Question	Scheme	Marks	AOs
9(a)	$5000-5000\mathrm{e}^{-0.075\times3}=\ldots$	M1	3.4
	1007	A1	1.1b
		(2)	
(b)	$5000-5000\mathrm{e}^{-0.075T}=3000\rightarrow5000\mathrm{e}^{-0.075T}=2000$	M1	1.1b
	$\Rightarrow T=\dfrac{1}{-0.075}\ln\dfrac{2000}{5000}$	dM1	1.1b
	$\Rightarrow T=12.22$	A1	1.1b
		(3)	
(c)	$\left(\dfrac{\mathrm{d}N}{\mathrm{d}t}=\right)-5000\times-0.075\mathrm{e}^{-0.075\times3}=\ldots$	M1	3.4
	299 (car sales per month)	A1	1.1b
		(2)	
(d)	Change the constant 5000 to 6500.	B1	3.5c
		(1)	
			(8 marks)

Notes

(a)

M1: Substitutes $t = 3$ into the given model and proceeds to a value.
Implied by awrt 1007, 1008 or 1010
Condone copying slips e.g. –0.75 or –0.0075 in place of –0.075 or 500 in place of 5000 – in such cases you may need to check their calculation if the substitution isn't shown.

A1: 1007 but allow 1008 or 1010 (3sf). Must be a whole number.
Correct answer only scores both marks. A0 for e.g. 1007.4
Do not ISW if they go on to sum their values of N from $t = 1$ to 3

(b)

M1: Sets $5000-5000\mathrm{e}^{-0.075T}$ equal to 3000 and proceeds to either $A\mathrm{e}^{-0.075T}=B$ or $\mathrm{e}^{-0.075T}=k$ where A, B, k are constants with no restrictions for this mark.
May use t instead of T. Condone slips.
Condone copying slips e.g. –0.75 or –0.0075 in place of –0.075 or 500 in place of 5000.

dM1: Uses the correct order of operations and correct log work from an equation of the form $A\mathrm{e}^{-0.075T}=B$ with $AB > 0$ **or** $\mathrm{e}^{-0.075T}=k$ with $k > 0$ to proceed to a value for T or t which may be a numerical expression.

e.g. $A\mathrm{e}^{-0.075T}=B \Rightarrow \ln A-0.075T=\ln B \Rightarrow T=\dfrac{\ln A-\ln B}{0.075}$ or $=\dfrac{\ln\left(A/B\right)}{0.075}$

Condone log being used in place of ln unless there is clear evidence that they have used an inconsistent base.

May not be scored if "recovered" from e.g. $\mathrm{e}^{-0.075T}=-\dfrac{2}{5}$

Condone copying slips e.g. –0.75 or –0.0075 in place of –0.075 or 500 in place of 5000.

A1: 12.22 cao but must see a correct equation following use of logs, e.g., $-0.075T=\ln\dfrac{2}{5}$ or $T=\dfrac{1}{-0.075}\times-0.916$ which may have intermediate rounding. Ignore any units given.
This mark is available following the occasional slip in writing –0.075 as –0.75 or –0.0075 provided it is not consistently used.

(c)

M1: Differentiates once to the form $\lambda e^{-0.075t}$, λ a constant (even ±5000), and substitutes in $t = 3$
Award for an expression of the form $ke^{-0.075\times3}$ with constant k if no incorrect working is seen.
The substitution of $t = 3$ may be implied by a correct value for their derivative of the required form, provided the derivative is seen. Do not be concerned with what they call their derivative.

A1: awrt 299 (car sales per month). Answer only scores no marks. Condone 300 following 299.4
Requires a correct derivative to be seen, e.g., $375e^{-0.075t}$ o.e., with or without the substitution of $t = 3$ present.
Units may be omitted, but score A0 if an incorrect time frame is given e.g. cars per week

(d)

B1: Acceptable refinement. Some examples:

- Change the 5000 to 6500 (condone ambiguity about which 5000)
- Change the first 5000 to 6500
- Change both 5000s to 6500s
- Multiply the model by 1.3 (or e.g. $\frac{65}{50}$ or $\frac{13}{10}$)
- Add 1500 to the model
- Change the constant to 6500

The statement of an acceptable refined model e.g. $(N =)\ 6500 - 6500e^{-0.075t}$
or e.g. $(N =)\ 6500 - 5000e^{-0.075t}$ scores B1.

Ignore any extra unnecessary refinements such as increase/decrease the 0.075.

The following score B0:

- Change 5000 in the model (not specific enough – they haven't said to 6500)
- Change the second 5000 to 6500 (incorrect)