

Question Number	Scheme	Marks
2 (a) (i)	$\log_6 T = 4 - 2 \log_6 x$	B1
(ii)	E.g. $\log_6 T = 4 - 2 \log_6 216 \Rightarrow \log_6 T = 4 - 2 \times 3 = -2 \Rightarrow T = \dots$ $\Rightarrow T = 6^{-2} = \frac{1}{36}$	M1 A1 (3)
(b)	$\log_6 T = 4 - 2 \log_6 x \Rightarrow T = 6^{4 - 2 \log_6 x}$ $\Rightarrow T = 6^4 \times 6^{\log_6 x^{-2}}$ $\Rightarrow T = \frac{1296}{x^2}$	M1 dM1 A1 (3) (6 marks)

3(a)	$\log_{10} y = \pm \frac{2}{3.5} \log_{10} x - 2$	M1
	$\log_{10} y = -\frac{4}{7} \log_{10} x - 2$	A1
		(2)

(b)	$\log_{10} y = -\frac{4}{7} \log_{10} x - 2 \Rightarrow$ $y = 10^{\left(-\frac{4}{7} \log_{10} x - 2\right)}$ or $y = 10^{\left(\log_{10} x^{-\frac{4}{7}} - 2\right)}$ or $y = 10^{-\frac{4}{7} \log_{10} x} \times 10^{-2}$ or e.g. $\log_{10} y = \log_{10} x^{-\frac{4}{7}} - 2 \Rightarrow \log_{10} \frac{y}{x^{-\frac{4}{7}}} = -2$ or e.g. $\log_{10} y = -\log_{10} x^{\frac{4}{7}} - 2 \Rightarrow \log_{10} yx^{\frac{4}{7}} = -2$	M1
	$y = 10^{\left(\log_{10} x^{-\frac{4}{7}} - 2\right)}$ or $y = 10^{-\frac{4}{7} \log_{10} x} \times 10^{-2} \Rightarrow y = x^{-\frac{4}{7}} \times 10^{-2}$ or e.g. $10^{\frac{\log_{10} y}{x^{-\frac{4}{7}}}} = 10^{-2} \Rightarrow \frac{y}{x^{-\frac{4}{7}}} = 10^{-2}$ or $10^{\log_{10} yx^{\frac{4}{7}}} = 10^{-2} \Rightarrow yx^{\frac{4}{7}} = 10^{-2}$	dM1
	$y = \frac{1}{100} x^{-\frac{4}{7}}$ oe	A1
		(3)
		Total 5

Question Number	Scheme	Marks
3(a)	$\log_{10} D = 1.04 + 0.38t \Rightarrow D = 10^{1.04+0.38t}$	M1
	or $a = 10^{1.04}$ or $b = 10^{0.38}$	
	$a = \text{awrt } 10.96$ or $b = \text{awrt } 2.399$	A1
	$D = 10.96 \times 2.399^t$	A1
		(3)
(b)	$45000 = "10.96" \times "2.399"^T \Rightarrow T = \dots$	M1
	or $\log_{10} 45000 = 1.04 + 0.38T \Rightarrow T = \dots$	
	awrt 9.51	A1
		(2)
(c)	$D = "10.96" \times "2.399"^{12} \Rightarrow D = \dots$	M1
	or $\log_{10} D = 1.04 + 0.38 \times 12 \Rightarrow D = \dots$	
	or $350000 = "10.96" \times "2.399"^{12} \Rightarrow t = \dots$	
	or $\log_{10} 350000 = 1.04 + 0.38 \times t \Rightarrow t = \dots$	
	$D = \text{awrt } (\text{£})400\,000 \Rightarrow \text{yes}$	A1
	or $t = \text{awrt } 11.9 \Rightarrow \text{yes}$	
		(2)
		(7 marks)

7.(a)	States or implies that $A = 2\,500$	B1
	$10000 = 2500e^{k \times 8} \Rightarrow 8k = \ln 4 \Rightarrow k = \dots$	M1
	$\Rightarrow k = \frac{1}{8} \ln 4$ or awrt 0.1733	A1
		(3)
(b)	$\frac{dN}{dt} = 60\,000 \times -0.6e^{-0.6 \times 5} = -1792$	M1, A1
	So decrease is 1790	(2)
(c)	$60000e^{-0.6t} = 2500e^{0.1733t}$	M1
	$24 = e^{0.1733t+0.6t} \Rightarrow 0.1733t + 0.6t = \ln 24 \Rightarrow t = \dots$	dM1
	$T = 4.11$	A1
		(3)
		8 marks

2 (a)	10 m^2	B1
		(1)
(b)	$\log_{10} 25 = 1 + 0.03T \Rightarrow T = \dots$	M1
	$T = 13.26$	A1cso
		(2)
		(3 marks)

4 (a)	$\log_{10} N = 2 \Rightarrow N = 100$	B1
		(1)
(b)	$\log_{10} N = 0.35t + 2 \Rightarrow N = 10^{0.35t+2}$	M1
	$\Rightarrow N = 10^{0.35t} \times 10^2$	dM1
	$\Rightarrow N = 100 \times 2.24^t$	A1
		(3)
(c)	Rate of growth at 5 hours is $\frac{dN}{dt} = 100 \times \ln 2.24 \times 2.24^5$	M1
	Allow an answer in the range 4530 to 4550 (bacteria per hour)	A1
		(2)
		Total 6