

General Certificate of Education  
June 2005  
Advanced Level Examination



**MATHEMATICS**  
**Unit Statistics 2A**

**MS2A/W**

Thursday 9 June 2005 Morning Session

**In addition to this paper you will require:**

- an 8-page answer book;
- the **blue** AQA booklet of formulae and statistical tables.

You may use a graphics calculator.

Time allowed: 1 hour 15 minutes

**Instructions**

- Use blue or black ink or ball-point pen. Pencil should only be used for drawing.
- Write the information required on the front of your answer book. The *Examining Body* for this paper is AQA. The *Paper Reference* is MS2A/W.
- Answer **all** questions.
- All necessary working should be shown; otherwise marks for method may be lost.
- The **final** answer to questions requiring the use of tables or calculators should normally be given to three significant figures.

**Information**

- The maximum mark for this paper is 60.
- Mark allocations are shown in brackets.
- Unit Statistics 2A has a **written paper and coursework**.

**Advice**

- Unless stated otherwise, formulae may be quoted, without proof, from the booklet.

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Answer **all** questions.

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1 The number of letters,  $Y$ , delivered each day to Martin's house can be modelled by a Poisson distribution with mean 1.9. Assume that the number of letters delivered on any day is independent of the number of letters delivered on any other day.

(a) (i) Calculate the value of  $P(Y = 2)$ . *(2 marks)*

(ii) Hence determine the probability that exactly 2 letters will be delivered on each of five consecutive days. *(2 marks)*

(b) (i) Write down the distribution of  $X$ , the number of letters delivered during a 5-day period. *(1 mark)*

(ii) Find the probability that at least 10 letters will be delivered during a 5-day period. *(2 marks)*

(iii) Hence calculate the probability that at least 10 letters will be delivered during exactly three out of five consecutive 5-day periods. *(2 marks)*

2 A hockey team's coach believes that the results of matches are affected by whether the team plays at home or away.

The results of 50 randomly selected matches played by the team are given in the table below.

	Home	Away	Total
Win	15	5	20
Lose	6	12	18
Draw	6	6	12
Total	27	23	50

Use a  $\chi^2$  test, at the 5% level of significance, to determine whether the coach's belief is justified. *(10 marks)*

3 The discrete random variable  $R$  has the following probability distribution.

$r$	1	2	4
$\mathbf{P}(R = r)$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{4}$

(a) Calculate exact values for  $E(R)$  and  $\text{Var}(R)$ . (4 marks)

(b) (i) By tabulating the probability distribution for  $X = \frac{1}{R^2}$ , show that  $E(X) = \frac{25}{64}$ . (3 marks)

(ii) Hence find the value of the mean of the **area** of a rectangle which has sides of length  $\frac{8}{R}$  and  $\left(R + \frac{8}{R}\right)$ . (3 marks)

4 The heights, in metres, of a random sample of 10 students attending Higrade School are recorded below.

1.76    1.59    1.54    1.62    1.49    1.52    1.56    1.47    1.75    1.50

Assume that the heights of students attending Higrade School are normally distributed.

(a) Calculate unbiased estimates for the mean and variance of the heights of students attending Higrade School. (3 marks)

(b) Construct a 90% confidence interval for the mean height of students attending Higrade School. (5 marks)

**TURN OVER FOR THE NEXT QUESTION**

- 5 The time,  $T$  hours, that the supporters of Bracken Football Club have to queue in order to obtain their Cup Final tickets has the following probability density function.

$$f(t) = \begin{cases} \frac{1}{5} & 0 \leq t < 3 \\ \frac{1}{45}t(6-t) & 3 \leq t \leq 6 \\ 0 & \text{otherwise} \end{cases}$$

- (a) Sketch the graph of  $f$ . *(3 marks)*
- (b) Write down the value of  $P(T = 3)$ . *(1 mark)*
- (c) Find the probability that a randomly selected supporter has to queue for at least 3 hours in order to obtain tickets. *(2 marks)*
- (d) Show that the median queuing time is 2.5 hours. *(2 marks)*
- (e) Calculate  $P(\text{median} < T < \text{mean})$ . *(6 marks)*
- 6 The mean age of people attending a large concert is claimed to be 35 years.

A random sample of 100 people attending the concert was taken and their mean age was found to be 37.9 years.

- (a) Given that the standard deviation of the ages of the people attending the concert is 12 years, test, at the 1% level of significance, the claim that the mean age is 35 years. *(7 marks)*
- (b) Explain, in the context of this question, the meaning of a Type II error. *(2 marks)*

**END OF QUESTIONS**