Question			Answer	Marks	AOs		Guidance
8	(a)	(i)	$\frac{dy}{dx} = \frac{-4x}{(x^2+1)^3}$	M1	1.1a	Attempt to differentiate	chain or quotient or product rule
				A1	1.1	Correct first derivative	Don't have to simplify
			$\frac{d^2y}{dx^2} = \frac{-4(x^2+1)^3+4x.2x.3(x^2+1)^2}{(x^2+1)^6}$	M1	1.1a	Attempt to use quotient rule to find second derivative	For each M1 allow one error
				A1	1.1	Any correct expression for second derivative	
			$\frac{d^2y}{dx^2} = \frac{-4(x^2+1)+24x^2}{(x^2+1)^4}$ $\Rightarrow \frac{d^2y}{dx^2} = \frac{20x^2-4}{(x^2+1)^4}$	A1	2.1	Simplifying expression for second derivative by cancelling (x^2+1) and correct completion (AG)	
				[5]			
8	(a)	(ii)	**DR**				
			For concave downwards, $\frac{20x^2-4}{(x^2+1)^4} < 0$ so $20x^2 - 4 < 0$	M1	2.2a		
			$5x^2 < 1$ so $x^2 < \frac{1}{5}$	M1	1.1	Or $x = \pm\frac{1}{\sqrt{5}}$	Condone $x^2 > \frac{1}{5}$ following y'' > 0 for M1
			$-\frac{1}{\sqrt{5}} < x < \frac{1}{\sqrt{5}}$	A1	2.5	Correct solution correctly expressed	Allow decimals (±0.447)
				[3]			

Question			Answer	Marks	AOs		Guidance
8	(b)		$\frac{dx}{d\theta} = sec^2\,\theta$	M1	1.1a	o.e.	Condone $\sec^2 x$
			$\int_{x=-1}^{x=1} \frac{sec^2\,\theta}{(1+tan^2\,\theta)^2} d\theta$	M1	1.1	Substitution for either x or dx (limits may be missing)	
			$\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \frac{sec^2\,\theta}{(1+tan^2\,\theta)^2} d\theta$	M1	1.1	Limits (may be done at any point)	
			$\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \frac{1}{sec^2\,\theta} d\theta$	M1	2.2a	Use of $1 + tan^2 \quad \theta = sec^2\,\theta$	
			$\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} cos^2\theta d\theta$	M1	1.1	Use of $sec\,\theta = \frac{1}{cos \quad \theta}$	
			$\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \frac{1}{2}(cos\,2\,\theta + 1) d\theta$	M1	3.1a	Use of $cos\,2\,\theta = 2\,cos^2\,\theta - 1$	
			$\frac{1}{2}\left[\frac{1}{2} sin\,2\,\theta + \theta\right]_{-\frac{\pi}{4}}^{\frac{\pi}{4}}$	M1	1.1	Integration. Must include at least one trig term. Limits may be wrong or missing	
			$\frac{1}{2}\left(1+\frac{\pi}{2}\right) = \frac{1}{2} + \frac{\pi}{4}$	A1	2.1	Exact form	
				[8]			