Question Number	Scheme	Notes	Marks
8(a)	$I_n = \int \cos^n x \,\mathrm{d}x = \int \cos x \cos^{n-1} x \,(\mathrm{d}x)$	Correct split. Could be implied by their work	M1
Way 1	$= \sin x \cos^{n-1} x + \int (n-1)\cos^{n-2} x \sin^2 x \,(\mathrm{d}x)$	Obtains $p \sin x \cos^{n-1} x + \int q \cos^{n-2} x \sin^2 x \,(\mathrm{d}x)$ oe **Requires previous M mark.**	**d**M1
	$= \sin x \cos^{n-1} x + \int (n-1)\cos^{n-2} x \left(1-\cos^2 x\right)(\mathrm{d}x)$	Replaces $\sin^2 x$ with $1-\cos^2 x$ to achieve a correct expression for I_n	A1
	$= \sin x \cos^{n-1} x + (n-1) I_{n-2} - (n-1) I_n$ $\Rightarrow I_n = \frac{1}{n}\cos^{n-1} x \sin x + \frac{n-1}{n} I_{n-2}$ *	Proceeds to the given answer with at least one intermediate step and no errors. Condone missing "dx"s but there must be no missing arguments. Any clear bracketing error must be recovered **before** given answer.	A1*
			(4)
Way 2	$I_n = \int \cos^n x \,\mathrm{d}x = \int \cos^2 x \cos^{n-2} x \,(\mathrm{d}x)$ $= \int \left(1-\sin^2 x\right)\cos^{n-2} x \,(\mathrm{d}x)$	Correct split **and** replaces $\cos^2 x$ with $1-\sin^2 x$	M1
	$= \int \left(\cos^{n-2} x - \cos^{n-2} x \sin^2 x\right)(\mathrm{d}x)$ $= \int \cos^{n-2} x \,(\mathrm{d}x) - \int \left(\sin x \sin x \cos^{n-2} x\right)(\mathrm{d}x) = \ldots$ M1: Expands, splits and obtains $p\int \cos^{n-2} x \,(\mathrm{d}x) + q\cos^{n-1} x \sin x + \int r \cos^n x \,(\mathrm{d}x)$ oe **Requires previous M mark.** A1: Correct expression for I_n: $\int \cos^{n-2} x \,(\mathrm{d}x) - \left(-\frac{1}{n-1}\cos^{n-1} x \sin x + \int \frac{1}{n-1}\cos^n x \,(\mathrm{d}x)\right)$ oe		**d**M1 A1
	$= I_{n-2} + \frac{1}{n-1}\cos^{n-1} x \sin x - \frac{1}{n-1} I_n$ $\Rightarrow I_n = \frac{1}{n}\cos^{n-1} x \sin x + \frac{n-1}{n} I_{n-2}$ *	Proceeds to the given answer with at least one intermediate step and no errors. Condone missing "dx"s but there must be no missing arguments. Any bracketing error must be recovered **before** given answer.	A1*
			(4)
(b)	$I_n = \frac{1}{n}\left[\cos^{n-1} x \sin x\right]_0^{\frac{\pi}{2}} + \frac{n-1}{n} I_{n-2}$ or $= \frac{1}{n}(n-1) I_{n-2}$ $I_2 = \frac{1}{2}\left[\cos^{2-1} x \sin x\right]_0^{\frac{\pi}{2}} + \frac{2-1}{2} I_0$ or $= \frac{1}{2} I_0$	Uses the RF to obtain an expression for I_n in terms of I_{n-2} or I_2 in terms of I_0 Condone if necessary if limits are absent.	M1
	$I_n = \frac{(n-1)(n-3)\ldots 5\times 3\times 1}{n(n-2)(n-4)\ldots 6\times 4\times 2} I_0$ with dots & at least 3 terms in each product (first 2 & last, or first & last 2)	Correct expression for I_n in terms of I_0 oe following correct work including 2 applications of the reduction formula (which could be embedded) **prior** to this answer. I_0 may have been calculated previously but do not allow just the final printed answer to imply this mark.	A1
	e.g., $I_0 = \int_0^{\frac{\pi}{2}} \mathrm{d}x = \frac{\pi}{2}$ or $I_0 = \left[x\right]_0^{\frac{\pi}{2}} = \frac{\pi}{2}$ or $I_0 = \frac{\pi}{2} - 0$	Correct value for I_0 - requires written evidence of integration (minimal)	B1
	$\therefore I_n = \frac{(n-1)(n-3)\ldots 5\times 3\times 1}{n(n-2)(n-4)\ldots 6\times 4\times 2} \times \frac{\pi}{2}$ * Allow extra terms in both products.	Proceeds to given answer. Requires all previous marks. Withhold this mark if no $\frac{1}{k}\left[\cos^{k-1} x \sin x\right]_0^{\frac{\pi}{2}}$ is seen or expression just disappears – one such expression must be replaced by "0" or have substitution seen	A1*
	Attempts via proof by induction will be reviewed.		**(4)**
	Attempts may be seen via $I_n = \frac{(n-1)(n-3)\ldots 3}{n(n-2)\ldots 4} I_2$ and $I_2 = \frac{1}{2}\left[\theta + \frac{1}{2}\sin 2\theta\right]_0^{\frac{\pi}{2}} = \frac{1}{2}\times\frac{\pi}{2}$		

Question Number	Scheme	Notes	Marks
8(c)	$\int_0^{\frac{\pi}{2}} \cos^6 x \sin^2 x \, \mathrm{d}x = \int_0^{\frac{\pi}{2}} \cos^6 x \left(1-\cos^2 x\right) \mathrm{d}x$	Replaces $\sin^2 x$ with $1-\cos^2 x$ Can be implied by an attempt at $I_6 - I_8$	M1
	$= I_6 - I_8 = \left(\frac{5\times3\times1}{6\times4\times2} - \frac{7\times5\times3\times1}{8\times6\times4\times2}\right)\frac{\pi}{2}$	Any correct numerical expression for the integral	A1
	$\left(= \frac{5}{32}\pi - \frac{35}{256}\pi = \right)\frac{5}{256}\pi$ oe	Correct exact value. Accept equivalent fractions and allow e.g., $\left(\frac{5}{128}\right)\frac{\pi}{2}$	A1
	This is a "Hence" and requires clear use of $I_6 - I_8$ For the A marks there must be no evidence that the answer has been arrived at without using part (b). There is no credit in (b) for work in (c). Just "$I = \frac{5}{256}\pi$" is 0/3 but just "$I_6 - I_8 = \frac{5}{256}\pi$" is 3/3		
			(3)
			Total 11