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Cambridge Assessment International Education

# Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

*8955405244*

**MATHEMATICS** **9709/61**

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 **12** pages.


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**[Turn over**

**1** It is known that 1% of houses in a certain area have a wind turbine. A random sample of 400 houses in this area is chosen for a survey on domestic heating. The number of houses in the sample that have a wind turbine is denoted by $X$.

Use a suitable approximating distribution to find $P(X \leqslant 3)$. [3]

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**2** The random variable $X$ has the distribution $\mathrm{B}\left(8, \frac{3}{4}\right)$. A random sample of 100 values of $X$ is chosen, and the sample mean, $\overline{X}$, is found.

**(a)** Find $\mathrm{P}(\overline{X} > 6.2)$. You are **not** expected to use a continuity correction. [6]

**(b)** State why the Central Limit Theorem was needed in the calculation in part **(a)**. [1]

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**3** The time, $T$ minutes, for a certain daily bus journey is normally distributed. The bus company claims that the mean of $T$ is 45. A passenger believes that the mean of $T$ is actually greater than 45. She notes the times taken for this journey on a random sample of 60 days. The results are summarised below.

$$n = 60 \qquad \Sigma t = 2750 \qquad \Sigma t^2 = 127000$$

**(a)** Calculate unbiased estimates of the population mean and variance. [3]

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**(b)** Test the passenger's belief at the 5% significance level. [5]

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**4** At an entertainment centre, the cost for using a particular video game is \$0.40 per minute. The number of minutes for which people use the video game has mean 15 and variance 9.

**(a)** Find the mean and variance of the amount people pay for using the video game. [3]

Each day, 35 people independently use the video game.

**(b)** Find the mean and variance of the total amount paid by 35 people. [3]

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**5** **(a)** The random variables $W$ and $X$ have the independent distributions Po(1.2) and Po(2.3) respectively.

**(i)** Find $\mathrm{P}(3 \leqslant W+X \leqslant 5)$. [2]

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The random variable $S$ is the sum of 100 independent values of $W$ and 200 independent values of $X$.

**(ii)** Use a suitable approximation to find $\mathrm{P}(S > 600)$. [6]

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**(b)** The random variable $Y$ has the distribution $\mathrm{Po}(\lambda)$, where $\lambda > 0$.

It is given that $\frac{5}{2}\mathrm{P}(Y = 3) + \mathrm{P}(Y = 4) = \mathrm{P}(Y = 5)$.

Find the value of $\lambda$. [3]

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**6** A manufacturer of cell phones claims that 25% of students own a Pumpkin phone. Jeyeraj thinks that the proportion of students at his large college who own a Pumpkin phone is less than 25%. He plans to test the manufacturer's claim. He chooses a random sample of 30 students at his college. If the number of students who own a Pumpkin phone is less than 5, Jeyeraj will reject the manufacturer's claim.

**(a)** State suitable hypotheses for the test. [1]

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**(b)** Given that the true proportion of students at the college who own a Pumpkin phone is 10%, use a binomial distribution to find the probability of a Type II error. [3]

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At Florence's college, in a random sample of 40 students, it was found that 5 own a Pumpkin phone.

**(c)** Calculate an approximate 95% confidence interval for the proportion of students at Florence's college who own a Pumpkin phone. [3]

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**7** $X$ is a random variable with probability density function given by

$$f(x) = \begin{cases} (1+\cos \pi x) & 0 \leqslant x \leqslant 1, \\ 0 & \text{otherwise.} \end{cases}$$

**(a)** Show that $P\left(X < \frac{1}{2}\right) = \frac{1}{2} + \frac{1}{\pi}$. [3]



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**(b)** Show that $\mathrm{E}(X) = \frac{1}{2} - \frac{2}{\pi^2}$. [5]

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## Additional page

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