Question	Scheme	Marks
5	$\frac{dy}{dx} = 2e^{2x}\left(x^2 - 5x\right) + e^{2x}\left(2x - 5\right) \Rightarrow \left[e^{2x}\left(2x - 5\right) = \frac{dy}{dx} - 2y\right]$	M1A1A1
	$\frac{d^2y}{dx^2} = 4e^{2x}\left(x^2 - 5x\right) + 2e^{2x}\left(2x - 5\right) + 2e^{2x}\left(2x - 5\right) + 2e^{2x}$	M1A1
	$\left[\text{OR} \quad \frac{d^2y}{dx^2} = 2\frac{dy}{dx} + 2e^{2x}\left(2x - 5\right) + 2e^{2x}\right]$	
	$\frac{d^2y}{dx^2} = 2\frac{dy}{dx} + 2\left[\frac{dy}{dx} - 2y\right] + 2e^{2x}$	M1
	$\Rightarrow 2e^{2x} = \frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y \quad *$	A1 cso [7]
	ALT 1 LHS = RHS	
	$\frac{dy}{dx} = 2e^{2x}\left(x^2 - 5x\right) + e^{2x}\left(2x - 5\right) = 2e^{2x}x^2 - 10xe^{2x} + 2e^{2x}x - 5e^{2x}$	
	$\left[= 2e^{2x}x^2 - 8e^{2x}x - 5e^{2x}\right]$	[M1A1A1
	$\frac{d^2y}{dx^2} = 4e^{2x}x^2 + 4e^{2x}x - 8e^{2x} - 16e^{2x}x - 10e^{2x}$	
	$\left[= 4e^{2x}x^2 - 12e^{2x}x - 18e^{2x}\right]$	M1A1
	$\textbf{RHS} = 4e^{2x}x^2 - 12e^{2x}x - 18e^{2x} - 4\left(2e^{2x}x^2 - 8e^{2x}x - 5e^{2x}\right) + 4\left(e^{2x}x^2 - 5e^{2x}\right)$	
	$\textbf{RHS} = 4e^{2x}x^2 - 12e^{2x}x - 18e^{2x} - 8e^{2x}x^2 + 32e^{2x}x + 20e^{2x} + 4e^{2x}x^2 - 20e^{2x}x$	M1
	$\textbf{RHS} = 2e^{2x} = \textbf{LHS} \quad *$	A1]
	ALT 2 LHS = RHS	
	$\frac{dy}{dx} = 2e^{2x}\left(x^2 - 5x\right) + e^{2x}\left(2x - 5\right) = \left[e^{2x}\left(2x^2 - 8x - 5\right)\right]$	[M1A1A1
	$\frac{d^2y}{dx^2} = e^{2x}\left(4x - 8\right) + 2e^{2x}\left(2x^2 - 8x - 5\right) = \left[e^{2x}\left(4x^2 - 12x - 18\right)\right]$	M1A1
	$\textbf{RHS} = e^{2x}\left(4x^2 - 12x - 18\right) - 4\left(e^{2x}\left(2x^2 - 8x - 5\right)\right) + 4\left(e^{2x}\left(x^2 - 5x\right)\right)$	
	$\textbf{RHS} = 4e^{2x}x^2 - 12e^{2x}x - 18e^{2x} - 8e^{2x}x^2 + 32e^{2x}x + 20e^{2x} + 4e^{2x}x^2 - 20e^{2x}x$	M1
	$\textbf{RHS} = 2e^{2x} = \textbf{LHS} \quad *$	A1]
		Total 7 marks

Mark	Notes
General principles of marking this question. • You must read every line of working carefully. • The first 3 marks are for the correct application of Product Rule • The next 2 marks are for the correct reapplication of Product rule. • The final M mark is effectively for rearranging/substituting to the required form. • The final mark is only to be awarded if everything is correct**. This is a show question.** **Some candidates may use implicit differentiation, this is absolutely fine.**	
M1	For an attempt at product rule. • There must be an acceptable attempt to differentiate both terms. • The correct formula must be applied. • Minimally acceptable differentiation is as follows: $e^{2x} \Rightarrow \pm ke^{2x}$ and $x^2 - 5x \Rightarrow \pm(2x-5)$
A1	For one term correct within product rule
A1	For a fully correct derivative.
M1	For differentiating their first derivative a second time to find the second derivative. There are several different ways this can be completed. Please apply the same rules for the second derivative as for the first. There must be only 4 terms here out of which, award this mark for at **least two** terms correct.
A1	For a fully correct $\frac{d^2y}{dx^2}$ in any form
M1	For substituting $e^{2x}(2x-5) = \frac{dy}{dx} - 2y$
A1cso	For the correct final expression with no errors.
ALT 1 and 2	
M1	For an attempt at product rule. • There must be an acceptable attempt to differentiate both terms. • The correct formula must be applied. • Minimally acceptable differentiation is as follows: $e^{2x} \Rightarrow \pm ke^{2x}$ and $x^2 - 5x \Rightarrow \pm(2x-5)$
A1	For one term correct within product rule
A1	For both terms fully correct.
M1	For differentiating their first derivative a second time to find the second derivative. There are several different ways this can be completed. Please apply the same rules for the second derivative as for the first. Look for two out of four terms correct If their starting point is $\frac{dy}{dx} = e^{2x}(2x^2 - 8x - 5)$ or $2e^{2x}x^2 - 8e^{2x}x - 5e^{2x}$ check their differentiation for the M mark and apply 1 out of 2, or 2 out of 4 correct..
A1	For a fully correct $\frac{d^2y}{dx^2}$ in any form
M1	Collects up all terms on the RHS to obtain Ke^{2x} $K \neq 0$ **Please check their working carefully.**
A1cso	For the correct final expression with no errors.