1. The equation of a curve is $y = \cos 2x + 2 \sin x$. Find $\frac{dy}{dx}$ and hence find the coordinates of the stationary points on the curve for $0 < x < \pi$.

[6]

2. **In this question you must show detailed reasoning.**

Find the gradient of the curve $y = 3 \cos 2x$ at the point where $x = \frac{1}{8}\pi$. [4]

END OF QUESTION paper

Mark scheme

Question			Answer/Indicative content	Marks	Part marks and guidance	
1			Use of sin 2x = +/– 2 sin x cos x or +/– $\cos\left(\frac{\pi}{2}-2x\right)$ *or* cos2x = +/– 2cos^2x +/– 1 etc	M1	Seen anywhere in the solution	
			$\left(\frac{\mathrm{d}y}{\mathrm{d}x}=\right)$ – 2 sin 2x (or –4sin x cos x); + 2 cos x	B1,B1		
			their $\frac{\mathrm{d}y}{\mathrm{d}x}$ = 0	*M1		
					−1(once) for using degrees in an answer instead of radians.	
			$\left(\frac{\pi}{2},1\right)$; $\left(\frac{\pi}{6},\frac{3}{2}\right)$ and $\left(\frac{5\pi}{6},\frac{3}{2}\right)$	dep* A1; A1	If B0 & / or B0 <u>because of sign error</u>, allow A1 to be awarded for $\left(\frac{\pi}{2},1\right)$	SC If A0 but all 3 x-values are correct, award SC A1 SC B2 for 3 ✓ answers without working
					Examiner's Comments This relatively simple-looking question did test a number of useful features: the differentiation of cos 2x, the solution of sin 2x = cos x and, finally, the solution of sin x = $\frac{1}{2}$ for 0 < x < π. The majority of candidates passed the first test but failed the second and third. Most divided each side of the equation by cos$x$ without considering the possibility of cos x being 0 and a similar number forgot that $\frac{5}{6}\pi$ was also a solution of the equation sin x = $\frac{1}{2}$. Although the sin 2x formula was generally used correctly at the end of the first main stage, it was surprising how many decided to use the double-angle formula for cos 2 x at the beginning; unfortunately the derivative of cos^2x	

					often proved more problematic than that of cos2x.	
			Total	6		
2			DR $\frac{dy}{dx} = -6\sin 2x$ Substitute $x = \frac{1}{8}\pi$ n attempt at first derivative Obtain $-3\sqrt{2}$	M1(AO1.1) A1(AO1.1) M1(AO1.1) A1(AO1.1) [4]	For $k\sin 2x$ For completely correct derivative oe, e.g. $-\frac{6}{\sqrt{2}}$	
			Total	4		