



Cambridge International AS & A Level

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MATHEMATICS

9709/63

Paper 6 Probability & Statistics 2

May/June 2021

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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2 In the past, the time, in hours, for a particular train journey has had mean 1.40 and standard deviation 0.12. Following the introduction of some new signals, it is required to test whether the mean journey time has decreased.

(a) State what is meant by a Type II error in this context. [1]

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(b) The mean time for a random sample of 50 journeys is found to be 1.36 hours.

Assuming that the standard deviation of journey times is still 0.12 hours, test at the 2.5% significance level whether the population mean journey time has decreased. [5]

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(c) State, with a reason, which of the errors, Type I or Type II, might have been made in the test in part (b). [2]

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(b) Calculate a 98% confidence interval for the population mean. [3]

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(c) Explain why it was necessary to use the Central Limit theorem in answering part **(b)**. [1]

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(d) Find the probability that the confidence interval found in part **(b)** is wholly above the true value of the population mean. [2]

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5 Most plants of a certain type have three leaves. However, it is known that, on average, 1 in 10 000 of these plants have four leaves, and plants with four leaves are called ‘lucky’. The number of lucky plants in a random sample of 25 000 plants is denoted by X .

(a) State, with a justification, an approximating distribution for X , giving the values of any parameters. [2]

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Use your approximating distribution to answer parts (b) and (c).

(b) Find $P(X \leq 3)$. [2]

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(c) Given that $P(X = k) = 2P(X = k + 1)$, find k . [2]

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The number of lucky plants in a random sample of n plants, where n is large, is denoted by Y .

(d) Given that $P(Y \geq 1) = 0.963$, correct to 3 significant figures, use a suitable approximating distribution to find the value of n . [3]

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