Question	Scheme	Marks	AOs
11 (i)	$\{y = a^x \Rightarrow\}\ \ \ln y = \ln a^x \ \Rightarrow\ \ln y = x\ln a \ \Rightarrow\ \frac{1}{y}\frac{dy}{dx} = \ln a$	M1	2.1
	$\frac{dy}{dx} = y\ln a \Rightarrow \frac{dy}{dx} = a^x \ln a$ *	A1*	1.1b
		(2)	
(i) Alt 1	$\{y = a^x \Rightarrow\}\ \ y = e^{x\ln a} \ \Rightarrow\ \frac{dy}{dx} = (\ln a)e^{x\ln a}$	M1	2.1
	$\Rightarrow \frac{dy}{dx} = a^x \ln a$ *	A1*	1.1b
		(2)	
(ii)	$\frac{d}{dy}(2\tan y) = 2\sec^2 y$	M1	1.1b
	$\{x = 2\tan y \Rightarrow\}\ \frac{dx}{dy} = 2\sec^2 y$ or $1 = (2\sec^2 y)\frac{dy}{dx}$	A1	1.1b
	$\frac{dx}{dy} = 2(1+\tan^2 y)$ or $1 = 2(1+\tan^2 y)\frac{dy}{dx}$	M1	1.1b
	E.g. $\frac{dx}{dy} = 2\left(1+\left(\frac{x}{2}\right)^2\right) \Rightarrow \frac{dx}{dy} = 2\left(1+\frac{x^2}{4}\right) \Rightarrow \frac{dx}{dy} = 2+\frac{x^2}{2}$ $\Rightarrow \frac{dx}{dy} = \frac{4+x^2}{2} \Rightarrow \frac{dy}{dx} = \frac{2}{4+x^2}$	A1	2.1
		(4)	
(ii) Alt 1	$\{x = 2\tan y \Rightarrow\}\ \ y = \arctan\left(\frac{x}{2}\right) \Rightarrow \frac{dy}{dx} = \frac{1}{\left(1+\left(\frac{x}{2}\right)^2\right)} \times \left(\frac{1}{2}\right)$	M1 M1 A1	1.1b 1.1b 1.1b
	$\Rightarrow \frac{dy}{dx} = \frac{1}{2\left(1+\frac{x^2}{4}\right)} \Rightarrow \frac{dy}{dx} = \frac{1}{\left(2+\frac{x^2}{2}\right)} \Rightarrow \frac{dy}{dx} = \frac{1}{\left(\frac{4+x^2}{2}\right)}$ $\Rightarrow \frac{dy}{dx} = \frac{2}{4+x^2}$	A1	2.1
		(4)	
		(6 marks)	

Question 11 Notes:	
(i)	
M1:	Applies the natural logarithm to both sides of $y = a^x$, applies the power law of logarithms and applies implicit differentiation to the result
A1*:	Shows $\frac{dy}{dx} = a^x \ln a$, with no errors seen
(i)	
Alt 1	
M1:	Rewrites $y = a^x$ as $y = e^{x\ln a}$ and writes $\frac{dy}{dx} = c e^{x\ln a}$, where c can be 1
A1*:	Shows $\frac{dy}{dx} = a^x \ln a$, with no errors seen
(ii)	
M1:	Evidence of $2\tan y$ being differentiated to $2\sec^2 y$
A1:	Differentiates correctly to show that $x = 2\tan y$ gives $\frac{dx}{dy} = 2\sec^2 y$ or $1 = (2\sec^2 y)\frac{dy}{dx}$
M1:	Applies $\sec^2 y = 1 + \tan^2 y$ to their differentiated expression
A1:	Shows that $\frac{dy}{dx} = \frac{2}{4+x^2}$, with no errors seen
(ii)	
Alt 1	
M1:	Evidence of $\arctan(\lambda x)$; $\lambda \neq 0$ being differentiated to $\lambda\left(\frac{1}{1+\left(\mu x^2\right)}\right)$; $\lambda, \mu \neq 0$ **Note:** λ can be 1 for this mark
M1:	Differentiates $y = \arctan(\lambda x)$; $\lambda \neq 0, \lambda \neq 1$ to give an expression of the form $\frac{1}{\left(1+(\lambda x)^2\right)} \times (\lambda)$
A1:	Differentiates $y = \arctan\left(\frac{x}{2}\right)$ correctly to give $\frac{dy}{dx} = \frac{1}{\left(1+\left(\frac{x}{2}\right)^2\right)} \times \left(\frac{1}{2}\right)$, o.e.
A1:	Shows that $\frac{dy}{dx} = \frac{2}{4+x^2}$, with no errors seen