

Question			Answer	Marks	AO	Guidance
10	(a)		When $t = 0$, $A = 8$ so $a = 8$ When $t = 1$, $A = 8.8$ so $b = 0.8$	B1 B1 [2]	3.3 3.3	Allow embedded in $A = 8 + 0.8t$
10	(b)		$15 = 8 + 0.8t$ so $t = 8.75$	B1 [1]	3.4	Allow for “after 9 days” oe FT their values in (a)
10	(c)		The model is linear so gives the same increase each day. 10% increase each day gives bigger increases as the size of the culture increases.	B1 [1]	3.5b	Must indicate the mis-match between the linear model and the exponential observed results either in general terms or for a particular day (Amounts are 8, 8.8 and 9.6 for the model and 8, 8.8 9.68 for the 10% increase) (see appendix)
10	(d)		Using $A = Pe^{kt}$ when $t = 0$ gives $P = 8$ When $t = 1$, $8.8 = 8e^{1k}$ So $k = \ln 1.1 = [0.0953...]$	B1 M1 A1 [3]	3.3 3.3 3.3	cao Forming an equation for k using $t = 1$ and $A = 8.8$ oe FT their value for P Allow for $\ln 1.1$ or a decimal answer to at least 2sf
10	(e)		Area 15 cm^2 when $15 = 8e^{(\ln 1.1)t}$ $t = \frac{\ln\left(\frac{15}{8}\right)}{\ln 1.1} = 6.60$	M1 A1 [2]	3.4 1.1	Correct use of logs in an attempt to solve indicial equation Similarly for $15 = 8 \times 1.1^t$ FT their P and k
10	(f)		The model predicts unlimited growth which is not possible in the laboratory	B1 [1]	3.5b	Must describe what the model predicts and compare with the situation being modelled (see appendix)

Exemplar responses for Q10(c)

Response	Mark
Larger values of t give inaccurate results	B0
Exponential doesn't give the same increase each day	B0
10% of the new area is not 10% of the original area	B0
Original model predicts an increase of 0.8 each day but the increase 10% each day so the model is an underestimate	B1
This model doesn't grow exponentially but increasing by 10% each day would be modelled by that	B1
The model is linear whereas 10% each day is exponential	B1

Exemplar responses for Q10(f)

Response	Mark
It would get too big	B0
It would get impossibly big	B1
There is no limit to the size of the area, but growth will eventually reduce or stop	B0
The area <i>would be</i> too large to be plausible and have to outgrow the lab (would be implies the model)	B1 BOD
For large values of t , the area would be too large (large values of t implies the model being used)	B0
For large values of t , the area would be impossibly large	B1
It suggests that the culture grows to a size that is unrealistic ("it" refers to the model)	B1
The model predicts unlimited growth but this is not possible	B1