Question Number	Scheme	Marks
3(a)	$(\cos 2A \equiv)\cos A\cos A - \sin A\sin A \equiv \cos^2 A - (1-\cos^2 A)$	M1
	$\Rightarrow \cos 2A \equiv 2\cos^2 A - 1$ *	A1*
		(2)
(b)	$\int (3-2\cos 6x)\,\mathrm{d}x = 3x - \frac{\sin 6x}{3}$ $(+c)$	M1A1
	$\left[3x - \frac{\sin 6x}{3}\right]_{\frac{\pi}{12}}^{\frac{\pi}{8}} = \left(3\left(\frac{\pi}{8}\right) - \frac{\sin\left(6\times\frac{\pi}{8}\right)}{3}\right) - \left(3\left(\frac{\pi}{12}\right) - \frac{\sin\left(6\times\frac{\pi}{12}\right)}{3}\right) = \frac{1}{8}\pi + \frac{2-\sqrt{2}}{6}$	dM1A1
		(4)
		(6 marks)

Notes

(a)

M1: Writes $(\cos 2A \equiv)\cos A\cos A - \sin A\sin A$ and attempts to **use** (not just stated separately) the identity $\pm\sin^2 A \pm \cos^2 A = \pm 1$ Note going directly to $\cos 2A \equiv \cos^2 A - \sin^2 A$ is allowed M1 as long as a use of the Pythagorean identity is clear. NB Watch out for answers which use double angle identities in the proof (circular reasoning) and score M0 if no Pythagorean identity is used.

A1*: Achieves the given answer with no errors seen (and no circular reasoning). Must see $\cos 2A \equiv \cos A\cos A - \sin A\sin A$ and clear attempt at substitution of $\sin^2 A + \cos^2 A = 1$ but allow "LHS" for "cos 2*A*". Going directly to $\cos 2A \equiv \cos^2 A - \sin^2 A$ in the first step would score A0. Correct notation must used throughout but condone a missing closing bracket.

Note : $\cos 2A = \cos^2 A - \sin^2 A = 2\cos^2 A - 1$ with no further evidence scores M0A0 as they are just writing out known formulae.

(b)

M1: Attempts to substitute in the given result in part (a) and integrates to the form $...x \pm ...\sin 6x$ Must be a full substitution in terms of *x*, $\cos 2A \to k\sin 2A$ is M0 unless recovered, e.g by later substitution may be implied by the limits substituted).

A1: $3x - \frac{\sin 6x}{3}$

dM1: Shows evidence of substituting in both limits into an expression of the form $...x \pm ...\sin 6x$ and subtracts either way round to achieve an exact (not necessarily simplified but trig must be evaluated) answer.

A1: Correct answer e.g as scheme or $\frac{1}{8}\pi + \frac{1}{3} - \frac{\sqrt{2}}{6}$ or exact equivalent (and isw after a correct answer).

Question Number	Scheme	Marks
4(a)	$A = 93$	B1
		(1)
(b)	$100 = 125 - "93"\mathrm{e}^{-0.109T} \Rightarrow A\mathrm{e}^{-0.109T} = ...$	M1
	$A\mathrm{e}^{kT} = B \Rightarrow T = \dfrac{\ln\left(\dfrac{B}{A}\right)}{k}$	dM1
	$T = 12.05$	A1
		(3)
(c)	$\dfrac{\mathrm{d}N}{\mathrm{d}t} = 0.109 \times "93"\mathrm{e}^{-0.109\times 7}$	M1
	4 730 (total sales per month)	A1
		(2)
(d)	The limit is 125 000 / the model has a limit below 150 000	B1
		(1)
		(7 marks)

Notes

(a)

B1: 93

(b)

M1: Sets $100 = 125 - "93"\mathrm{e}^{-0.109T}$ and proceeds to $A\mathrm{e}^{-0.109T} = ...$ May use *t* instead of *T*. Condone slips.

dM1: Uses correct order of operations and correct log work from an equation of form $A\mathrm{e}^{kT} = B,\ AB > 0$ to proceed to a value for *T* (must be a solvable equation). Implied by a correct answer for their equation.

A1: 12.05 cao

Note: Candidates who use 100 000 in the equation will score no marks in this part.

Note: Answer only with no working send to review, but 12.05 following a correct equation seen score M1dM1A1.

(c)

M1: Attempts to differentiate to form $\lambda\mathrm{e}^{-0.109\times t}$, λ constant, and substitutes in $t = 7$. Award for an expression of the form $...\mathrm{e}^{-0.109\times 7}$ if no incorrect working is seen. The substitution of *t* = 7 may be implied by a correct value for their derivative of correct form.

A1: awrt 4 730 (total sales per month). Accept equivalent forms for the answer, e.g. 4.73 thousand, but just 4.73 is A0. "Sales per month" may be omitted, but score A0 if an incorrect unit is given.

Note: Answer only scores no marks.

(d)

B1: A **correct** reason given – any factual statements must be correct. E.g The limit is 125 000 / the model has a limit below 150 000 oe. Accept maximum value of *N* is 125, or *N* cannot reach 150 as asymptote at 125. Also allow attempts to substitute in 150 and find that they cannot take the log a negative number, but score B0 if a "negative time" is reached and used as reason.
Attempts using e.g 150 000 in the equation score B0.
There must be a reference to the information given in the answer, just "number is too large" or similar is B0.