Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

FURTHER MATHEMATICS **9231/42**

Paper 4 Further Probability & Statistics **October/November 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. Any blank pages are indicated.

[Turn over

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1 A large company claims that the median salary of its employees is \$32 500. The salaries (\$) of 15 randomly selected employees are listed below.

18 750	30 500	125 000	42 500	25 000
26 000	52 500	23 000	27 500	19 500
25 500	33 000	30 000	21 500	29 000

(a) Explain why a Wilcoxon signed-rank test may not be appropriate to test the company's claim in this case. [1]

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(b) Carry out a sign test at the 10% significance level to investigate the company's claim. [5]

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2 A factory produces packets of biscuits. The total mass of biscuits in a packet has a normal distribution with mean μ. A random sample of 12 packets is taken and the mass of the contents of each packet, x g, is recorded. The results are summarised as follows.

$$\sum x = 2390 \qquad \sum x^2 = 476117$$

(a) Find a 99% confidence interval for μ. [4]

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A test of the null hypothesis $\mu = k$ is carried out on this sample using a 5% significance level. The test does not support the alternative hypothesis $\mu < k$.

(b) Find the greatest possible value of k. [3]

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3 A traffic expert claims that the number of breakdowns occurring each day on a busy section of a motorway follows a Poisson distribution with mean 0.7. The number of breakdowns each day over a 200-day period was recorded. The following table contains the observed frequencies together with some of the expected frequencies using the expert's distribution.

Number of breakdowns per day	0	1	2	3	4	$\geqslant 5$
Observed frequency	88	73	26	7	3	3
Expected frequency	99.317	m	24.333	5.678	0.994	n

(a) Find the value of m and the value of n, correct to 3 decimal places. [2]

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(b) Carry out a goodness of fit test at the 5% significance level to investigate the expert's claim. [6]

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4 A continuous random variable X has cumulative distribution function F given by

$$\mathrm{F}(x) = \begin{cases} 0 & x < 1, \\ \frac{1}{5}x + a & 1 \leqslant x < 4, \\ \frac{1}{50}x^2 + b & 4 \leqslant x \leqslant 6, \\ 1 & x > 6, \end{cases}$$

where a and b are constants.

(a) Find the value of a and the value of b. [2]

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(b) Find the probability density function of X. [2]

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(c) Given that $\mathrm{E}(X) = \frac{529}{150}$, find $\mathrm{Var}(X)$. [3]

(d) Find the 10th and 90th percentiles of X. [3]

5 An engineer is comparing the tensile strengths of steel rods made from two machines, *A* and *B*. The engineer randomly selects 8 rods from machine *A* and 6 rods from machine *B*. The tensile strengths, in appropriate units, are given in the following table.

Machine *A*	402	403	415	412	409	407	406	410
Machine *B*	401	398	395	397	410	405		

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

Use a *t*-test at the 5% significance level to test whether there is any difference in the mean tensile strengths of steel rods from the two machines. [9]

6 The discrete random variable X has probability generating function $G_X(t)$ given by

$$G_X(t) = \frac{t}{(3-2t)^2} .$$

(a) Find $E(X)$ and $Var(X)$. [5]

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

$$G_Y(t) = \frac{t^2}{(3-2t)^2} .$$

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

(b) Assuming X and Y are independent, find $P(Z > 4)$. [5]

Additional page

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