Question Number	Scheme	Marks
7(a)	$y = \mathrm{e}^x \sin x \Rightarrow \left(\frac{\mathrm{d}y}{\mathrm{d}x} =\right) \mathrm{e}^x \sin x + \mathrm{e}^x \cos x$ $\Rightarrow \left(\frac{\mathrm{d}^2y}{\mathrm{d}x^2} =\right) \mathrm{e}^x \sin x + \mathrm{e}^x \cos x + \mathrm{e}^x \cos x - \mathrm{e}^x \sin x = 2\mathrm{e}^x \cos x$ (oe – see notes)	M1
	E.g. (see notes for equivalents) $\Rightarrow \left(\frac{\mathrm{d}^3y}{\mathrm{d}x^3} =\right) 2\mathrm{e}^x \cos x - 2\mathrm{e}^x \sin x$ $\Rightarrow \frac{\mathrm{d}^4y}{\mathrm{d}x^4} = 2\mathrm{e}^x \cos x - 2\mathrm{e}^x \sin x - 2\mathrm{e}^x \cos x - 2\mathrm{e}^x \sin x$ $\frac{\mathrm{d}^4y}{\mathrm{d}x^4} = -4\mathrm{e}^x \sin x = -4y$ (oe – see notes)	dM1 A1
	$\Rightarrow \frac{\mathrm{d}^4y}{\mathrm{d}x^4} = -4y \Rightarrow \frac{\mathrm{d}^5y}{\mathrm{d}x^5} = -4\frac{\mathrm{d}y}{\mathrm{d}x} \Rightarrow \frac{\mathrm{d}^6y}{\mathrm{d}x^6} = -4\frac{\mathrm{d}^2y}{\mathrm{d}x^2}$	A1
		(4)
(b)	$(y)_0 = 0, \left(\frac{\mathrm{d}y}{\mathrm{d}x}\right)_0 = 1, \left(\frac{\mathrm{d}^2y}{\mathrm{d}x^2}\right)_0 = 2, \left(\frac{\mathrm{d}^3y}{\mathrm{d}x^3}\right)_0 = 2, \left(\frac{\mathrm{d}^4y}{\mathrm{d}x^4}\right)_0 = 0, \left(\frac{\mathrm{d}^5y}{\mathrm{d}x^5}\right)_0 = -4, \left(\frac{\mathrm{d}^6y}{\mathrm{d}x^6}\right)_0 = -8$	M1
	$(y =) 0 + x + \frac{x^2}{2} \times 2 + \frac{x^3}{3!} \times 2 + 0 - \frac{x^5}{5!} \times 4 - \frac{x^6}{6!} \times 8 + \ldots$	M1
	$(y =) x + x^2 + \frac{x^3}{3} - \frac{x^5}{30} - \frac{x^6}{90} + \ldots$	A1
		(3)
		Total 7

Notes: Accept other forms of notation for the derivatives, e.g. *y*' etc.

(a)

M1: Applies the product rule on *y* and *y*' to reach at least the second derivative. Condone mislabelling of the derivatives for the Ms. May work in terms of *x* or *y* or a combination of both, e.g. $y' = y + \mathrm{e}^x \cos x, y'' = y' + \mathrm{e}^x \cos x - \mathrm{e}^x \sin x = y' - y + \mathrm{e}^x \cos x = 2y' - 2y$ etc

dM1: Continues the differentiation process to obtain an expression for the 4th derivative. Again, may be working in either *x* or *y* or a combination of both.

A1: Any correct fourth derivative expression, may be unsimplified and award when first seen, e.g. may identify $\frac{\mathrm{d}^4y}{\mathrm{d}x^4} = -4y$ or even $2y''' - 2y''$. Must be correctly identified as the fourth derivative.

A1: Completes the process to obtain a correct expression, or for $k = -4$. May work in *x* or *y* or a mixture for the final derivatives.

E.g. $y^{vi} = 2y^v - 2y^{iv} = 4y^{iv} - 4y''' - 2y^{iv} = 2y^{iv} - 4y''' = 4y''' - 4y'' - 4y''' = -4y''$ is one possible variation, but others are possible with earlier eliminations. Most will use main scheme.

(b)

M1: Attempts to find values for all 6 derivatives at $x = 0$, but condone one missing as a slip. Accept values seen stated for each derivative as an attempt.

M1: Applies Maclaurin's theorem correctly with their values, allowing for one slip in the factorials, up to the term in x^6 (or a fifth non-zero term if errors mean the x^6 terms is not needed).

A1: Correct expansion, condone missing the "*y* = ".