OCR
Oxford Cambridge and RSA

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