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Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

5667366507

MATHEMATICS **9709/65**

Paper 6 Probability & Statistics 2 **May/June 2025**

1 hour 15 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 [ ].

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1 The random variable X has the distribution Po(1.5). The sum of three independent values of X is denoted by S.

(a) Find $P(S \leqslant 3)$. [3]

(b) Show that the exact value of $\frac{P(S \leqslant 2)}{P(S \leqslant 1)}$ is $\frac{125}{44}$. [3]

2 A random sample of 200 values of a random variable X gives the following results.

$$n = 200 \qquad \Sigma(x-2) = 60 \qquad \Sigma(x-2)^2 = 20$$

(a) Find a 95% confidence interval for the population mean of X. [6]

(b) State which part of your solution to part **(a)** makes use of the Central Limit Theorem. [1]

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3 Maroulla's calculator can generate random numbers between 0.000 and 0.999 inclusive, correct to 3 significant figures. She plans to use her calculator to choose a sample of members from the 851 members in her health club. She numbers the members from 1 to 851. Then she uses her calculator to generate some random numbers. She multiplies each random number by 851 and rounds **up** to the next whole number to give the number of a member in the sample. This is called a 'member number'.

(a) Maroulla's first random number is 0.401.

Find the member number that is produced by this random number. [1]

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(b) Find all possible random numbers, correct to 3 decimal places, that would produce the following member numbers.

(i) A member number of 680. [1]

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(ii) A member number of 850. [1]

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(c) Explain briefly how your answers to part **(b)** show that Maroulla's method does not produce a random sample. [1]

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4 The numbers of cars and trucks arriving per minute at a fuel station are modelled by independent variables with distributions Po(0.8) and Po(0.5) respectively.

(a) Find the probability that at least 4 cars and at least 2 trucks arrive at the fuel station during a randomly chosen 5-minute period. [4]

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(b) Use a suitable approximating distribution to find the probability that a total of fewer than 145 cars and trucks arrive at the fuel station during a randomly chosen 2-hour period. [5]

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5 Candidates for a certain diploma take two tests. Their marks for the first test and the second test are modelled by the independent variables with distributions $N(38.1, 3.8^2)$ and $N(64.0, 6.1^2)$ respectively. The final mark, F, for each candidate is found by doubling the mark in the first test and adding the result to the mark in the second test.

Find the probability that the mean, $\overline{F}$, of the final marks of a random sample of 25 candidates is greater than 143. [5]

6 It is claimed that 28% of voters in a certain town support the Forward Now political party. A researcher suspects that the true figure is less than 28%. She interviews a random sample of 30 voters from the town and she finds that 4 voters in the sample say that they support the Forward Now party. She plans to carry out a hypothesis test at the 10% significance level.

(a) Use a binomial distribution to carry out the test. [5]

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(b) State, with a reason, whether it is possible that a Type I error was made in carrying out the test. [1]

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Later the researcher carries out a similar test at the 10% significance level, using a new random sample of 30 voters from the town.

(c) Find the probability of a Type I error. [2]

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7 A firm makes a certain type of battery-powered toy. The battery life is denoted by X hours and the population mean of X is supposed to be 12. The Quality Control department wished to test whether the population mean of X is actually less than 12. They tested a random sample of 50 of these toys and found that the sample mean, $\overline{X}$, was 11.4.

(a) State suitable null and alternative hypotheses for the test. [1]

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You may assume that the standard deviation of the battery life is 2.3 hours.

(b) Show that the value $\overline{X} = 11.4$ leads to rejection of the null hypothesis at the 5% significance level. [2]

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(c) It is given that the value $\overline{X} = 11.4$ leads to rejection of the null hypothesis at the α% significance level.

Find the set of possible values of α. [2]

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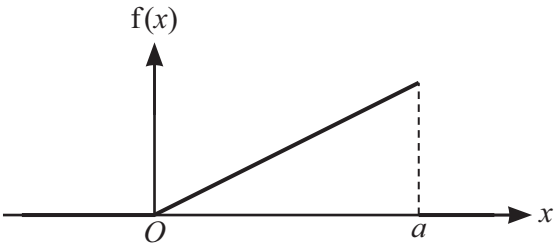
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The diagram shows the graph of the probability density function f of a random variable X. Between $x = 0$ and $x = a$ the graph consists of a straight line through O with gradient k, where k and a are positive constants. Elsewhere $f(x) = 0$.

It is given that the median of X is $\sqrt{2}$.

(a) Find the value of k. [2]

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(b) Find the value of $E(X)$. [4]

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