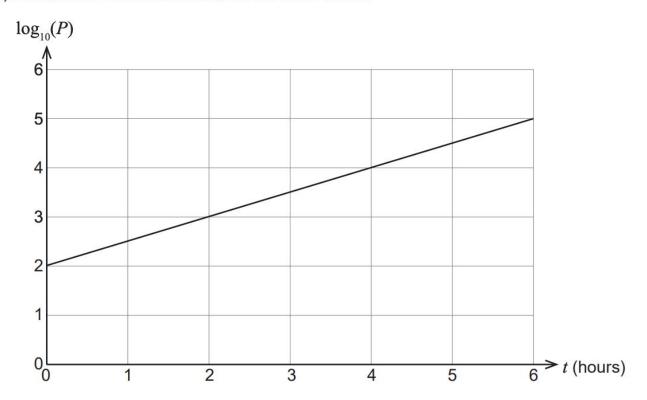
Question 17 (15 marks)

A microbiologist is studying the effect of temperature on the growth of a certain type of bacteria under controlled laboratory conditions. A population of bacteria is incubated at a temperature of 30 °C and the size of the population measured at hourly intervals for six hours. The logarithm of the population size appears to lie on a straight line when plotted against time (measured in hours) and the line of best fit shown on the axes below.



(a) (i) On the basis of the graph above, what is the size of the bacteria population after two hours? (2 marks)

(ii) The equation of the line can be written in the form  $\log_{10}(P) = At + B$ . Use the graph to determine the values of A and B. (2 marks)

Another population of the same bacteria is cultured at 40  $^{\circ}$ C. The size of the population, P, after t hours satisfies the equation

$$\log_{10}(P) = \frac{1}{3}t + 2.$$

(b) (i) Express the above equation in the form  $P = A(10)^{Bt}$ . (3 marks)

- (ii) Determine the size of the population after exactly four hours to the nearest whole number. (1 mark)
- (iii) Express the above equation in the form  $t = C \log_{10} \left( \frac{P}{D} \right)$ . (3 marks)

(iv) How many minutes does it take for the population to reach a size of 5000? Give your answer to the nearest minute. (2 marks)

(c)	With reference to parts (a) and (b), describe the effect of temperature on the population growth of this type of bacteria. (2 marks)