B1: $\int \frac{3+2x+\ln x}{x^2}\,dx = -x^{-1}(3+2x+\ln x) + \int \left(2+\frac{1}{x}\right)\times\frac{1}{x}dx$

M1: Area $= \left[\pm x^{-1}(3+2x+\ln x)"\pm 2\ln x \pm x^{-1}\right]_2^4$

Question Number	Scheme	Marks
6 (a)	$y = x^{\sin x} \Rightarrow \ln y = \sin x \ln x$	B1
	Differentiates $\frac{1}{y}\frac{dy}{dx} = \frac{\sin x}{x} + \ln x \cos x$	M1 M1 A1
	$\frac{dy}{dx} = \frac{y\sin x}{x} + y\ln x\cos x$ oe	A1
		(5)
(b)	Puts $\frac{dy}{dx} = 0 \Rightarrow \frac{\sin x}{x} + \ln x\cos x = 0$	M1
	$\frac{\sin x}{\cos x} + x\ln x = 0 \Rightarrow \tan x + x\ln x = 0$*	A1*
		(2)
		(7 marks)

(a)

B1: $y = x^{\sin x} \Rightarrow \ln y = \sin x \ln x$ o.e. Condone this written $\log y = \sin x \log x$

This may have been found via $\log_x y = \sin x \rightarrow \frac{\ln y}{\ln x} = \sin x$

M1: For differentiation of $\ln y \rightarrow \frac{1}{y}\times\frac{dy}{dx}$ or $\log_e y \rightarrow \frac{1}{y}\times\frac{dy}{dx}$

M1: Attempts the product rule on $\sin x \ln x$ If the rule is quoted it must be correct.

If candidates set $u = ..., u' = ..., v = ..., v' = ...$ it may be implied by their $vu' + uv'$

If it is neither quoted nor implied score for $\frac{\sin x}{x} \pm \ln x\cos x$

A1: Correct differentiation to $\frac{1}{y}\frac{dy}{dx} = \frac{\sin x}{x} + \ln x\cos x$

A1: Achieves $\frac{dy}{dx} = \frac{y\sin x}{x} + y\ln x\cos x$ or exact equivalent such as $\frac{dy}{dx} = y\left(\frac{\sin x + x\ln x\cos x}{x}\right)$

Accept this in terms of just x. For instance $\frac{dy}{dx} = \frac{x^{\sin x}\sin x}{x} + x^{\sin x}\ln x\cos x$

ISW after sight of a correct answer.

.....

Note that you will see candidates who write $\frac{1}{y}dy = \frac{\sin x}{x}dx + \ln x\cos x\,dx$ which can be marked in the same way

.....

(b)

M1: Sets their $\frac{dy}{dx}=0$, divides by y or $x^{\sin x}$ to form a simplified equation in x.

This may be implied by $\frac{dy}{dx}=\frac{y\sin x}{x}+y\ln x\cos x=0\Rightarrow \sin x+x\ln x\cos x=0$ o.e.

For this to be scored $\frac{dy}{dx}$ **must be in the form**

$$\frac{y\sin x}{...}\pm y\ln x\cos x$$

$$\frac{x^{\sin x}\sin x}{...}\pm x^{\sin x}\ln x\cos x \text{ where ... could be 1}$$

A1*: CSO Proceeds to the given answer of $\tan x+x\ln x=0$

showing at least the intermediate line $\frac{\sin x}{\cos x}+x\ln x=0$

It can be implied by $\sin x+x\ln x\cos x=0 \quad (\div\cos x)\Rightarrow \tan x+x\ln x=0$

6 (a)	$y=x^{\sin x}\Rightarrow y=e^{\sin x\ln x}$	B1
	Differentiates $y=e^{\sin x\ln x}\rightarrow \frac{dy}{dx}=e^{\sin x\ln x}\times...$	M1
	$\frac{d}{dx}(\sin x\ln x)=\frac{\sin x}{x}+\ln x\cos x$	M1
	$\frac{dy}{dx}=e^{\sin x\ln x}\times\left(\frac{\sin x}{x}+\ln x\cos x\right)$	A2
		(5)

B1: $y=x^{\sin x}\Rightarrow y=e^{\sin x\ln x}$

M1: Differentiates $e^{\sin x\ln x}\rightarrow e^{\sin x\ln x}\times...$ where ... could be 1

M1: Attempts the product rule on $\sin x\ln x$. **See main scheme on how to apply this mark**.

A2: Correct differentiation $=\frac{\sin x}{x}+\ln x\cos x$

Question	Scheme	Marks
7 (i)	Chooses a suitable substitution for $\int_1^5 \frac{3x}{\sqrt{2x-1}}\,\mathrm{d}x$	
	E.g. $u=\sqrt{2x-1}$	B1
	$u=\sqrt{2x-1} \Rightarrow \frac{\mathrm{d}x}{\mathrm{d}u}=u$	
	$\int \frac{3x}{\sqrt{2x-1}}\,\mathrm{d}x$	
	$=\int \frac{3}{2}u^2+\frac{3}{2}\,\mathrm{d}u$	M1
	$=\frac{1}{2}u^3+\frac{3}{2}u$	dM1 A1
	$\text{Limits}=\left[\frac{1}{2}u^3+\frac{3}{2}u\right]_1^3=\ldots$	M1
	$\left(\frac{1}{2}\times 3^3+\frac{3}{2}\times 3\right)-\left(\frac{1}{2}\times 1^3+\frac{3}{2}\times 1\right)=16$	A1
		(6)
	E.g. $u=2x-1$	B1
	$u=2x-1 \Rightarrow \frac{\mathrm{d}x}{\mathrm{d}u}=\frac{1}{2}$	
	$\int \frac{3x}{\sqrt{2x-1}}\,\mathrm{d}x$	
	$=\int \frac{3}{4}u^{\frac{1}{2}}+\frac{3}{4}u^{-\frac{1}{2}}\mathrm{d}u$	M1
	$=\frac{1}{2}u^{\frac{3}{2}}+\frac{3}{2}u^{\frac{1}{2}}$	dM1 A1
	$=\left[\frac{1}{2}u^{\frac{3}{2}}+\frac{3}{2}u^{\frac{1}{2}}\right]_1^9=\ldots$	M1
	$\left(\frac{1}{2}\times 9^{\frac{3}{2}}+\frac{3}{2}\times 9^{\frac{1}{2}}\right)-\left(\frac{1}{2}\times 1+\frac{3}{2}\times 1\right)=16$	A1
		(6)
7 (ii)	$\frac{6x^2-16}{(x+1)(2x-3)}=3+\ldots..$	B1
	$\frac{6x^2-16}{(x+1)(2x-3)}=3+\frac{2}{x+1}-\frac{1}{2x-3}$	M1 A1
	$\int \frac{6x^2-16}{(x+1)(2x-3)}\,\mathrm{d}x=\int 3+\frac{2}{x+1}-\frac{1}{2x-3}\,\mathrm{d}x$	
	$=3x+2\ln\lvert x+1\rvert-\frac{1}{2}\ln\lvert 2x-3\rvert+c$	M1 A1ft A1
		(6)
		(12 marks)

(i)

B1: States or uses a suitable substitution. That is one that will work.

M1: Attempts to change the integral in x to an integral in 'u'

Expect to see all aspects changed including the dx

For $u=\sqrt{2x-1}$ expect to see $\int Au^2+B\,\mathrm{d}u$