

Question number	Scheme	Marks
7 a	$\frac{dy}{dx} = 2e^{2x} \cos 2x - 2e^{2x} \sin 2x$ $\frac{dy}{dx} = 2y - 2e^{2x} \sin 2x$ *	M1 A1 A1 A1 cso (4)
b	$\frac{d^2y}{dx^2} = 2 \frac{dy}{dx} - 4e^{2x} \sin 2x - 4e^{2x} \cos 2x$ $\frac{d^2y}{dx^2} = 2 \frac{dy}{dx} + 2 \left(\frac{dy}{dx} - 2y \right) - 4y$ $\frac{d^2y}{dx^2} = 4 \frac{dy}{dx} - 8y$ *	M1 A1 dM1ddM1 A1 cso (5)
Total 9 marks		

Part	Mark	Notes
(a)	M1	For an attempt to use the product rule. The definition of an attempt is as follows: <ul style="list-style-type: none"> There must be a correct attempt to differentiate both terms. $\cos 2x \Rightarrow \pm 2 \sin 2x$ $e^{2x} \Rightarrow 2e^{2x}$ where $x \neq 0$ The terms must be added The correct formula must be used.
	A1	For one term correct
	A1	For both terms correct
	A1 cso	For obtaining the given result with no errors seen.
(b)	Method 1	
	M1	For attempting to differentiate $\frac{dy}{dx}$ to obtain $\frac{d^2y}{dx^2}$ $\frac{d^2y}{dx^2} = 4e^{2x} \cos 2x - 4e^{2x} \sin 2x - 4e^{2x} \sin 2x - 4e^{2x} \cos 2x$ For this mark accept either: $(4e^{2x} \cos 2x - 4e^{2x} \sin 2x)$ OR $-4e^{2x} \sin 2x - 4e^{2x} \cos 2x$
	A1	For the correct $\frac{d^2y}{dx^2}$ (This is an M mark in Epen)
	dM1	For simplifying $\frac{d^2y}{dx^2}$ to obtain $\frac{d^2y}{dx^2} = -8e^{2x} \sin 2x$ (A mark in Epen) This mark is dependent on the first M mark

ddM1	For using the substitution $-2e^{2x} \sin 2x = \frac{dy}{dx} - 2y \Rightarrow -8e^{2x} \sin 2x = 4 \frac{dy}{dx} - 8y$ This mark is dependent on BOTH previous M marks.
A1cso	For obtaining the given result with no errors seen. $\frac{d^2y}{dx^2} = 4 \frac{dy}{dx} - 8y$
Method 2	
M1	For attempting to differentiate $\frac{dy}{dx}$ to obtain $\frac{d^2y}{dx^2}$ $\frac{d^2y}{dx^2} = 2 \frac{dy}{dx} - 4e^{2x} \sin 2x - 4e^{2x} \cos 2x$ For this mark accept either: $2 \frac{dy}{dx}$ or $-4e^{2x} \sin 2x - 4e^{2x} \cos 2x$
A1	For the correct $\frac{d^2y}{dx^2}$ This is an M mark in Epen
dM1	For substituting $-4e^{2x} \cos 2x \Rightarrow -2y$ This is an A mark in Epen
ddM1	For using the substitution $-4e^{2x} \sin 2x = 2 \frac{dy}{dx} - 4y$
A1	For obtaining the given result with no errors seen. $\frac{d^2y}{dx^2} = 4 \frac{dy}{dx} - 8y$
Method 3 – Works form LHS and RHS together.	
M1	For attempting to differentiate $\frac{dy}{dx}$ to obtain $\frac{d^2y}{dx^2}$ $\frac{d^2y}{dx^2} = 4e^{2x} \cos 2x - 4e^{2x} \sin 2x - 4e^{2x} \sin 2x - 4e^{2x} \cos 2x$ For this mark accept either: $(4e^{2x} \cos 2x - 4e^{2x} \sin 2x)$ OR $-4e^{2x} \sin 2x - 4e^{2x} \cos 2x$
A1	For the correct $\frac{d^2y}{dx^2}$ This is an M mark in Epen
dM1	For simplifying $\frac{d^2y}{dx^2}$ to obtain $\frac{d^2y}{dx^2} = -8e^{2x} \sin 2x$ (A mark in Epen) This mark is dependent on the first M mark
ddM1	Multiplies out the given expression in (b) $\frac{d^2y}{dx^2} = 4 \frac{dy}{dx} - 8y = 4(2e^{2x} \cos 2x - 2e^{2x} \sin 2x) - 8(e^{2x} \cos 2x)$ $= 8e^{2x} \cos 2x - 8e^{2x} \sin 2x - 8e^{2x} \cos 2x$ $= -8e^{2x} \sin 2x$