Question Number	Scheme	Marks
4	$4\dfrac{\mathrm{d}^2y}{\mathrm{d}x^2}-4\dfrac{\mathrm{d}y}{\mathrm{d}x}+y=2\mathrm{e}^{\frac{1}{2}x}$	
(a)	$\left(\text{AE:}\right)\ 4m^2-4m+1=0$ $\left[\Rightarrow\left(2m-1\right)^2=0\right]$ $\Rightarrow m=\dfrac{1}{2}$	M1
	$\left(\text{CF:}y=\right)\ \left(A+Bx\right)\mathrm{e}^{\frac{1}{2}x}$	A1
	$\left(\text{PI:}y=\right)\ \lambda x^2\mathrm{e}^{\frac{1}{2}x}$	B1
	$y'=2\lambda x\mathrm{e}^{\frac{1}{2}x}+\dfrac{\lambda}{2}x^2\mathrm{e}^{\frac{1}{2}x}=\mathrm{e}^{\frac{1}{2}x}\left(\dfrac{\lambda}{2}x^2+2\lambda x\right)$	M1
	$y''=\dfrac{1}{2}\mathrm{e}^{\frac{1}{2}x}\left(\dfrac{\lambda}{2}x^2+2\lambda x\right)+\mathrm{e}^{\frac{1}{2}x}\left(\lambda x+2\lambda\right)=\mathrm{e}^{\frac{1}{2}x}\left(\dfrac{\lambda}{4}x^2+2\lambda x+2\lambda\right)$	dM1
	Substituting into given equation to get $\mathrm{e}^{\frac{1}{2}x}\left[\left(\lambda x^2+8\lambda x+8\lambda\right)-\left(2\lambda x^2+8\lambda x\right)+\lambda x^2\right]=2\mathrm{e}^{\frac{1}{2}x}$ $\Rightarrow 8\lambda=2\Rightarrow\lambda=\ldots$	ddM1
	$y=\left(A+Bx\right)\mathrm{e}^{\frac{1}{2}x}+\dfrac{1}{4}x^2\mathrm{e}^{\frac{1}{2}x}$	A1ft
		(7)
(b)	Sub $\left(0,1\right)\Rightarrow\cdots\left(1=A\right)$	B1
	$\dfrac{\mathrm{d}y}{\mathrm{d}x}=B\mathrm{e}^{\frac{1}{2}x}+\dfrac{1}{2}\left(A+Bx\right)\mathrm{e}^{\frac{1}{2}x}+\dfrac{1}{2}x\mathrm{e}^{\frac{1}{2}x}+\dfrac{1}{8}x^2\mathrm{e}^{\frac{1}{2}x}$	M1
	$\mathrm{e}^{\frac{1}{2}}=B+\dfrac{A}{2}\Rightarrow B=\mathrm{e}^{\frac{1}{2}}-\dfrac{1}{2}$ $\left[y\right]=\left(1+\left(\mathrm{e}^{\frac{1}{2}}-\dfrac{1}{2}\right)x\right)\mathrm{e}^{\frac{1}{2}x}+\dfrac{1}{4}x^2\mathrm{e}^{\frac{1}{2}x}$ oe	M1A1
		(4)
		Total 11

Notes

Allow recovery from mixed/incorrect variables etc but if not recovered then A and B marks may be lost

(a)

M1: Forms the auxiliary equation (condone one slip/copying error) and solves 3TQ (usual rules). One consistent solution if no working (could be complex). Implied by a correct CF if no incorrect working shown.

A1: Correct complementary function $y = ...$ not required. May only be seen in final answer.

B1: Correct form for particular integral $y = ...$ not required.

M1: Differentiates their PI using the product rule- allowing for sign/coefficient errors only

dM1: Differentiates their PI twice using the product rule- allowing for sign/coefficient errors only. **Dependent on the previous M mark.**

ddM1: Dependent on both previous M marks Substitutes into the given equation, equates coefficients and obtains a value for λ. Must be comparing like terms.

A1ft: A correct general solution following through on their CF only - **the PI must be correct**. Must have " $y =$ " e.g., not " GS = "

Note:

If a candidate uses a PI of the form $\lambda x e^{\frac{1}{2}x}$ then they can score a max of M1A1B0M1M1M0A0

If a candidate uses a PI of the form $\lambda e^{\frac{1}{2}x}$ then they can score a max of M1A1B0M0M0M0A0

(b)

B1: Uses (0, 1) in their answer to (a) and forms an equation in one or both of their constants. This mark could be implied by a correct value for 'A' from a correct part (a).

M1: Differentiates their GS, which must contain a term "Bxe^{kx}" and a non-zero PI, to obtain an expression of the correct form for the derivative- product rule must be used, allowing for sign/coefficient errors only

M1: Substitutes $x = 0, \frac{dy}{dx} = e^{\frac{1}{2}}$ into their equation where their derivative is a changed function and finds values for their B (and their A if not found already).

A1: Any correct expression. Condone e.g., " PS =... "