3)
(c)	$y = -4x - 22 \Rightarrow 21x^2 + 202x + 472 = 0$ or $x = \frac{y + 22}{-4} \Rightarrow 21y^2 + 116y - 60 = 0$	M1
	$21x^2 + 202x + 472 = 0 \Rightarrow x = -\frac{118}{21}, \ (-4)$ or $21y^2 + 116y - 60 = 0 \Rightarrow y = \frac{10}{21}, (-6)$	dM1
	$x = -\frac{118}{21}$, o.e.e $\quad y = \frac{10}{21}$ o.e.e.	A1
		(3)
		Total 10

(a)

M1: For $xy \rightarrow \alpha y + \beta x\frac{dy}{dx}$ **or** $y^2 \rightarrow \alpha y\frac{dy}{dx}$

A1: Fully correct differentiation on the whole equation unsimplified or simplified.

M1: Makes $\frac{dy}{dx}$ the subject from **2** different terms in $\frac{dy}{dx}$ coming from the correct terms only

A1: Any correct expression

(b)

M1: Correct method for the gradient of the normal using their numerical value for $\frac{dy}{dx}$

M1 Correct method for finding the equation of the normal. Ft their normal gradient which must not be their tangent gradient.

A1: Correct equation in the required form

(c)

M1: Substitutes for x or y into the given equation to obtain a 3TQ in x or y.