Question Number	Scheme	Notes	Marks
7.	$x^2\dfrac{\mathrm{d}^2y}{\mathrm{d}x^2}-2x\dfrac{\mathrm{d}y}{\mathrm{d}x}+(2-x^2)y=2x^3$		
(a)	$y=vx\Rightarrow\dfrac{\mathrm{d}y}{\mathrm{d}x}=\dfrac{\mathrm{d}v}{\mathrm{d}x}x+v$	Correct expression	B1
	$\dfrac{\mathrm{d}^2y}{\mathrm{d}x^2}=\dfrac{\mathrm{d}^2v}{\mathrm{d}x^2}x+2\dfrac{\mathrm{d}v}{\mathrm{d}x}$	$\dfrac{\mathrm{d}^2y}{\mathrm{d}x^2}=\alpha x\dfrac{\mathrm{d}^2v}{\mathrm{d}x^2}+\beta\dfrac{\mathrm{d}v}{\mathrm{d}x}$	M1
		$\dfrac{\mathrm{d}^2y}{\mathrm{d}x^2}=\dfrac{\mathrm{d}^2v}{\mathrm{d}x^2}x+2\dfrac{\mathrm{d}v}{\mathrm{d}x}$	A1
	$x^2\left(\dfrac{\mathrm{d}^2v}{\mathrm{d}x^2}x+2\dfrac{\mathrm{d}v}{\mathrm{d}x}\right)-2x\left(\dfrac{\mathrm{d}v}{\mathrm{d}x}x+v\right)+\left(2-x^2\right)vx=2x^3$ Substitutes their $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ and $\dfrac{\mathrm{d}^2y}{\mathrm{d}x^2}$ into the given equation to give an equation in x and v only		M1
	$\dfrac{\mathrm{d}^2v}{\mathrm{d}x^2}-v=2*$	Correct proof with no errors with at least one more line of working (usually $x^3\dfrac{\mathrm{d}^2v}{\mathrm{d}x^2}-x^3v=2x^3$)	A1
			(5)
(b)	$m^2-1=0\Rightarrow m=\pm1$	Attempts to solve $"m"^2-1=0$	M1
	$\left(v=\right)Ae^{x}+Be^{-x}$	Correct CF (v = … not required)	A1
	PI is –2	Correct PI	B1
	$v=CF\ +\ PI\ =...$	Adds their CF and their non-zero PI to find v in terms of x. **Must be v =… here unless this is implied by subsequent work.**	M1
	$\left(y=\right)x\left(CF\ +\ PI\right)$	Multiplies their v by x to find y in terms of x. (Can be awarded if no PI is found or their PI = 0)	M1
	$y=Axe^{x}+Bxe^{-x}-2x$	Correct expression. Must be y = …	A1
			(6)
(c)	$\dfrac{\mathrm{d}y}{\mathrm{d}x}=Axe^{x}+Ae^{x}-Bxe^{-x}+Be^{-x}-2$	Differentiate their GS wrt x using the Product Rule	M1
	$x=1,y=\mathrm{e}\Rightarrow\mathrm{e}=A\mathrm{e}+B\mathrm{e}^{-1}-2$ and $x=1,\dfrac{\mathrm{d}y}{\mathrm{d}x}=\mathrm{e}$ $\Rightarrow\mathrm{e}=A\mathrm{e}+A\mathrm{e}-B\mathrm{e}^{-1}+B\mathrm{e}^{-1}-2$	Substitutes the given values in for y and $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ to obtain 2 equations	M1
	$A=\dfrac{\mathrm{e}+2}{2\mathrm{e}},\ B=\dfrac{\mathrm{e}(\mathrm{e}+2)}{2}$	Both values correct or exact equivalent	A1
	$y=\left(\dfrac{\mathrm{e}+2}{2\mathrm{e}}\right)xe^{x}+\left(\dfrac{\mathrm{e}(\mathrm{e}+2)}{2}\right)xe^{-x}-2x$	Correct expression (or equivalent). Must be y = …	A1
			(4)
			Total 15