



Rewarding Learning

ADVANCED

General Certificate of Education

2016

Mathematics

Assessment Unit S4

assessing

Module S2: Statistics 2



AMS41

[AMS41]

FRIDAY 24 JUNE, MORNING

TIME

1 hour 30 minutes.

INSTRUCTIONS TO CANDIDATES

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

Answer **all eight** 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 eight questions.

Show clearly the full development of your answers.

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

Normal and t-distribution values should be read from the tables provided.

- 1** A group of ten mature students took a “Typing for Beginners” course. Each kept a record of the hours of practice they did during the course. At the end of the course they were given a test where the number of errors was recorded.
The results are given in **Table 1** below.

Table 1

Student	A	B	C	D	E	F	G	H	I	J
Hours of practice (x)	68	79	63	87	84	90	67	55	73	89
Number of errors (y)	30	19	32	16	17	13	34	34	22	16

Summary values of these data are:

n	$\sum x$	$\sum y$	$\sum x^2$	$\sum y^2$	$\sum xy$
10	755	233	58323	6051	16725

- (i) Calculate the product-moment correlation coefficient for these data. [4]
- (ii) Comment on the value obtained in part (i). [2]
- 2** Eva grows tomatoes for the catering industry. The masses of the tomatoes are normally distributed with mean 155 grams and standard deviation 12 grams. Eva picks fifteen tomatoes at random.
- Find the probability that the mean mass of the fifteen tomatoes is between 154 grams and 156.5 grams. [5]

- 3 When carrying out a field study, biologist Anne recorded the number of worms found in a sample of metre-square areas on a patch of land.
Her results are given in **Table 2** below.

Table 2

Number of worms	10	11	12	13	14	15	16	17	18	19	20
Number of metre-square areas	2	7	6	13	19	17	21	16	7	1	1

Calculate a 95% confidence interval for the mean number of worms per square metre on that patch of land.

Give your answer to four significant figures. [8]

- 4 You have been asked to select a sample of 15 pupils from the 120 Year 9 pupils in a large girls' school.

(i) State one factor you would consider when deciding how to choose the fifteen pupils. [1]

You decide to use random number sampling.

(ii) Describe how you would use this method of selection, highlighting issues you might encounter. [5]

(iii) State one strength and one weakness in using this method. [2]

- 5 The labels on packets of crisps state that they contain 40 grams. Michael is not convinced by this statement and decides to investigate. He records the mass (x , grams) of the contents of fifty packets of crisps.

His results are summarised below.

$$\sum x = 1972 \quad \sum x^2 = 78210$$

Carry out a suitable hypothesis test at 5% level. [12]

- 6 Luke is investigating the effect of fertiliser on the growth of broccoli. He picks 6 broccoli seedlings of similar size, and plants one in each of six pots. He adds different amounts of fertiliser to each pot. Three months later he weighs each plant. His results are given in **Table 3** below.

Table 3

Amount of fertiliser (x , grams)	10	20	30	40	50	60
Mass of broccoli plant (y , grams)	76.8	103.5	156.1	214.2	270.5	321.4

Summary values for these data are:

n	$\sum x$	$\sum y$	$\sum x^2$	$\sum y^2$	$\sum xy$
6	210	1142.5	9100	263 327.55	48 898

- (i) Find the regression equation of “mass of broccoli plant” on “amount of fertiliser”. [5]
- (ii) Estimate the mass of broccoli plant that would result from 45 g of fertiliser being added. [2]
- (iii) Briefly explain why you should not use your answer to (i) to estimate the amount of fertiliser that would produce a broccoli plant of mass 200 grams. [1]

- 7 A team of dieticians was investigating the effectiveness of their weight loss literature. Ten volunteers took part in a test where they were weighed, given the literature and weighed again after three weeks. The results are given in **Table 4** below.

Table 4

Volunteer	A	B	C	D	E	F	G	H	I	J
Initial weight (kg)	93.2	82.1	87.8	84.1	67.7	76.7	90.7	85.4	85.9	102.8
Weight after 3 weeks (kg)	91.4	83.6	88.9	79.8	71.2	74.0	88.8	82.7	82.5	104.0

Test at 5% level whether the weight loss literature is effective. [13]

- 8 Two independent normally distributed random variables X and Y are such that $X \sim N(200, 25)$ and $Y \sim N(190, 20)$.

Find:

(i) $P(2X + Y > 600)$, [5]

(ii) $P(|Y - X| < 5)$. [6]

If Y_1 and Y_2 are independent random variables each with the same distribution as Y ,

(iii) find $P(X + Y_1 + Y_2 < 590)$. [4]

THIS IS THE END OF THE QUESTION PAPER
