AQA Level 2 Further Mathematics Algebra III

Section 3: Exponentials functions

Exercise

1. The graph shows the curve $y = a^x$.

x	0	1	2
$y = a^x$			
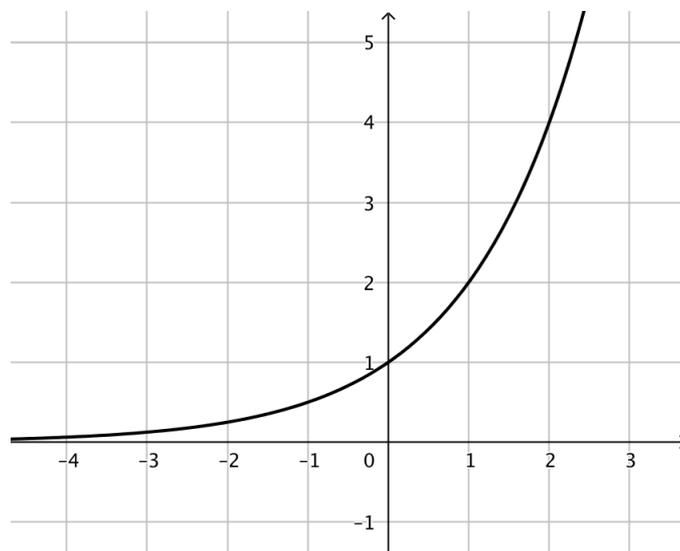
(i) Complete the table to show the values of y at the given values of x.

(ii) Determine the value of a.

(iii) Evaluate y when $x = 4$ and $x = -2$

2. Sketch the following pairs of equations on the same axes.

(i) $y = 3^x$ and $y = 4^x$

(ii) $y = 2^x$ and $y = 2^x - 1$

(iii) $y = 3^x$ and $y = 3^{-x}$

3. (i) Complete the table of values for the graph of $y = 4 - \left(\dfrac{1}{2}\right)^x$.

x	-3	-2	-1	0	1	2	3
$y = 4 - \left(\dfrac{1}{2}\right)^x$							

(ii) Plot the graph of $y = 3 - \left(\dfrac{1}{2}\right)^x$.

(iii) Use your graph to estimate the solution to $3 - \left(\dfrac{1}{2}\right)^x = 0$.

4. ***You may use graphing software or a graphing calculator for this question.***
   Consider the equations $y = 3^x$ and $y = 5 + 2x$.

   (i) Plot $y = 3^x$ and $y = 5 + 2x$ on the same axes.

   (ii) Determine how many solutions the equation $3^x = 5 + 2x$ has.

5. A graph goes through points (-1,5), (5, 3645) and (c, 135). It has equation
   $y = a \cdot b^x$

   (i) Find the values of a and b.

   (ii) Find the value of c.

6. A town has population 40 000. The population is expected to increase by 20% each year.

   (i) Write down a function $P(t)$ that shows the population t years from now.

   (ii) Find the expected population in 5 years time.

7. Atmospheric pressure, measured in millibars, decreases as you move further above sea level. It can be modelled using the following function
   $P(x) = 1013 \times 0.88^{\left(\frac{x}{1000}\right)}$, where x is the distance above sea level.

   (i) The Eiffel tower is 324m tall. What is the atmospheric pressure at the top of the Eiffel tower according to this model?

   (ii) Ben Nevis is 1345m tall. What is the atmospheric pressure at the top of Ben Nevis according to this model?

8. ***You may use graphing software or a graphing calculator for this question.***

   A biologist is modelling the growth of a population of bacteria. The number of bacteria after t hours is modelled by $N = 100 \times 3^{\left(\frac{x}{24}\right)}$.

   (i) Using this model calculate how many bacteria the sample started with.

   (ii) Calculate the number of bacteria after 2 days.

   (iii) Approximately how long would we expect it to take to get to 10 000 bacteria?