Question Number	Scheme	Notes	Marks
6	$2\dfrac{\mathrm{d}y}{\mathrm{d}x}+\left(\cot x\right)y+\left(\tan x\sec x\right)y^3=0$		
(a)	$z=\dfrac{1}{y^2}\Rightarrow\dfrac{\mathrm{d}z}{\mathrm{d}x}=-\dfrac{2}{y^3}\dfrac{\mathrm{d}y}{\mathrm{d}x}$ or $y^2=\dfrac{1}{z}\Rightarrow 2y\dfrac{\mathrm{d}y}{\mathrm{d}x}=-\dfrac{1}{z^2}\dfrac{\mathrm{d}z}{\mathrm{d}x}\ \left\{=-y^4\dfrac{\mathrm{d}z}{\mathrm{d}x}\right\}$ or $y=z^{-\frac{1}{2}}\Rightarrow\dfrac{\mathrm{d}y}{\mathrm{d}x}=-\dfrac{1}{2}z^{-\frac{3}{2}}\dfrac{\mathrm{d}z}{\mathrm{d}x}$	Any correct equation in $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ and $\dfrac{\mathrm{d}z}{\mathrm{d}x}$ (may be implied)	B1
	$-y^3\dfrac{\mathrm{d}z}{\mathrm{d}x}+\left(\cot x\right)y+\left(\tan x\sec x\right)y^3=0$	Substitutes to obtain an equation with $\dfrac{\mathrm{d}z}{\mathrm{d}x}$ as the only derivative	M1
	$-\dfrac{\mathrm{d}z}{\mathrm{d}x}+\dfrac{\cot x}{y^2}+\tan x\sec x=0$ $\dfrac{\mathrm{d}z}{\mathrm{d}x}-\left(\cot x\right)z=\tan x\sec x$ *	Fully correct proof with intermediate step after substitution	A1*
			(3)
(b)	$\text{I.F.}=\mathrm{e}^{\int-\cot x\,\mathrm{d}x}$	$\text{I.F.}=\mathrm{e}^{\int\pm\cot x\,\mathrm{d}x}$	M1
	$=\mathrm{e}^{-\ln\sin x}=\dfrac{1}{\sin x}$	Correct processed I.F. in any form	A1
	$\dfrac{z}{\sin x}=\int\dfrac{1}{\sin x}\times\dfrac{\sin x}{\cos x}\times\dfrac{1}{\cos x}\mathrm{d}x$	Applies $\text{I.F.}\times z=\int\text{I.F.}\times\tan x\sec x\,\mathrm{d}x$ Condone y for z	M1
	$\dfrac{z}{\sin x}=\int\sec^2 x\,\mathrm{d}x\Rightarrow\dfrac{z}{\sin x}=\tan x\ \left(+c\right)$	Correct equation in z and x Condone missing "+c"	A1
	$z=\sin x\left(\tan x+c\right)\Rightarrow y^2=\dfrac{1}{\sin x\left(\tan x+c\right)}$ oe	Fully correct general solution. Accept equivalent forms.	A1
			(5)
(c)	$\dfrac{4\sqrt{3}}{3}=\dfrac{1}{\frac{1}{2}\left(\frac{\sqrt{3}}{3}+c\right)}\Rightarrow\dfrac{\sqrt{3}}{3}+c=\dfrac{\sqrt{3}}{2}\Rightarrow c=...\left(\dfrac{\sqrt{3}}{6}\right)$	Correctly substitutes the given values to find a value for c	M1
	$x=\dfrac{\pi}{3}\Rightarrow y^2=\dfrac{1}{\frac{\sqrt{3}}{2}\left(\sqrt{3}+\frac{\sqrt{3}}{6}\right)}=\dfrac{4}{7}$ $\Rightarrow y=\pm\dfrac{2\sqrt{7}}{7}$ oe	**d**M1: Substitutes $x=\dfrac{\pi}{3}$ and their c into their equation and reaches $y^2=...$ or $y=$ with trig terms evaluated. A1: Both correct exact values. The negative value must not be rejected.	**d**M1 A1
			(3)
			Total 11

Additional Notes:

Condone poor notation of $\sin^{-1}x$ for cosec x as long as it is treated correctly.

(a) Note for A mark you may condone a missing "=0" in intermediate lines as long as it is implied by working.

(b) Note an equivalent form for the answer is $y^2=\dfrac{\cos x}{\sin^2 x+K\sin 2x}$ which will lead to $c=\dfrac{\sqrt{3}}{12}$ in (c)