



Cambridge International AS & A Level

CANDIDATE NAME				
CENTRE NUMBER		CANDIDATE NUMBER		

110319521

FURTHER MATHEMATICS

9231/42

Paper 4 Further Probability & Statistics

May/June 2025

1 hour 30 minutes

You must answer on the question paper.

You will need: List of formulae (MF19)

INSTRUCTIONS

- Answer all questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do not use an erasable pen or correction fluid.
- Do not write on any bar codes.
- If additional space is needed, you should use the lined page at the end of this booklet; the question number or numbers must be clearly shown.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

INFORMATION

- The total mark for this paper is 50.
- The number of marks for each question or part question is shown in brackets [].

This document has 16 pages. Any blank pages are indicated.

DC (PQ/CGW) 347143/3 © UCLES 2025

[Turn over

BLANK PAGE

2

© UCLES 2025



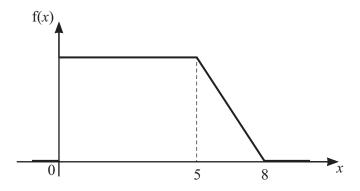
1 The manager of a hardware store is interested in whether there is a difference in the amount spent per customer on weekdays (\$x) compared to weekends (\$y). Random samples of 120 customers on weekdays and 80 customers on weekends are taken and the amount spent by each customer is recorded. The results are summarised as follows.

$$\Sigma x = 10470$$
 $\Sigma (x - \overline{x})^2 = 12283$ $\Sigma y = 6560$ $\Sigma (y - \overline{y})^2 = 13520$

Test at the 1% significance level whether there is a difference in the mean amount spent per customer on weekdays compared to weekends. You should not assume that the population variances of the amounts spent on weekdays and weekends are equal. [7]

2

4



As shown in the diagram, the continuous random variable X has probability density function f given by

$$f(x) = \begin{cases} a & 0 \le x \le 5, \\ b - cx & 5 \le x \le 8, \\ 0 & \text{otherwise,} \end{cases}$$

where a, b and c are constants.

(a)	Show that $a = \frac{2}{13}$ and find the values of b and c.	[3]
		••••
		•••••
		•••••
		•••••
		•••••
		••••
		••••
		••••
		•••••
		••••
		••••
		•••••
		••••
		••••
		•••••

* 0000800000005 *

(b) Fi	and the mean of X .	
•••		
•••		
•••		
(c) Fi	nd the median of X .	
•••		
	andom variable Y is defined by $Y = X^2$. In the cumulative distribution function for Y .	
(d) Fi		
(d) Fi	nd the cumulative distribution function for <i>Y</i> .	
(d) Fi	nd the cumulative distribution function for Y.	
(d) Fi	nd the cumulative distribution function for Y.	
(d) Fi	nd the cumulative distribution function for Y.	
(d) Fi	nd the cumulative distribution function for Y.	
(d) Fi	nd the cumulative distribution function for Y.	
(d) Fi	nd the cumulative distribution function for Y.	
(d) Fi	nd the cumulative distribution function for Y.	
(d) Fi	nd the cumulative distribution function for Y.	



3 Eggs in a supermarket are sold in boxes of six. A supermarket manager wishes to model the number of broken eggs in the boxes sold in the store. A random sample of 2000 boxes is taken and the number of broken eggs recorded. The observed frequencies are shown in the table below.

Number of broken eggs	0	1	2	3	4	5	6
Observed frequency	1844	143	11	0	1	0	1

(a)	(a) Use the data to estimate the probability that an egg is broken. 4 significant figures.	Give your answer correct to [1]

It is decided to carry out a goodness of fit test at the 0.5% significance level to determine whether a binomial distribution fits the data.

The observed frequencies and the expected frequencies are given in the following table.

Number of broken eggs	0	1	2	3	4	5	6
Observed frequency	1844	143	11	0	1	0	1
Expected frequency	1831.3	а	6.016	0.119	0.001	0.000	0.000

Show that $a = 162.6$ correct to 1 decimal place.	[1]
	· • • • • • • • • • • • • • • • • • • •
	•••••
	•••••
	•••••
	•••••
	•••••

(b)

(c) Carı disti	ry out a goodness of fit ribution is a satisfactory n	test at the 0.5% level of significance nodel for the data.	to test whether a binomic
	-		
•••••			
•••••			
•••••			
•••••			
•••••			
•••••			
•••••			
•••••			
(d) Give	e a reason why a binomial	distribution may not be a suitable mode	el in this situation.
•••••			
UCLES 2025		9231/42/M/J/25	[Turn ov



A researcher is interested in whether there is a difference between two schools in students' aptitude for English. She randomly chooses 10 students from school X and 8 students of a similar age from school Y to take a written English test. The scores for the students from school X (x) and school Y (y) are summarised as follows.

8

$$\Sigma x = 612$$
 $\Sigma x^2 = 40104$ $\Sigma y = 444$ $\Sigma y^2 = 27460$

You should assume that the two distributions are normal and have the same population variance.

and students from school Y in the written English test.	

* 0	000800000009 *		9	_
	•••••	•••••		
		••••••		
	Use the confidence a 5% significance leftom school <i>Y</i> are d	evel to suggest that the	part (a) to explain why E English scores of stud	y there is insufficient evidence at dents from school X and students [1]
JCLES 202	25	9231	/42/M/J/25	[Turn over

© UCLES



5 Two jigsaw puzzles have the same number of pieces with identical shapes but have different pictures printed on them. One puzzle has a seaside picture and the other has a cartoon picture. A researcher believes that children will complete the cartoon puzzle more quickly. To test this belief, 10 children are randomly selected. The time taken in seconds for each child to complete each puzzle is recorded below.

Child	A	В	C	D	E	F	G	Н	I	J
Seaside	182	130	193	181	192	204	184	192	180	189
Cartoon	161	111	195	159	202	200	168	165	145	160

(a)	Carry out a Wilcoxon matched-pairs signed-rank test at the 5% significance level to test th researcher's belief.

b) Show conclu	that using a paired-sandsion to that found in p	part (a).	e 370 significance	iever would lesuit in	тие орр
••••			•••••		•••••
••••					
********		••••••	••••••	••••••	••••••
•••••					•••••
•••••					
•••••					••••••
•••••					•••••
•••••		•••••	•••••		
*****	••••••	•••••	•••••	•••••	••••••
•••••					•••••
•••••					
••••					
*******		•••••	•••••		••••••
******		•••••	•••••		•••••
•••••				······	
•••••					
t was late	r discovered that the	evneriment had be	een conducted suc	sh that each child or	omnlete
easide puz	zzle first followed by the	he cartoon puzzle.	cen conducted suc	in that each china ea	Jiipicico
c) Comn	nent on the validity of	using this experim	ent to test the rese	archer's belief.	
	Ž				
•••••		•••••	•••••		•••••



6 Y is a discrete random variable which takes the values $0, 2, 4, \ldots$. The probability generating function of Y is given by

$$G_Y(t) = \frac{k}{1 - at^2}.$$

	1 4	
(a)	Find k in terms of a .	[1]
(b)	Show that $P(Y > 2) = a^2$.	[3]



It is now given that a = 0.2.

(c)

Find the value of $E(Y)$.	[2]



Additional page

If you use the following page to complete the answer to any question, the question number must be clearly shown.

* 0000800000015 *

15

BLANK PAGE

16

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of Cambridge Assessment. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which is a department of the University of Cambridge.

© UCLES 2025

