

**Cambridge Assessment**
International Education

Cambridge International AS & A Level

CANDIDATE
NAMECENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

FURTHER MATHEMATICS**9231/42**

Paper 4 Further Probability & Statistics

October/November 2024**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.



BLANK PAGE

DO NOT WRITE IN THIS MARGIN





- 1 A scientist is investigating the lengths of the leaves of a certain type of plant. The scientist assumes that the lengths of the leaves of this type of plant are normally distributed. He measures the lengths, x cm, of the leaves of a random sample of 8 plants of this type. His results are as follows.

3.5 4.2 3.8 5.2 2.9 3.7 4.1 3.2

Find a 90% confidence interval for the population mean length of leaves of this type of plant. [4]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.


$$G_X(t) = \frac{1}{5} + pt + qt^2,$$

(a) Given that $E(X) = 1.1$, find the numerical value of $\text{Var}(X)$.

[4]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.



The random variable Y has probability generating function $G_Y(t)$ given by

$$G_Y(t) = \frac{2}{3}t\left(1 + \frac{1}{2}t^2\right).$$

The random variable Z is the sum of independent observations of X and Y .

- (b) Find the probability generating function of Z . [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (c) Find $P(Z > 2)$. [1]

.....

.....

.....

.....

- (d) State the most probable value of Z . [1]

.....

.....

.....

.....

.....

.....

.....





- DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

- DO NOT WRITE IN THIS MARGIN

[illegible]

- DO NOT WRITE IN THIS MARGIN

[illegible]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.



- 4 The random variable X has probability density function f given by

$$f(x) = \begin{cases} \frac{1}{21}(x-1)^2 & 2 \leq x \leq 5, \\ 0 & \text{otherwise.} \end{cases}$$

- (a) Find the cumulative distribution function of X .

[3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

The random variable Y is defined by $Y = (X-1)^4$.

- (b) Find the probability density function of Y .

[3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....





(c) Find the median value of Y . [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(d) Find $E(Y)$. [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....





- 5 Dev owns a small company which produces bottles of juice. He uses two machines, X and Y , to fill empty bottles with juice. Dev is investigating the volumes of juice in the bottles. He chooses a random sample of 35 bottles filled by machine X and a random sample of 60 bottles filled by machine Y . The volumes of juice, x and y respectively, measured in suitable units, are summarised by

$$\Sigma x = 30.8, \quad \Sigma x^2 = 29.0, \quad \Sigma y = 62.4, \quad \Sigma y^2 = 76.8.$$

Dev claims that the mean volume of juice in bottles filled by machine Y is greater than the mean volume of juice in bottles filled by machine X . A test at the $\alpha\%$ significance level suggests that there is sufficient evidence to support Dev's claim.

Find the set of possible values of α .

[9]

[illegible]

[illegible]



- DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

[illegible]



BLANK PAGE

DO NOT WRITE IN THIS MARGIN





BLANK PAGE

DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

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.

