



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]

[illegible]



- | Machine | <i>A</i> | <i>B</i> | <i>C</i> | <i>D</i> | <i>E</i> | <i>F</i> | <i>G</i> | <i>H</i> | <i>I</i> | <i>J</i> | <i>K</i> |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Sound level | 7.66 | 8.48 | 8.21 | 7.98 | 8.01 | 7.77 | 8.25 | 8.11 | 8.03 | 8.16 | 7.92 |

- [illegible]

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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 .

[2]

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

[2]

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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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- (a) Find the values of $\sum x$ and $\sum x^2$ for the 10 songs in Lina's sample. [5]

[illegible]


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

(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]

[illegible]

[illegible]

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