



Cambridge International AS & A Level

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MATHEMATICS

9709/62

Paper 6 Probability & Statistics 2

February/March 2023

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.

2 The number of orders arriving at a shop during an 8-hour working day is modelled by the random variable X with distribution $Po(25.2)$.

(a) State **two** assumptions that are required for the Poisson model to be valid in this context. [2]

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(b) (i) Find the probability that the number of orders that arrive in a randomly chosen 3-hour period is between 3 and 5 inclusive. [3]

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(ii) Find the probability that, in two randomly chosen 1-hour periods, exactly 1 order will arrive in one of the 1-hour periods, and at least 2 orders will arrive in the other 1-hour period. [4]

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(b) It is now given that the equation of the probability density function of X is

$$f(x) = \begin{cases} kx^2(3-x)^2 & 0 \leq x \leq 3, \\ 0 & \text{otherwise,} \end{cases}$$

where k is a constant.

(i) Show that $k = \frac{10}{81}$. [3]

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(ii) Find $\text{Var}(X)$. [3]

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4 The number of accidents per 3-month period on a certain road has the distribution $Po(\lambda)$. In the past the value of λ has been 5.7. Following some changes to the road, the council carries out a hypothesis test to determine whether the value of λ has decreased. If there are fewer than 3 accidents in a randomly chosen 3-month period, the council will conclude that the value of λ has decreased.

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

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(b) Find the probability of a Type II error if the mean number of accidents per 3-month period is now actually 0.9. [3]

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6 Last year, the mean time taken by students at a school to complete a certain test was 25 minutes. Akash believes that the mean time taken by this year's students was less than 25 minutes. In order to test this belief, he takes a large random sample of this year's students and he notes the time taken by each student. He carries out a test, at the 2.5% significance level, for the population mean time, μ minutes. Akash uses the null hypothesis $H_0: \mu = 25$.

(a) Give a reason why Akash should use a one-tailed test. [1]

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Akash finds that the value of the test statistic is $z = -2.02$.

(b) Explain what conclusion he should draw. [2]

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In a different one-tailed hypothesis test the z-value was found to be 2.14.

(c) Given that this value would lead to a rejection of the null hypothesis at the $\alpha\%$ significance level, find the set of possible values of α . [3]

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