Question Number	Scheme	Notes	Marks
3(a)	$x^2\dfrac{\mathrm{d}y}{\mathrm{d}x}+xy=2y^2 \qquad y=\dfrac{1}{z}$		
	$\dfrac{\mathrm{d}y}{\mathrm{d}x}=-\dfrac{1}{z^2}\dfrac{\mathrm{d}z}{\mathrm{d}x}$	Correct differentiation	B1
	$-\dfrac{x^2}{z^2}\dfrac{\mathrm{d}z}{\mathrm{d}x}+\dfrac{x}{z}=\dfrac{2}{z^2}$	Substitutes into the given differential equation	M1
	$\dfrac{\mathrm{d}z}{\mathrm{d}x}-\dfrac{z}{x}=-\dfrac{2}{x^2}*$	Achieves the printed answer with no errors. Allow this to be written down following a correct substitution i.e. with no intermediate step.	A1*
			(3)
(a) Way 2	$y=\dfrac{1}{z}\Rightarrow zy=1\Rightarrow y\dfrac{\mathrm{d}z}{\mathrm{d}x}+z\dfrac{\mathrm{d}y}{\mathrm{d}x}=0$	Correct differentiation	B1
	$-\dfrac{y}{z}x^2\dfrac{\mathrm{d}z}{\mathrm{d}x}+\dfrac{x}{z}=\dfrac{2}{z^2}$	Substitutes into the given differential equation	M1
	$\dfrac{\mathrm{d}z}{\mathrm{d}x}-\dfrac{z}{x}=-\dfrac{2}{x^2}*$	Achieves the printed answer with no errors. Allow this to be written down following a correct substitution i.e. with no intermediate step.	A1*
(a) Way 3	$y=\dfrac{1}{z}\Rightarrow z=\dfrac{1}{y}\Rightarrow\dfrac{\mathrm{d}z}{\mathrm{d}x}=-\dfrac{1}{y^2}\dfrac{\mathrm{d}y}{\mathrm{d}x}$	Correct differentiation	B1
	$-\dfrac{1}{y^2}\dfrac{\mathrm{d}y}{\mathrm{d}x}-\dfrac{1}{xy}=-\dfrac{2}{x^2}$	Substitutes into differential equation (II)	M1
	$x^2\dfrac{\mathrm{d}y}{\mathrm{d}x}+xy=2y^2$	Obtains differential equation (I) with no errors. Allow this to be written down following a correct substitution i.e. with no intermediate step.	A1*
(b)	$I=\mathrm{e}^{-\int\frac{1}{x}\mathrm{d}x}=\mathrm{e}^{-\ln x}=\dfrac{1}{x}$	Correct integrating factor of $\dfrac{1}{x}$	B1
	$\dfrac{z}{x}=-\int\dfrac{2}{x^3}\mathrm{d}x$	For $Iz=-\int\dfrac{2I}{x^2}\mathrm{d}x$. Condone the "dx" missing.	M1
	$\dfrac{z}{x}=\dfrac{1}{x^2}+c$	Correct equation including constant	A1
	$z=\dfrac{1}{x}+cx$	Correct equation in the required form	A1
			(4)
(c)	$\dfrac{1}{y}=\dfrac{1}{x}+cx\Rightarrow-\dfrac{8}{3}=\dfrac{1}{3}+3c\Rightarrow c=-1$	Reverses the substitution and uses the given conditions to find their constant	M1

	$\frac{1}{y}=\frac{1}{x}-x \Rightarrow y=\frac{x}{1-x^2}$	Correct equation for y in terms of x. Allow any correct equivalents e.g. $y=\frac{1}{x^{-1}-x}$, $y=\frac{1}{\frac{1}{x}-x}$	A1
			(2)
			Total 9