

Cambridge International AS & A Level

CANDIDATE NAME		
CENTRE NUMBER	CANDIDATE NUMBER	

MATHEMATICS 9709/63

Paper 6 Probability & Statistics 2

October/November 2024

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. Any blank pages are indicated.

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* 0000800000003 *

The heights of a certain species of deer are known to have standard deviation $0.35\,\mathrm{m}$. A zoologist takes a random sample of 150 of these deer and finds that the mean height of the deer in the sample is $1.42\,\mathrm{m}$.

(a)	Calculate a 96% confidence interval for the population mean height.	[3]
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(b)	Bubay says that 96% of deer of this species are likely to have heights that are within this confiniterval.	idence
	Explain briefly whether Bubay is correct.	[1]
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The masses, in kilograms, of small and large bags of wheat have the independent distributions N(16.0, 0.4) and N(51.0, 0.9) respectively.

randomly chosen large bag.	5 [5]
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* 0000800000005 *

The times, T minutes, taken by a random sample of 75 students to complete a test were noted. Th
results were summarised by $\Sigma t = 230$ and $\Sigma t^2 = 930$.

(a)	Calculate unbiased estimates of the population mean and variance of T .	[3]
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		••••••
	should now assume that your estimates from part (a) are the true values of the popular variance of T .	oulation mean
(b)	The times taken by another random sample of 75 students were noted, and the sam was found.	ple mean, T ,
	Find the value of a such that $P(\overline{T} > a) = 0.234$.	[3]

6

4 A random variable X has probability density function f defined by

$$f(x) = \begin{cases} \frac{a}{x^2} - \frac{18}{x^3} & 2 \le x \le 3, \\ 0 & \text{otherwise,} \end{cases}$$

where a is a constant.

(a)	Show that $a = \frac{27}{2}$.	[3]
(b)	Show that $E(X) = \frac{27}{2} \ln \frac{3}{2} - 3$.	[3]
		•••••••

7

The lengths, in centimetres, of worms of a certain kind are normally distributed with mean μ and standard deviation 2.3. An article in a magazine states that the value of μ is 12.7. A scientist wishes to test whether this value is correct. He measures the lengths, $x \, \text{cm}$, of a random sample of 50 worms of this kind and finds that $\Sigma x = 597.1$. He plans to carry out a test, at the 1% significance level, of whether the true value of μ is different from 12.7. (a) State, with a reason, whether he should use a one-tailed or a two-tailed test. [1] **(b)** Carry out the test. [5]



6 The numbers of customers arriving at service desks A and B during a 10-minute period have the independent distributions Po(1.8) and Po(2.1) respectively.

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(c) An inspector waits at desk *B*. She wants to wait long enough to be 90% certain of seeing at least one customer arrive at the desk.

minute.	e nearest [4]
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The number of accidents per year on a certain road has the distribution $Po(\lambda)$. In the past the value of λ was 3.3. Recently, a new speed limit was imposed and the council wishes to test whether the value of λ has decreased. The council notes the total number, X, of accidents during **two** randomly chosen years after the speed limit was introduced and it carries out a test at the 5% significance level.

(a)	Calculate the probability of a Type Ferror.	[4]
		•••••
(b)	Given that $X = 2$, carry out the test.	[3]
		••••••••••

(d)



(c) The council decides to carry out another similar test at the 5% significance level using the same hypotheses and two different randomly chosen years.

Given that the true value of λ is 0.6, calculate the probability of a Type II error.	[3]
	•••••
	will be [4]
Using $\lambda=0.6$ and a suitable approximating distribution, find the probability that there more than 10 accidents in 30 years.	[4]
more than 10 accidents in 30 years.	[4]
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more than 10 accidents in 30 years.	[4]

Additional page

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