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Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8692521245

MATHEMATICS **9709/62**

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 [ ].

This document has **16** pages. Any blank pages are indicated.

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1 **(a)** One of a group of three students is to be chosen at random.

Explain how a single throw of a fair six-sided dice could be used to make the choice. [1]

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The times, in minutes, taken by students to complete a test are normally distributed with mean 125 and variance 50. Two students are chosen at random.

(b) Find the probability that the difference between the times taken by these two students to complete the test is more than 12 minutes. [5]

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2 The height of a certain species of plant is denoted by Hcm. The heights of a random sample of 100 plants were measured, and the following results were found.

- The mean, $\overline{h}$, for the sample was 80.2.
- An unbiased estimate of the population variance of H was 15.6.

Calculate the value of Σh^2. [3]

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3 The random variable X has the distribution $\mathrm{Po}(15)$.

(a) Write down an expression in terms of e for $\mathrm{P}(X = 12)$. [1]

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It is given that $\mathrm{P}(X = n) = \mathrm{P}(X = n+1)$.

(b) Write down an equation in n, and hence find the value of n. [3]

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4 A biased spinner has four sides. Each side is of a different colour: yellow, red, green or black. The probability, p, that the spinner will land on red is unknown. The spinner was spun 200 times, and the proportion, a, of times that it landed on red was noted. This proportion was used to calculate an approximate 90% confidence interval for p. The width of this confidence interval was 0.1066 correct to 4 significant figures.

Find the two possible values of a. [4]

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5 The amount of time, in minutes, spent by a customer on one visit to a certain shop is modelled by the random variable $X \sim \mathrm{N}(\mu, \sigma^2)$. In the past, the values of μ and σ were 10.5 and 3.8 respectively. The shop has recently moved to a new location, and the manager hopes that the new value of μ will be greater than 10.5. He takes a random sample of 10 customers and notes the time they each spend in the shop. He then calculates the sample mean $\overline{x}$ for these 10 times.

Using a hypothesis test at the 5% significance level, the manager finds that there is sufficient evidence to conclude that the new value of μ is greater than 10.5.

Stating a necessary assumption, find the smallest possible value of $\overline{x}$. [4]

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6 Use suitable approximating distributions to answer the following.

(a) The random variable W has the distribution $\mathrm{B}(700, 0.005)$.

(i) Find $\mathrm{P}(W \geqslant 4)$. [3]

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Two values of W are chosen at random.

(ii) Find the probability that the sum of these two values is less than 3. [3]

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(b) The random variable X has the distribution $\mathrm{Po}(200)$.

Use a suitable approximating distribution to find $\mathrm{P}(X > 205)$. [4]

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7 The random variable X has probability density function given by

$$f(x) = \begin{cases} \dfrac{kx^2}{a^2} & 0 \leqslant x \leqslant a, \\ 0 & \text{otherwise,} \end{cases}$$

where k and a are positive constants.

(a) Show that $k = \dfrac{3}{a}$. [3]

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It is given that $E(X) = 1$.

(b) Find the value of a. [3]

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(c) Find the median of X. [3]

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8 Birgitte has a six-sided dice. She suspects that the dice is biased so that the probability, p, that it will show a six on one throw is less than $\frac{1}{6}$. She throws the dice 30 times and finds that it shows a six on exactly 2 throws.

(a) Use a binomial distribution with a 5% significance level to test Birgitte's suspicion. [5]

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Later, Birgitte carries out a similar test at the 5% significance level, using another 30 throws of the dice.

(b) Calculate the probability of a Type I error. [2]

(c) Given that the value of p is actually 0.02, calculate the probability of a Type II error. [3]

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