Question	Scheme	Marks	AOs
12(a)	$y = a^x \Rightarrow \ln y = \ln a^x = x \ln a$ or $y = a^x \Rightarrow y = \left(e^{\ln a}\right)^x = e^{x \ln a}$	M1	3.1a
	$\ln y = x \ln a \Rightarrow \frac{1}{y}\frac{dy}{dx} = \ln a$ or $y = e^{x \ln a} \Rightarrow \frac{dy}{dx} = e^{x \ln a} \ln a$	M1	1.1b
	$\frac{1}{y}\frac{dy}{dx} = \ln a \Rightarrow \frac{dy}{dx} = y \ln a = a^x \ln a$ * or $\frac{dy}{dx} = e^{x \ln a} \ln a = \left(e^{\ln a}\right)^x \ln a = a^x \ln a$ * or $\frac{dy}{dx} = e^{x \ln a} \ln a = y \ln a = a^x \ln a$ *	A1*	2.1
		(3)	
(b)	$\int 4^x \, dx = \frac{4^x}{\ln 4}(+c)$	B1	2.2a
	$\int_1^2 4^x \, dx = \left[\frac{4^x}{\ln 4}\right]_1^2 = \frac{16}{\ln 4} - \frac{4}{\ln 4} = \frac{12}{\ln 4}$	M1	1.1b
	$\frac{12}{\ln 4} = \frac{12}{2 \ln 2} = \frac{6}{\ln 2} = 6(\ln 2)^{-1}$	A1	2.1
		(3)	
			(6 marks)

Notes

(a)

M1: For making the key step of taking ln's and applying the power law of logs to expressing $\ln y$ in terms of x or expresses a as $e^{\ln a}$ and applies the power law of indices

M1: Differentiates implicitly or explicitly for their chosen method

A1*: Fully correct proof

(b)

B1: Deduces the correct integration

M1: Applies the given limits correctly and attempts to combine terms

A1: Correct answer using correct log work