Question Number	Scheme	Notes	Marks
6(a)	$\int \mathrm{e}^x \sin^n x\,\mathrm{d}x = \mathrm{e}^x \sin^n x - n\int \mathrm{e}^x \sin^{n-1} x\cos x\,\mathrm{d}x$ Applies integration by parts to obtain $\pm\mathrm{e}^x \sin^n x \pm \alpha\int \mathrm{e}^x \sin^{n-1} x\cos x\,\mathrm{d}x$		M1
	$= \mathrm{e}^x \sin^n x - n\left\{\mathrm{e}^x \sin^{n-1} x\cos x - \int \mathrm{e}^x\left((n-1)\sin^{n-2} x\cos^2 x - \sin^n x\right)\mathrm{d}x\right\}$ M1: Applies integration by parts to $\pm\alpha\int \mathrm{e}^x \sin^{n-1} x\cos x\,\mathrm{d}x$ to obtain $\pm\mathrm{e}^x \sin^{n-1} x\cos x \pm \int \mathrm{e}^x\left(\alpha\sin^{n-2} x\cos^2 x - \beta\sin^n x\right)\mathrm{d}x$ Or equivalent e.g. $\pm\mathrm{e}^x \sin^{n-1} x\cos x \pm \int \mathrm{e}^x\left(\alpha\sin^{n-2} x - \beta\sin^n x\right)\mathrm{d}x$ (if Pythagoras applied first) A1: Fully correct expression for I_n from parts applied twice.		**d**M1A1
	$= \mathrm{e}^x \sin^n x - n\left\{\mathrm{e}^x \sin^{n-1} x\cos x - \int \mathrm{e}^x\left((n-1)\sin^{n-2} x\left(1-\sin^2 x\right) - \sin^n x\right)\mathrm{d}x\right\}$ Applies $\cos^2 x = 1-\sin^2 x$		**d**M1
	$= \mathrm{e}^x \sin^n x - n\left\{\mathrm{e}^x \sin^{n-1} x\cos x - \int \mathrm{e}^x\left((n-1)\sin^{n-2} x - (n-1)\sin^n x - \sin^n x\right)\mathrm{d}x\right\}$ $= \mathrm{e}^x \sin^n x - n\left\{\mathrm{e}^x \sin^{n-1} x\cos x - \int \mathrm{e}^x\left((n-1)\sin^{n-2} x - n\sin^n x\right)\mathrm{d}x\right\}$ $= \mathrm{e}^x \sin^n x - n\mathrm{e}^x \sin^{n-1} x\cos x + n(n-1)I_{n-2} - n^2 I_n \Rightarrow I_n = \ldots$ Completes by introducing I_{n-2} and I_n and makes I_n the subject		**d**M1
	$I_n = \dfrac{\mathrm{e}^x \sin^{n-1} x}{n^2+1}(\sin x - n\cos x) + \dfrac{n(n-1)}{n^2+1}I_{n-2}$ * Fully correct proof with no errors but allow e.g. the occasional missing "dx" but any clear errors must be recovered before final answer e.g. missing brackets.		A1*
			(6)

(b)	$I_4 = \frac{e^x \sin^3 x}{17}(\sin x - 4\cos x) + \frac{12}{17} I_2$ or $I_2 = \frac{e^x \sin x}{5}(\sin x - 2\cos x) + \frac{2}{5} I_0$ Applies the reduction formula once	M1
	$= \frac{e^x \sin^3 x}{17}(\sin x - 4\cos x) + \frac{12}{17}\left(\frac{e^x \sin x}{5}(\sin x - 2\cos x) + \frac{2}{5} I_0\right)$ $= \frac{e^x \sin^3 x}{17}(\sin x - 4\cos x) + \frac{12e^x \sin x}{85}(\sin x - 2\cos x) + \frac{24}{85} e^x$ Applies the reduction formula again and uses $I_0 = \int e^x \, dx = e^x$ to obtain an expression in terms of x	M1
	$\int_0^{\frac{\pi}{2}} e^x \sin^4 x \, dx = \left[\frac{e^x \sin^3 x}{17}(\sin x - 4\cos x) + \frac{12e^x \sin x}{85}(\sin x - 2\cos x) + \frac{24}{85} e^x\right]_0^{\frac{\pi}{2}}$ $= \frac{e^{\frac{\pi}{2}}}{17} + \frac{12e^{\frac{\pi}{2}}}{85} + \frac{24e^{\frac{\pi}{2}}}{85} - \frac{24}{85}$ Uses the limits 0 and $\frac{\pi}{2}$ and subtracts**. Depends on both previous marks.**	**d**M1
	$= \frac{41e^{\frac{\pi}{2}}}{85} - \frac{24}{85}$ Correct expression or correct values e.g. $A = \ldots$, $B = \ldots$	A1
		(4)
	Note that the limits may be applied as they go e.g.: M1: $I_4 = \frac{e^{\frac{\pi}{2}}}{17}(1-0) + \frac{12}{17} I_2$ $I_2 = \frac{e^{\frac{\pi}{2}}}{5}(1-0) + \frac{2}{5} I_0$ $I_0 = e^{\frac{\pi}{2}} - 1$ M1M1: $I_4 = \frac{e^{\frac{\pi}{2}}}{17} + \frac{12}{17}\left(\frac{e^{\frac{\pi}{2}}}{5} + \frac{2}{5}\left(e^{\frac{\pi}{2}} - 1\right)\right)$ A1: $= \frac{41e^{\frac{\pi}{2}}}{85} - \frac{24}{85}$	
		Total 10