

Question	Scheme	Marks
8(a)	$\left(\frac{dy}{dx} = \frac{5x^2 \times 2 \times 3 \times e^{3x+1} - 10x \times 2e^{3x+1}}{(5x^2)^2} \text{ oe}$ $\left(\frac{dy}{dx} = \frac{xe^{3x+1}(30x-20)}{25x^4} \text{ or } \frac{10xe^{3x+1}(3x-2)}{25x^4}\right.$ $\left. = \left[\frac{10e^{3x+1}(3x-2)}{25x^3} \right] = \frac{2e^{3x+1}(3x-2)}{5x^3}\right.$	M1A1A1 dM1 A1 [5]
ALT – use of product rule	$\left(\frac{dy}{dx} = \right) 2e^{3x+1}(-1) \times 2 \times 5x \times (5x^2)^{-2} + 2 \times 3e^{3x+1}(5x^2)^{-1} \text{ oe}$ $= x \times (5x^2)^{-2} e^{3x+1}(-20 + 30x) \text{ or } 10x \times (5x^2)^{-2} e^{3x+1}(-2 + 3x)$ $= \left[\frac{10e^{3x+1}(3x-2)}{25x^3} \right] = \frac{2e^{3x+1}(3x-2)}{5x^3}$	M1A1A1 dM1 A1 [5]
(b)	$\left(\frac{\delta y}{y} \times 100 = \right) \left[\frac{2xe^{3x+1}(3x-2)}{5x^4} \right] \times \delta x \times \frac{100}{y} \text{ or } \left[\frac{2e^{3x+1}(3x-2)}{5x^3} \right] \times \delta x \times \frac{100}{y} \text{ oe}$ $\text{or } (\delta y =) \left[\frac{2xe^{3x+1}(3x-2)}{5x^4} \right] \times \delta x \text{ or } \left[\frac{2e^{3x+1}(3x-2)}{5x^3} \right] \times \delta x \text{ or } y \times \frac{(3x-2)}{5x} \times \delta x$ $\delta x \text{ may also be written as } 0.02x$ $\left(\frac{\delta y}{y} \times 100 = \right) \frac{2e^{3x+1}(3x-2)}{5x^3} \times 0.02x \times \frac{100}{\frac{2e^{3x+1}}{5x^2}} \text{ oe}$ $\text{or } y \times \frac{(3x-2)}{x} \times 0.02x \times \frac{100}{y}$ $(\% \text{ change in } y =) 6x - 4$	M1 dM1 A1 [3]
Total 8 marks		

Part	Mark	Notes
(a)	M1	For attempting to use the quotient rule. The definition of an attempt is as follows: <ul style="list-style-type: none"> The denominator must be correct. The terms in the numerator subtracted either way around The expression must be of the form: $\frac{K \times x^2 \times e^{3x+1} - L \times x \times e^{3x+1}}{(5x^2)^2} \quad K \neq 10 \text{ or } 15 \text{ and } L \neq 10 \text{ and } K, L > 0$ Note K and L may not be simplified and will often need to be checked.
	A1	Following M1 (general principle of marking), at least one fully correct simplified or unsimplified term on the numerator.
	A1	Fully correct unsimplified derivative
	dM1	For correctly taking out common factors of x and e^{3x+1} and attempting to simplify. A numerical factor does not need to be taken out at this point. Dependent on the 1 st method mark.
	A1	For the correct derivative in the required form.
ALT use of product rule	M1	For attempting to use the product rule to give an expression of the form $Me^{3x+1}x \times (5x^2)^{-2} + Ne^{3x+1}(5x^2)^{-1} \quad M < 0 \text{ and } \neq 4, 10 \quad N > 0 \text{ and } \neq 2, 3$
	A1	Following M1 (general principle of marking), at least one term is fully correct.
	A1	Fully correct unsimplified derivative
	M1	For correctly taking out common factors of x and $(5x^2)^{-2}$ and e^{3x+1} and attempting to simplify. A numerical factor does not need to be taken out at this point. Dependent on the 1 st method mark.
	A1	For the correct derivative in the required form.
For the final M mark in particular – any work felt to be of credit not fitting the mark scheme – send to Review.		
(b)	M1	For any of the statements shown, using their answer from part (a), which must be of the form: $\frac{Ae^{3x+1}(Bx - C)}{Dx^3}$ Note, we'll allow candidates to use an expression here that is not quite of the form given in part (a). This mark may be implied by further correct working.
	dM1	For substituting in the expression for y and a correct attempt to simplify their expression to the required form. You must check their working here, do not allow an answer that has come from incorrect working (general principle anyway, but extra care needed for this question). Condone 100 written as 100% if the candidate is correctly multiplying by 100. Dependent on previous method mark.
	A1	For the correct expression as shown.