

## Exponential Functions IB Questions

1. A function is represented by the equation  $f(x) = 3(2)^x + 1$ .

The table of values of  $f(x) - 3 \leq x \leq 2$  is given below.

$x$	-3	-2	-1	0	1	2
$f(x)$	1.375	1.75	$a$	4	7	$b$

- (a) Calculate the values for  $a$  and  $b$ .

(2)

- (b) On graph paper, draw the graph of  $f(x)$ , for  $-3 \leq x \leq 2$ , taking 1 cm to represent 1 unit on both axes.

(4)

The domain of the function  $f(x)$  is the real numbers,  $\mathbb{R}$ .

- (b) Write down the range of  $f(x)$ .

(2)

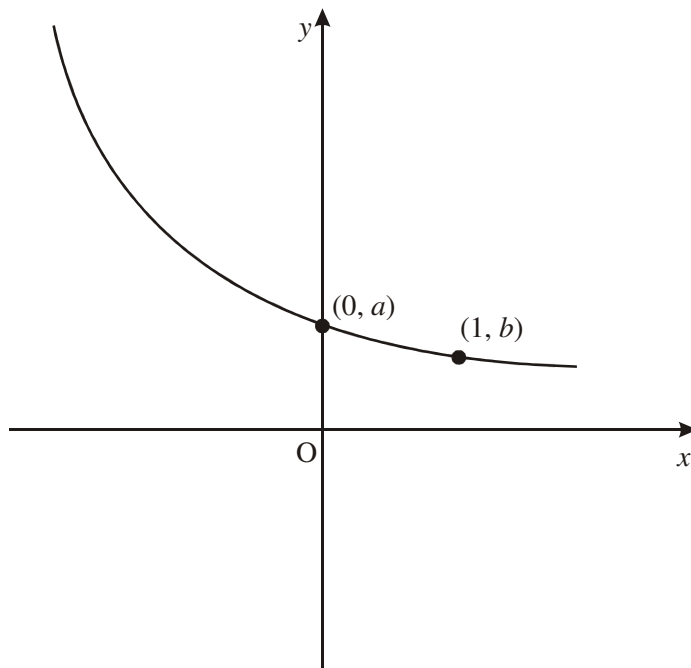
- (d) Using your graph, or otherwise, find the approximate value for  $x$  when  $f(x) = 10$ .

(2)

**(Total 10 marks)**

2. The following diagram shows the graph of  $y = 3^{-x} + 2$ . The curve passes through the points  $(0, a)$  and  $(1, b)$ .

Diagram not to scale



- (a) Find the value of
- $a$ ;
  - $b$ .
- (b) Write down the equation of the asymptote to this curve.

(Total 8 marks)

3. The diagram below shows a part of the graph of  $y = a^x$ . The graph crosses the y-axis at the point P. The point Q  $(4, 16)$  is on the graph.

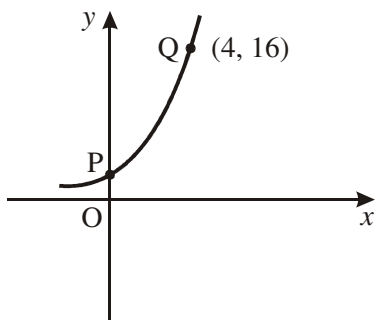


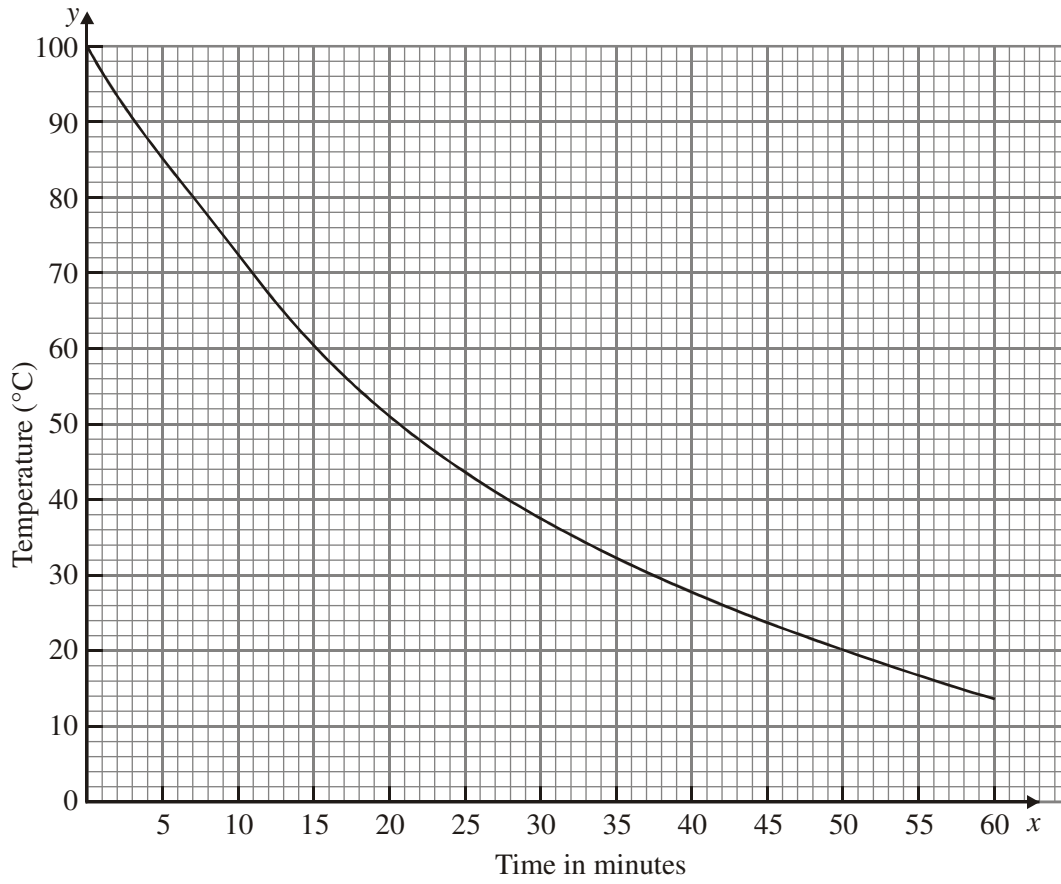
Diagram not to scale

Find

- the coordinates of the point P;
- the value of  $a$ .

(Total 8 marks)

4. The graph below shows the temperature of a liquid as it is cooling.



- (a) Write down the temperature after 5 minutes.
- (b) After how many minutes is the temperature  $50^{\circ}\text{C}$ ?

The equation of the graph for all positive  $x$  can be written in the form  $y = 100(5^{-0.02x})$ .

- (c) Calculate the temperature after 80 minutes.
- (d) Write down the equation of the asymptote to the curve.

**(Total 8 marks)**

5. The number ( $n$ ) of bacteria in a colony after  $h$  hours is given by the formula  $n = 1200(3^{0.25h})$ . Initially, there are 1200 bacteria in the colony.

- (a) Copy and complete the table below, which gives values of  $n$  and  $h$ .  
**Give your answers to the nearest hundred.**

time in hours ( $h$ )	0	1	2	3	4
no. of bacteria ( $n$ )	1200		2100	2700	

(2)

- (b) On graph paper, draw the graph of the above function. Use a scale of 3 cm to represent 1 hour on the horizontal axis and 4 cm to represent 1000 bacteria on the vertical axis. Label the graph clearly.

(5)

- (c) Use your graph to answer each of the following, showing your method **clearly**.

- (i) How many bacteria would there be after 2 hours and 40 minutes?  
Give your answer to the nearest hundred bacteria.
- (ii) After how long will there be approximately 3000 bacteria? Give your answer to the nearest 10 minutes.

(4)

(Total 11 marks)

6. In an experiment researchers found that a specific culture of bacteria increases in number according to the formula

$$N = 150 \times 2^t,$$

where  $N$  is the number of bacteria present and  $t$  is the number of hours since the experiment began.

Use this formula to calculate

- (a) the number of bacteria present at the start of the experiment;
- (b) the number of bacteria present after 3 hours;
- (c) the number of hours it would take for the number of bacteria to reach 19 200.

(Total 4 marks)