

AS Level Mathematics B (MEI)
H630/02 Pure Mathematics and Statistics

Question Set 1

- 1 Write down the value of
- (A) $\log_a(a^4)$, [1]
- (B) $\log_a\left(\frac{1}{a}\right)$. [1]
- 2 P and Q are consecutive odd positive integers such that $P > Q$.
Prove that $P^2 - Q^2$ is a multiple of 8. [3]
- 3 Find the set of values of a for which the equation
- $$ax^2 + 8x + 2 = 0$$
- has no real roots. [3]
- 4 Show that $\int_0^9 (3 + 4\sqrt{x}) dx = 99$. [4]
- 5 **In this question you must show detailed reasoning.**
The centre of a circle C is at the point $(-1, 3)$ and C passes through the point $(1, -1)$. The straight line L passes through the points $(1, 9)$ and $(4, 3)$. Show that L is a tangent to C . [7]
- 6 (i) A curve has equation $y = 16x + \frac{1}{x^2}$. Find
- (A) $\frac{dy}{dx}$, [2]
- (B) $\frac{d^2y}{dx^2}$. [2]
- (ii) Hence
- find the coordinates of the stationary point,
 - determine the nature of the stationary point. [5]
- 7 In an experiment 500 fruit flies were released into a controlled environment. After 10 days there were 650 fruit flies present.
Munirah believes that N , the number of fruit flies present at time t days after the fruit flies are released, will increase at the rate of 4.4% per day. She proposes that the situation is modelled by the formula $N = Ak^t$.
- (i) Write down the values of A and k . [2]
- (ii) Determine whether the model is consistent with the value of N at $t = 10$. [2]
- (iii) What does the model suggest about the number of fruit flies in the long run? [1]

Subsequently it is found that for large values of t the number of fruit flies in the controlled environment oscillates about 750. It is also found that as t increases the oscillations decrease in magnitude.

Munirah proposes a second model in the light of this new information.

$$N = 750 - 250 \times e^{-0.092t}$$

- (iv) Identify three ways in which this second model is consistent with the known data. [3]
- (v) (A) Identify one feature which is not accounted for by the second model. [1]
- (B) Give an example of a mathematical function which needs to be incorporated in the model to account for this feature. [1]

Total Marks for Question Set 1: 38 marks



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