



ADVANCED SUBSIDIARY (AS)
General Certificate of Education
January 2013

Mathematics

Assessment Unit S1

assessing

Module S1: Statistics 1

[AMS11]



TUESDAY 22 JANUARY, AFTERNOON

TIME

1 hour 30 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number on the Answer Booklet provided.

Answer **all seven** questions.

Show clearly the full development of your answers.

Answers should be given to three significant figures unless otherwise stated.

You are permitted to use a graphic or scientific calculator in this paper.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

A copy of the **Mathematical Formulae and Tables booklet** is provided.

Throughout the paper the logarithmic notation used is $\ln z$ where it is noted that $\ln z \equiv \log_e z$



Answer all seven questions.

Show clearly the full development of your answers.

Answers should be given to three significant figures unless otherwise stated.

- 1** **Table 1** below shows the time, recorded to the nearest hour, spent watching TV in a particular week by a random sample of 60 students.

Table 1

Time (nearest hour)	1–10	11–20	21–25	26–30	31–35	36–49
Frequency	7	15	16	12	6	4

- (i)** Find an estimate of the mean time spent watching TV by this sample of students. [3]

A histogram was drawn to illustrate this data.

In this histogram the 31–35 group was represented by a bar of width 1 cm and height 3 cm.

- (ii)** Find the width and height of the 11–20 group. [4]

- 2** A factory makes porcelain picture frames.
It is known that 20% of the picture frames are faulty.
A random sample of 8 picture frames is taken and examined for faults.
The number of faulty picture frames in the sample is denoted by X .

Find the probability that:

- (i)** none of the picture frames inspected are faulty; [3]

- (ii)** at most one quarter of those inspected is faulty. [4]

- (iii)** Calculate the mean and standard deviation of the number of faulty picture frames in this sample. [2]

- 3 A media company uses drums of cable when installing broadband in houses.
Each drum carries 100 m of cable.
An installer noticed that flaws occur at random in the cable at a constant average rate of 2 per 100 m of cable.

Find the probability that a drum will have:

(i) 1 flaw; [3]

(ii) at least 3 flaws. [4]

The installer uses 5 such drums in one week.

(iii) Find the probability that 2 of these drums have at least 3 flaws. [4]

The installer uses bigger drums of the same cable when installing broadband in flats.
Each drum carries 400 m of cable.

(iv) Find the probability that the cable in this drum has exactly 5 flaws. [2]

- 4 The discrete random variable X has the probability distribution given in **Table 2** below.

Table 2

x	1	2	3	4
$P(X = x)$	$3a$	a	b	b

Also, $P(X < 4) = 3P(X = 4)$

(i) Write down two equations involving a and b . [3]

(ii) Hence find a and b . [2]

(iii) Show that the expectation of X is 2.375 [3]

(iv) Calculate $\text{Var}(X)$. [4]

- 5 The continuous random variable X has probability density function $f(x)$ where:

$$f(x) = \begin{cases} k(16 - 2x) & 4 \leq x \leq 8 \\ 0 & \text{otherwise} \end{cases}$$

where k is a constant.

- (i) Show that $k = \frac{1}{16}$ [4]

- (ii) Sketch the probability density function. [2]

Find:

- (iii) $E(X)$; [3]

- (iv) $\text{Var}(X)$. [5]

- 6 A leisure centre offers two types of exercise class, Yoga and Zumba.

Y is the event that a person selected at random takes part in the Yoga class.

Z is the event that a person selected at random takes part in the Zumba class.

The events Y and Z are independent.

Also $P(Z) = \frac{2}{5}$ and $P(Y) = P(\bar{Y} \cap \bar{Z})$

By setting $y = P(Y)$ and forming an equation in y , or otherwise, find:

- (i) $P(Y)$; [5]

- (ii) $P(\bar{Y} \cap Z)$; [2]

- (iii) Write down $P(Y|Z)$. [1]

- 7 The Stationery Co. has a machine which produces individual pencil sharpeners. The weight of each pencil sharpener produced is Normally distributed with mean μ and standard deviation σ . 7.35% of the pencil sharpeners produced weigh more than 33 g and 4.55% weigh less than 27 g.

(i) Find μ and σ . [10]

A rival company, Printing Inc., also has a machine which produces similar pencil sharpeners. The pencil sharpeners produced by this machine are Normally distributed with mean 30 g and standard deviation 4 g.

(ii) Briefly comment on the production capabilities of the machines producing these two types of pencil sharpener. [2]

THIS IS THE END OF THE QUESTION PAPER

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