



ADVANCED SUBSIDIARY (AS)  
General Certificate of Education  
2013

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## Mathematics

Assessment Unit S1

*assessing*

Module S1: Statistics 1

[AMS11]

MV18

THURSDAY 13 JUNE, MORNING

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### TIME

1 hour 30 minutes, plus your additional time allowance.

### 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 at the end of each question 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** At a local airport planes cannot land if there are severe cross winds.  
During the winter months the probability of this happening on a given day is 0.04  
Find the probability that in a period of 7 winter days severe winds prevent landings on:
- (i) no days; [3 marks]
- (ii) 2 or more days. [3 marks]
- (iii) State why this distribution would not be suitable to calculate the probability of landing being prevented in all months of the year. [1 mark]

- 2 The wingspans of a random sample of moths were recorded.

The results are summarised in **Table 1** below.

**Table 1**

Wingspan, $w$ , mm	Frequency
$20 \leq w < 40$	10
$40 \leq w < 50$	16
$50 \leq w < 60$	30
$60 \leq w < 70$	36
$70 \leq w < 80$	30
$80 \leq w < 100$	0
$100 \leq w < 120$	1

Calculate an estimate of the:

(i) mean wingspan; [3 marks]

(ii) median wingspan. [4 marks]

- 3** A shop sells a particular make of multi-fuel burner. Assuming that the weekly demand for the multi-fuel burner is a Poisson variable with mean 3, find the probability that in a week the shop sells:
- (i) exactly three burners; [3 marks]
- (ii) at least four burners. [5 marks]
- (iii) If there were at least 4 burners sold, find the probability that exactly 7 were sold. [4 marks]

- 4 The number of roses on a small rose bush is modelled by the discrete random variable  $X$ , with the probability distribution given in **Table 2** below.

**Table 2**

$x$	1	2	3	4	5
$P(X = x)$	$c^2$	$4c^2$	$2c^2 + 2c$	$4c$	$3c^2 + 3c$

(i) Show that  $c = 0.1$  [4 marks]

(ii) Find  $E(X)$  and  $\text{Var}(X)$ . [6 marks]

The number of roses on a large rose bush is modelled by the discrete random variable  $Y$ .

$Y$  is related to  $X$  by the formula  $Y = 12 - X$ .

(iii) Find  $E(Y)$  and  $\text{Var}(Y)$ . [3 marks]

- 5** In a long-jump competition, the distance in excess of 3 m jumped by a competitor is  $X$ .  
 $X$  has probability density function:

$$f(x) = \begin{cases} k(16x - x^3) & 0 \leq x \leq 4 \\ 0 & \text{otherwise} \end{cases}$$

- (i) Show that  $k = \frac{1}{64}$  [4 marks]
- (ii) Find the expected distance in excess of 3 m jumped.  
 [3 marks]
- (iii) Find the probability that a competitor jumped in excess of 6 m. [2 marks]

- 6** Farmer Alcrop's hens produce eggs whose weights are Normally distributed with mean 62 g and standard deviation 5 g.  
 Eggs are graded as small, medium or large.  
 Eggs weighing over 68 g are graded as large.

- (i) Find the probability that an egg is graded as large.  
 [4 marks]

The lightest 30% of eggs are graded as small.

- (ii) Find the upper weight limit of the small grade. [5 marks]
- (iii) Hence find the percentage of eggs graded as medium.  
 [2 marks]

- 7 A mobile phone shop stocks three models of the top selling Sphere Smart phone.

**Table 3** below shows the number of Sphere phones of each model sold in one week, together with the length of contract chosen by each customer.

**Table 3**

	Length of Contract (months)			Total
	12 month	18 month	24 month	
<b>Sphere 220</b>	15	18	17	50
<b>Sphere 300</b>	32	24	14	70
<b>Sphere 350</b>	28	30	22	80
<b>Total</b>	75	72	53	200

Customers are selected at random for a customer satisfaction survey.

$A$  is the event that a customer purchased a Sphere 220 phone.

$B$  is the event that a customer chose an 18 month contract.

$C$  is the event that a customer purchased a Sphere 300 phone.

Find the values of:

(i)  $P(B)$ ; [1 mark]

(ii)  $P(A \cap B)$ ; [2 marks]



(iii)  $P(\bar{C} \cup \bar{B})$ ; [3 marks]

(iv)  $P(A \mid B)$ . [2 marks]

(v) Express in terms of the events  $A$ ,  $B$  and  $C$  that have been defined, the event that a customer purchased a Sphere 350 [2 marks]

A skin may also be purchased to protect and style the Sphere phones.

Of the customers who purchased the Sphere 220, 14% also purchased a skin, as did 30% of the customers who purchased the Sphere 300 and 40% of the customers who purchased the Sphere 350

Find the probability that a customer selected at random purchased:

(vi) a skin; [3 marks]

(vii) a Sphere 350, given that they did purchase a skin. [3 marks]

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**THIS IS THE END OF THE QUESTION PAPER**

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