Question			Answer	Marks	AO	Guidance	
9	(a)		35 seals	**B1** **[1]**	**3.4**	State 35	
9	(b)		$P_{10} = 61.53$ So increase is $P_{10} - P_0$ $= 61.53 - 35$	**M1**	**3.4**	Attempt the difference between their P_{10} and their P_0	Implied by answer of ±26, ±26.5… or ±27
			$61 - 35 = 26$	**A1** **[2]**	**1.1**	Obtain either 26 or 27	Must be an integer value, following subtraction in correct order
9	(c)		$\frac{dP}{dt} = 5 - 2.175e^{0.015t}$	**M1**	**1.1**	Attempt differentiation	Obtain derivative of form $5 + ke^{0.015t}$ Condone a slip in the index eg now $0.15t$ as long as it is a slip and not an attempt to 'reduce the power by 1'
				A1	**1.1**	Correct derivative	
			$5 - 2.175e^{0.015t} = 0$ $e^{0.015t} = \frac{200}{87}$ $0.015t = 0.8324…$	**M1**	**3.1a**	Equate their attempted derivative to 0 (soi) and attempt to rearrange at least as far as $0.015t = c$	As far as a linear equation in t, using correct order of operations Could follow **M0** Allow slip(s) in derivative when equating to 0, eg $0.015t$ becoming $0.15t$
			$t = 55.49…$	**A1**	**1.1**	Obtain a correct value for t	Could be 55 or 56, or decimal, or in exact form with log(s) still present
			$P = 124$ seals	**A1**	**3.2a**	Obtain 124 or 125	**From $55 \leq t \leq 56$** Final answer must be an integer **NB** it is possible to use $0.015t$ to find P, so the t value may never be seen; a correct value for P would imply the penultimate **A1**

Question			Answer	Marks	AO	Guidance	
				[5]			'Determine using calculus' so **SC B1** for answer only of 124 or 125
9	**(d)**		Predicts seal population is eventually 0 (ie dies out) The number of seals will be negative	**B1** [1]	**3.5a**	Sensible consideration of long term behaviour A 'negative' number of seals is what the model does predict Just need to refer to the prediction and not the possible reasons for it, nor how good the model is for the long term behaviour	Condone incorrect value of t in explanation (should be ≈ 106) Stating that the number of seals will decrease is not sufficient; part **(c)** has already identified that there is a maximum value Condone $P \rightarrow -\infty$ **B1 BOD** for P tends to 0