

Q	Marking instructions	AO	Marks	Typical solution
14	Begins integration by parts by writing $u = 4x \quad v' = \sin 2x$ $u' = 4 \quad v = A \cos 2x$ PI by $4Ax \cos 2x - 4A \int (\cos 2x) dx$ Or $-2x \cos 2x + \sin 2x (+c)$ Or $u = \sin 2x \quad v' = 4x$ $u' = A \cos 2x \quad v = 2x^2$ PI by $2x^2 \sin 2x - 2A \int (x^2 \cos 2x) dx$ In either approach the constant 4 may be contained within the u or v terms or taken out as a factor.	3.1a	M1	$\int 4x \sin 2x dx$ $u = 4x \quad u' = 4$ $v' = \sin 2x \quad v = -\frac{1}{2} \cos 2x$ $\int 4x \sin 2x dx =$ $-\frac{4x}{2} \cos 2x - \int -\frac{4}{2} \cos 2x dx$ $= -2x \cos 2x + \sin 2x + c$ area above $[-2x \cos 2x + \sin 2x]_0^{\frac{\pi}{2}} = \pi$ area below $[-2x \cos 2x + \sin 2x]_{\frac{\pi}{2}}^{\pi} =$ $-2\pi - \pi = -3\pi$ $\pi + 3\pi = 4\pi$
	Substitutes their u, u', v, v' of either of the above forms into the integration by parts formula PI by $-2x \cos 2x + \sin 2x (+c)$	1.1a	M1	
	Applies IBP correctly to obtain $\int 4x \sin 2x dx =$ $-\frac{4x}{2} \cos 2x - \int -\frac{4}{2} \cos 2x (dx)$ PI by $-2x \cos 2x + \sin 2x (+c)$	1.1b	A1	
	Completes integration to obtain $-2x \cos 2x + \sin 2x (+c)$	1.1b	A1	
	Deduces $x = \frac{\pi}{2}$ at intersection with x-axis. Accept $\frac{\pi}{2}$ labelled on the diagram, written as a limit in their integral or seen as the solution to the equation $4x \sin 2x = 0$	2.2a	B1	
	Evaluates their integral over two separate intervals.	3.1a	M1	

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14 cont	Demonstrates $\left[-2x \cos 2x + \sin 2x\right]_0^{\frac{\pi}{2}} = \pi$ Or $\left[-2x \cos 2x + \sin 2x\right]_{\frac{\pi}{2}}^{\pi} =$ $-2\pi - \pi = -3\pi$	1.1a	M1	
	Completes reasoned argument to show the area is 4π	2.1	R1	
	Question 14 Total		8	