Question	Scheme		Marks	AOs
7 (a)	Finds the gradient of the line $\frac{2.4-2}{20}=(0.02)$		M1	1.1b
	States $\log_{10} P = 0.02t + 2$		A1	2.5
			(2)	
(b)	Uses the model to deduces that $\log_{10} P_0 = 2$		M1	3.4
	Initial population is 100		A1	1.1b
			(2)	
(c)	Uses $\log_{10} P = 0.02t + 2$ $\Rightarrow P = 10^2 \times (10^{0.02})^t$ $\Rightarrow b = 10^{0.02}$	Uses $P = ab^t$ $\Rightarrow \log_{10} P = \log_{10} a + t \log_{10} b$ $\Rightarrow \log_{10} b = 0.02$	M1	2.1
	$b = 1.047$ $P = 100 \times 1.047^t$	$b(=10^{0.02}) = 1.047$ $P = 100 \times 1.047^t$	A1	1.1b
			(2)	
(d)	(i) Substitutes $t = 23$ into $\log_{10} P = 0.02t + 2$ or $P = 100 \times 1.047^t$ and proceeds to find a value for *P*		M1	3.4
	Achieves 288 or 289 red squirrels **and** states that this is significantly more than 198 so model is not valid in 2019		A1	3.5a
	(ii) Gives a suitable reason that explains why there are fewer squirrels • the wood may only be big enough to sustain a certain population • a predator/ competitor may have moved into the wood • weather effects, or disease, may have reduced the numbers after 2016		B1	3.5b
			(3)	
				(9 marks)

Notes:

(a)

M1: Attempts to find the gradient of the line suing the points $(0, 2)$ and $(20, 2.4)$

Condone use of $y = mx + 2$ with the point $(20, 2.4)$

A1: States $\log_{10} P = 0.02t + 2$ using correct notation

(b)

M1: Uses the model to deduce that the initial population of red squirrels is $\log_{10} P_0 = 2$ or 10^2

A1: States 100. This alone scores both marks

(c)

M1: Uses clear reasoning to proceed to an equation for *b*.

Starting at $\log_{10} P = 0.02t + 2$ it requires correct use of inverse logs and index work to arrive at $b = 10^{0.02}$

Starting at $P = ab^t$ or their $P = 100b^t$ it requires taking $\log_{10}$'s and using correct log work to arrive at $\log_{10} b = 0.02$

A1: $b = 1.047$ leading to the equation of the model $P = 100 \times 1.047^t$

(d)(i)

M1: Uses t = 23 in the model $\log_{10} P = 0.02t + 2$ or their $P = 100 \times 1.047^t$ and proceeds as far as P =...

A1: Achieves either 288 or 289 red squirrels, states that this is significantly more than the number of squirrels that are present, so model in not valid in 2019

This mark requires a correct number of squirrels, a correct reason and a (minimal) conclusion

(d)(ii)

B1: Gives a suitable reason that explains why there are fewer squirrels than the model would predict