Question Number	Scheme	Marks
5(a)	$\int \frac{\ln x}{x^2}\,\mathrm{d}x = \int x^{-2}\ln x\,\mathrm{d}x = -x^{-1}\ln x + \int x^{-1}\times\frac{1}{x}\,\mathrm{d}x$	M1
	$= -x^{-1}\ln x - x^{-1}(+c)$	dM1 A1 **(3)**
(b)	$\frac{3+2x+\ln x}{x^2} = 3x^{-2}+2x^{-1}+x^{-2}\ln x$ oe	B1
	Area $= \left[-\frac{3}{x}+2\ln x"-\frac{\ln x}{x}-\frac{1}{x}"\right]_2^4$	M1
	$=\left(-\frac{3}{4}+2\ln 4-\frac{\ln 4}{4}-\frac{1}{4}\right)-\left(-\frac{3}{2}+2\ln 2-\frac{\ln 2}{2}-\frac{1}{2}\right)=1+2\ln 2$	M1 A1 **(4)** **(7 marks)**

(a)

M1: Attempts by parts to reach a form $\int x^{-2}\ln x\,\mathrm{d}x = \pm ax^{-1}\ln x \pm b\int x^{-1}\times\frac{1}{x}\,\mathrm{d}x$ where $a,b\neq 0$

If a formula is stated it must be correct.

dM1: Integrates again to reach a form $\pm ax^{-1}\ln x \pm bx^{-1}$

A1: $-x^{-1}\ln x - x^{-1}(+c)$ o.e such as $-\frac{\ln x}{x}-\frac{1}{x}+c$

Condone the omission of the constant of integration. Condone $-x^{-1}\ln x+\left(-x^{-1}\right)$

(b)

B1: $\frac{3+2x+\ln x}{x^2} = 3x^{-2}+2x^{-1}+x^{-2}\ln x$ or $\frac{3}{x^2}+\frac{2}{x}+\frac{\ln x}{x^2}$.

The $\frac{2}{x}$ may be implied by later work. That is if they state $\int\frac{2x}{x^2}\,\mathrm{d}x = 2\ln x$ or $\ln x^2$

M1: Area $= \left[-\frac{3}{x}+2\ln x"-\frac{\ln x}{x}-\frac{1}{x}"\right]_2^4$ following through on their part (a)

M1: For substituting 2 and 4 **into an expression of the form** $\left[\frac{p}{x}+q\ln x+r\frac{\ln x}{x}+\frac{s}{x}\right]_2^4$ and attempts to simplify by using one log law correctly. (Note that the two terms in $\frac{1}{x}$ may be combined before substitution)

A1: Exact answer: Likely to be $1+2\ln 2$ or $1+\ln 4$

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For those who don't read the instruction in (b) to use (a) and do via parts score

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.

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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

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