Question	Scheme	Marks	AOs
13(a)	$y = \text{cosec}^3\theta \Rightarrow \dfrac{\mathrm{d}y}{\mathrm{d}\theta} = -3\text{cosec}^2\theta\text{cosec}\,\theta\cot\theta$	B1	1.1b
	$\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{\mathrm{d}y}{\mathrm{d}\theta} \div \dfrac{\mathrm{d}x}{\mathrm{d}\theta}$	M1	1.1b
	$\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{-3\text{cosec}^3\theta\cot\theta}{2\cos 2\theta}$	A1	1.1b
		(3)	
(b)	$y = 8 \Rightarrow \text{cosec}^3\theta = 8 \Rightarrow \sin^3\theta = \dfrac{1}{8} \Rightarrow \sin\theta = \dfrac{1}{2}$	M1	3.1a
	$\theta = \dfrac{\pi}{6} \Rightarrow \dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{-3\text{cosec}^3\left(\dfrac{\pi}{6}\right)\cot\left(\dfrac{\pi}{6}\right)}{2\cos\left(\dfrac{2\pi}{6}\right)} = \ldots$ **or** $\sin\theta = \dfrac{1}{2} \Rightarrow \dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{\dfrac{-3}{\sin^3\theta}\times\dfrac{\cos\theta}{\sin\theta}}{2\left(1-2\sin^2\theta\right)} = \dfrac{-3\times 8\times \dfrac{\sqrt{3}/2}{1/2}}{2\left(1-2\times\dfrac{1}{4}\right)}$	M1	2.1
	$= -24\sqrt{3}$	A1	2.2a
		(3)	
			(6 marks)

Notes

(a)

B1: Correct expression for $\dfrac{\mathrm{d}y}{\mathrm{d}\theta}$ seen or implied in any form e.g. $\dfrac{-3\cos\theta}{\sin^4\theta}$

M1: Obtains $\dfrac{\mathrm{d}x}{\mathrm{d}\theta} = k\cos 2\theta$ or $\alpha\cos^2\theta + \beta\sin^2\theta$ (from product rule on $\sin\theta\cos\theta$)

and attempts $\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{\mathrm{d}y}{\mathrm{d}\theta} \div \dfrac{\mathrm{d}x}{\mathrm{d}\theta}$

A1: Correct expression in any form.

May see e.g. $\dfrac{-3\cos\theta}{2\sin^4\theta\cos 2\theta}$, $-\dfrac{3}{4\sin^4\theta\cos\theta - 2\sin^3\theta\tan\theta}$

(b)

M1: Recognises the need to find the value of $\sin\theta$ or θ when $y = 8$ and uses the y parameter to establish its value. This should be correct work leading to $\sin\theta = \dfrac{1}{2}$ or e.g. $\theta = \dfrac{\pi}{6}$ or 30°.

M1: Uses their value of $\sin\theta$ or θ in their $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ from part (a) (working in exact form) in an attempt to obtain an exact value for $\dfrac{\mathrm{d}y}{\mathrm{d}x}$. May be implied by a correct exact answer.

If no working is shown but an exact answer is given you may need to check that this follows their $\dfrac{\mathrm{d}y}{\mathrm{d}x}$.

A1: Deduces the correct gradient