

Question	Scheme	Marks	AOs
8(a)	$\lim_{\delta x \rightarrow 0} \sum_{x=0}^3 xe^{2x} \delta x = \int_0^3 xe^{2x} dx$	B1	1.2
		(1)	
(b)	$\int xe^{2x} dx = \frac{1}{2} xe^{2x} - \frac{1}{2} \int e^{2x} dx$	M1	3.1a
	$\int xe^{2x} dx = \frac{1}{2} xe^{2x} - \frac{1}{4} e^{2x} (+c)$	A1	1.1b
	$\int_0^3 xe^{2x} dx = \left[\frac{1}{2} xe^{2x} - \frac{1}{4} e^{2x} \right]_0^3 = \frac{3}{2} e^6 - \frac{1}{4} e^6 - \left(-\frac{1}{4} \right)$	dM1	2.1
	$\frac{5}{4} e^6 + \frac{1}{4}$	A1	2.2a
		(4)	

(5 marks)

Notes

Mark (a) and (b) together

(a)

B1: States $\int_0^3 xe^{2x} dx$ or equivalent but must include the limits and the dx. If not scored in part (a) check part (b) to see if B1 can be scored.

Condone $dx \leftrightarrow \delta x$ as it is very difficult to tell one from another sometimes.

Withhold this mark if there is spurious notation e.g. “lim” or +c

(b)

M1: Obtains an expression of the form $\alpha xe^{2x} - \beta \int e^{2x} (dx)$ oe where $\alpha, \beta > 0$ You do not need to be concerned about how they arrive at this. M1 may be scored via the DI method for the expression of the form $\gamma xe^{2x} - \delta e^{2x}$ where $\gamma, \delta > 0$ (see below notes for A1)

A1: $\frac{1}{2} xe^{2x} - \frac{1}{4} e^{2x} (+c)$ oe Allow this to be unsimplified.

Watch out for the DI method which some will do:

	D	I
+	x	e^{2x}
-	1	$\frac{e^{2x}}{2}$
+	0	$\frac{e^{2x}}{4}$

Giving correct integration $\int_0^3 xe^{2x} dx = \frac{1}{2}xe^{2x} - \frac{1}{4}e^{2x} (+c)$

Score M1 for the expression of the form $\gamma xe^{2x} - \delta e^{2x}$ where $\gamma, \delta > 0$ and A1 for a correct expression

dM1: Applies the limits 0 and 3 to an expression of the form $\gamma xe^{2x} - \delta e^{2x}$ oe where $\gamma, \delta > 0$ and subtracts either way round, achieving the expression of the form $Ae^6 + B$ where $A, B \neq 0$ and which may be unsimplified i.e. terms do not need to be collected. It is dependent on the previous method mark.
An expression with the limits substituted in is sufficient to score this mark or may be implied by $\frac{5}{4}e^6 + \frac{1}{4}$ oe following correct integration.

Do not allow this mark to be scored if they have assumed substituting in 0 into the expression gives a value of 0 unless it was embedded into the expression.

However, condone the slip for $\left[\frac{1}{2}xe^{2x} - \frac{1}{4}e^{2x} \right]_0^3 \Rightarrow \frac{5}{4}e^6 - \frac{1}{4}$ to score dM1A0

A1: $\frac{5}{4}e^6 + \frac{1}{4}$ oe in the required form and all previous marks in (b) must have been scored.

Fractions do not need to be in their lowest terms.

Condone missing/poor notation e.g. missing the dx throughout.

If they subtract the wrong way round then withhold this mark if they just omit the negative signs.

Isw once a correct answer is seen but withhold this mark if there is spurious notation around their final answer

e.g. $\int \frac{5}{4}e^6 + \frac{1}{4} + c dx$ is M1A1dM1A0