Question Number	Scheme	Marks
1 (a)	$P_0 = 300$	B1 (1)
(b)	$420 = \dfrac{900e^{0.12t}}{2e^{0.12t}+1} \Rightarrow 60e^{0.12t} = 420$	M1 A1
	Correct use of lns $\Rightarrow t = \dfrac{\ln 7}{0.12} = 16.22$	dM1 A1 (4)
(c)	States that maximum number (upper limit) is 450 so cannot reach 500	B1 (1)
		6 marks

(a)

B1 300

(b)

M1 Substitutes $N = 420$ and proceeds to $Ae^{0.12t} = B$ condoning slips

A1 $60e^{0.12t} = 420$ oe

dM1 Uses correct ln work to find *t*. This must be from a solvable equation.

Method 1: $Ae^{0.12t} = B \rightarrow e^{0.12t} = k \rightarrow 0.12t = \ln k \rightarrow t = ...$ ($k > 0$)

Method 2: $Ae^{0.12t} = B \rightarrow \ln A + 0.12t = \ln B \rightarrow t = ...$ (A, $B > 0$)

A1 Awrt 16.22 (years)

Note: **Answers without working** (even to accuracy of 1 dp) can score SC 1100.

Eg. $420 = \dfrac{900e^{0.12t}}{2e^{0.12t}+1} \Rightarrow t = 16.2$