Question Number	Scheme	Marks
	$\sec x\dfrac{\mathrm{d}y}{\mathrm{d}x}-2y\sin x=\mathrm{e}^{x+\sin^2 x}$	
7(a)	$\dfrac{\mathrm{d}y}{\mathrm{d}x}-2y\sin x\cos x=\cos x\mathrm{e}^{x+\sin^2 x}\Rightarrow \text{I.F.}=\mathrm{e}^{-\int 2\sin x\cos x\mathrm{d}x}$ oe	M1
	$=\mathrm{e}^{-\sin^2 x}$	A1
		(2)
(b)	$\dfrac{\mathrm{d}}{\mathrm{d}x}\left(y\mathrm{e}^{-\sin^2 x}\right)=\mathrm{e}^{-\sin^2 x}\cos x\mathrm{e}^{x+\sin^2 x}$ $\Rightarrow y\mathrm{e}^{-\sin^2 x}=\int \mathrm{e}^{x}\cos x\mathrm{d}x$ oe	M1A1
	$I=\int \mathrm{e}^{x}\cos x\,\mathrm{d}x=\mathrm{e}^{x}\sin x-\int \mathrm{e}^{x}\sin x\,\mathrm{d}x$	$\mathrm{I}=\int \mathrm{e}^{x}\cos x\mathrm{d}x=\mathrm{e}^{x}\cos x+\int \mathrm{e}^{x}\sin x\,\mathrm{d}x$ M1
	$=\mathrm{e}^{x}\sin x-\left[-\mathrm{e}^{x}\cos x+\int \mathrm{e}^{x}\cos x\,\mathrm{d}x\right]$ $\Rightarrow I=\dfrac{1}{2}\mathrm{e}^{x}\left(\sin x+\cos x\right)$	$=\mathrm{e}^{x}\cos x+\left[\mathrm{e}^{x}\sin x-\int \mathrm{e}^{x}\cos x\,\mathrm{d}x\right]$ $\Rightarrow I=\dfrac{1}{2}\mathrm{e}^{x}\left(\sin x+\cos x\right)$ M1A1
	$y\mathrm{e}^{-\sin^2 x}=\dfrac{1}{2}\mathrm{e}^{x}\left(\sin x+\cos x\right)+C$ $\Rightarrow y=\dfrac{\mathrm{e}^{x}\left(\sin x+\cos x\right)}{2\mathrm{e}^{-\sin^2 x}}+\dfrac{C}{\mathrm{e}^{-\sin^2 x}}$ oe	A1
		(6)
(c)	$x=0,y=2\Rightarrow 2=\dfrac{1}{2}+C$ $\Rightarrow C=\ldots\left(\dfrac{3}{2}\right)$	M1
	$\Rightarrow y=\dfrac{\frac{1}{2}\mathrm{e}^{x}\left(\sin x+\cos x\right)}{\mathrm{e}^{-\sin^2 x}}+\dfrac{3}{2\mathrm{e}^{-\sin^2 x}}$ oe	A1
		(2)
		Total 10

Notes

Mark parts (a) and (b) together

(a)

M1: Dividing by $\sec x$ (or multiplying by $\cos x$) and obtaining $\text{I.F.} = e^{-\int 2\sin x\cos x dx}$ oe e.g. $\text{I.F.} = e^{-\int \sin 2x dx}$

A1: Obtains $\text{I.F.} = e^{-\sin^2 x}$

Note: if the candidate integrates $e^{-\int \sin 2x dx} = e^{\frac{1}{2}\cos 2x} = \cdots e^{\frac{1}{2}-\sin^2 x}$ then states that the $\text{I.F.} = e^{-\sin^2 x}$ with justification (e.g. any multiple of the IF is also an IF) then full marks can be scored in (a)

If candidates use a correct integration factor in parts (b) and (c) then all marks are available

(b)

M1: Obtains $y \times \text{their IF (or correct IF)} = \int \text{their IF (or correct IF)} \times \cos x e^{x+\sin^2 x}$

A1: simplifies RHS to obtain $y \times \text{their IF (or correct IF)} = \int e^x \cos x dx$ or equivalent correct expression: e.g. if their IF is $e^{\frac{1}{2}-\sin^2 x}$ then they will obtain $y \times e^{\frac{1}{2}-\sin^2 x} = e^{\frac{1}{2}} \int e^x \cos x dx$

if their IF is $e^{\frac{1}{2}\cos 2x}$ then they will obtain $y \times e^{\frac{1}{2}\cos 2x} = \int e^{\frac{1}{2}\cos 2x} \cos x e^{x+\sin^2 x} dx$

or $y \times e^{\frac{1}{2}\cos 2x} = \int e^{x+\frac{1}{2}} \cos x dx$

M1: Uses IBP once on RHS (sign errors only)

M1: Uses IBP twice on RHS (sign errors only)

A1: Correct integral for $\int e^x \cos x dx$

A1: c.a.o. Constant introduced and treated correctly- correct final answer in any equivalent form

e.g. if their IF is $e^{\frac{1}{2}-\sin^2 x}$ then they will obtain $y = \dfrac{e^x e^{\frac{1}{2}}(\sin x + \cos x)}{2e^{\frac{1}{2}-\sin^2 x}} + \dfrac{C}{e^{\frac{1}{2}-\sin^2 x}}$

e.g. if their IF is $e^{\frac{1}{2}\cos 2x}$ then they will obtain $y = \dfrac{e^x e^{\frac{1}{2}}(\sin x + \cos x)}{2e^{\frac{1}{2}\cos 2x}} + \dfrac{C}{e^{\frac{1}{2}\cos 2x}}$

(c) **M1:** Substitutes the given boundary conditions and re-arranges to obtain a value for the constant from their GS

A1: Correct value and correct particular solution (in any equivalent form)

if their IF is $e^{\frac{1}{2}-\sin^2 x}$ or $e^{\frac{1}{2}\cos 2x}$ their constant will be $C = \ldots \left(\dfrac{3}{2}e^{\frac{1}{2}}\right)$