



Cambridge International AS & A Level

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FURTHER MATHEMATICS

9231/44

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 **12** pages.



- Test, at the 10% significance level, the null hypothesis that the population mean is 10.6 against the alternative hypothesis that the population mean is less than 10.6. [4]

[4]

[illegible]



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[7]

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Handwriting practice area with 20 sets of dotted lines.



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

$$f(x) = \begin{cases} kx & 0 \leq x < 1, \\ kx^2 & 1 \leq x \leq 2, \\ 0 & \text{otherwise.} \end{cases}$$

- (a) Show that $k = \frac{6}{17}$. [2]

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- (b) Find the cumulative distribution function of X . [3]

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(c) Find the median value of X .

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(d) Find $E\left(\frac{1}{X}\right)$.

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- 5 Eric has three identical coins, each of which is biased so that the probability of obtaining a head when it is thrown is $\frac{1}{3}$. The random variable X is the number of heads obtained when Eric throws the three coins at the same time.

(a) Find the probability generating function $G_X(t)$ of X . [2]

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Eric also has two fair 6-sided dice with faces numbered 1 to 6. The random variable Y is the number of sixes obtained when Eric throws the two dice at the same time. It is given that the probability generating function of Y is $\frac{25}{36} + \frac{10}{36}t + \frac{1}{36}t^2$.

Eric throws the three coins and the two dice. The random variable Z is the sum of the number of heads obtained and the number of sixes obtained.

(b) Find the probability generating function $G_Z(t)$ of Z , expressing your answer as a polynomial in t . [3]

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(c) Use $G_Z(t)$ to find $E(Z)$ and $\text{Var}(Z)$.

[5]





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Mona's songs have times, y minutes, that are normally distributed. The times for a random sample of 8 of Mona's songs are summarised as follows.

$$\Sigma y = 24.8 \qquad \Sigma y^2 = 76.98$$

Mona claims that the population mean time of her songs is greater than the population mean time of Lina's songs.

- (b) Assuming that the two distributions have the same population variance, test at the 5% significance level whether there is evidence to support Mona's claim. [8]

This image shows a full page of a handwriting practice worksheet. It consists of multiple rows of horizontal dotted lines spaced evenly down the page, providing a guide for letter height and placement. The background is plain white, and there are no other markings or text present.



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

[illegible]

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