

## Topic assessment

- Write as a single logarithm:  
 (i)  $2\log a + 3\log b$  (ii)  $\log x - 3\log y + 4\log z$  [4]
- Express the following in terms of  $\log p$ ,  $\log q$  and  $\log r$ .  
 (i)  $\log \frac{pq}{r}$  (ii)  $\log \frac{\sqrt{p}}{r^2}$  [4]
- Solve the following equations;  
 (i)  $2^x = 7$  (ii)  $3^{2x} = 5$  [4]
- Solve the equations  
 (i)  $2e^x = 3e^{-x} + 5$  [3]  
 (ii)  $\ln(2x+1) = \ln x + 2$  [3]  
 giving your answers in exact form.
- Alice puts £500 in a savings account, at a fixed interest rate of 5% per year, when her grandson Harry is born. Interest is added to the account on Harry's birthday each year. The amount,  $P$ , in the account after  $n$  years is given by:  

$$P = 500 \times 1.05^n$$
  
 How old will Harry be when the amount in the savings account first exceeds £1000? [4]
- The number  $N$  of rabbits in a colony after  $t$  years is modelled by  $N = 20 \times 2^{0.8t}$ .  
 (i) How many rabbits are in the colony after 5 years? [2]  
 (ii) A biologist suggests that due to limited resources, this model will no longer be appropriate when  $N$  reaches 2000. For how many years will this model be appropriate? [3]
- The temperature  $T^\circ\text{C}$  of the water in a kettle  $t$  minutes after boiling is modelled by the equation  $T = 20 + 80e^{-0.5t}$ .  
 (i) What is the initial temperature of the water? [1]  
 (ii) Find the temperature of the water after 5 minutes. [2]  
 (iii) Find the time at which the temperature of the water is  $30^\circ\text{C}$ . [3]  
 (iv) Find the initial rate of cooling, and the rate of cooling after 2 minutes. [3]  
 (v) What will be the long-term temperature of the water? [1]
- In an experiment, the number of bacteria,  $N$ , in a culture was estimated at time  $t$  days after the measurements started.  
 The results were as follows:

$t$	1	2	3	4	5	6
$N$	120	170	250	400	620	910

# Edexcel AS Maths Exponentials and logs Assessment

It is believed that the relationship between  $N$  and  $t$  can be expressed in the form

$$N = ab^t$$

where  $a$  and  $b$  are constants.

- (i) Explain how this can be tested by plotting  $\log N$  against  $t$ . [2]
- (ii) Make out a table of values of  $\log N$  and draw the graph. [3]
- (iii) Use your graph to estimate the values of  $a$  and  $b$ . [3]
- (iv) Estimate the number of bacteria present after 20 days. State, with a reason, whether your estimate is likely to be a good one. [2]

9. It is believed that two quantities,  $x$  and  $y$ , are connected by a relationship of the form  $y = kx^n$ , where  $k$  and  $n$  are constants.

In an experiment, the following data were produced.

$x$	5	10	15	20	25	30	35
$y$	9	24	48	69	102	131	166

- (i) Explain how the form of the relationship can be tested by plotting  $\log y$  against  $\log x$ . [2]
- (ii) Make out a table of values of  $\log x$  and  $\log y$  and plot the graph. [3]
- (iii) Use your graph to estimate the values of  $k$  and  $n$ . [3]

**Total 55 marks**