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MATHEMATICS **9709/65**

Paper 6 Probability & Statistics 2 **October/November 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. Any blank pages are indicated.

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1 A student notes the length, t minutes, of certain lectures. The results for a random sample of 80 lectures are summarised as follows.

$$n = 80 \qquad \Sigma t = 6430 \qquad \Sigma t^2 = 519\,740$$

(a) Calculate a 96% confidence interval for the population mean length of the lectures. [6]

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(b) The method used in part **(a)** is valid because the sample size was large. Explain why the method would not be valid if the sample size were small. [1]

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2 A researcher is investigating whether the proportion of families who do not own a car in his town is different from the proportion of the population in the whole country, which is 10.1%. He takes a large random sample of families in his town and finds the proportion of families that do not own a car.

(a) Explain why a two-tailed test is appropriate in this context. [1]

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(b) State suitable null and alternative hypotheses for the test. [1]

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The researcher calculates the value of the test statistic z and finds that $z = 1.82$. He carries out the test at the 5% significance level.

(c) State the conclusion of the test, explaining your answer. [2]

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3 A certain website receives an average of μ hits per hour. In the past the value of μ was 14.4. After making some improvements, the owner of the website wishes to test whether the value of μ has increased. He chooses a 10-minute period at random and finds that there were 6 hits during this period. You may assume that the number of hits the website receives in any given time period follows a Poisson distribution.

(a) Carry out the test at the 2.5% significance level. [6]

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(b) Explain whether it is possible that a Type I error or a Type II error or both may have been made in carrying out the test. [2]

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4 A sports fan produces a magazine each month.

(a) On average 1 in 540 characters in the magazine is incorrect.

(i) Use an appropriate approximating distribution to find the probability that, in a magazine containing 2430 characters, there are at least 4 incorrect characters. [3]

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(ii) Justify your approximating distribution. [1]

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(b) On average the number of copies, X, of the magazine sold per month is 123.4.

(i) State one condition for X to have a Poisson distribution. [1]

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You are now given that X has a Poisson distribution.

(ii) Use an appropriate approximating distribution to find the probability that in a randomly chosen month, more than 130 copies of the magazine are sold. [5]

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5 The masses, in kg, of large and small bags of tomatoes have the distributions $L \sim \text{N}(2.10, 0.12)$ and $S \sim \text{N}(1.51, 0.09)$ respectively.

(a) Find $\text{P}(L > S + 0.5)$. [5]

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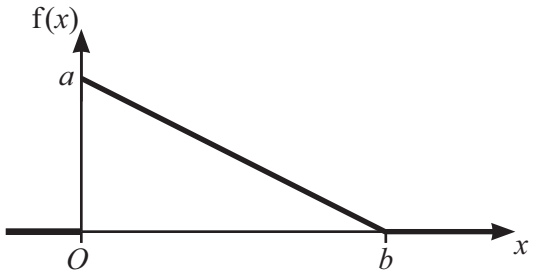
The price of tomatoes is $4.30 per kg.

(b) A large bag of tomatoes and a small bag of tomatoes are chosen at random. Find the probability that the total price of the tomatoes in the two bags is less than $16. [5]

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The diagram shows the graph of the probability density function, f, of a random variable X. The graph is a straight line from $(0, a)$ to $(b, 0)$ where a and b are constants. Elsewhere $\mathrm{f}(x) = 0$.

(a) Find an expression for b in terms of a. [2]

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(b) Given that $\mathrm{E}(X) = \frac{4}{9}$ find the value of a. [5]

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(c) Using the value of a found in part **(b)** find the value of k such that $P(X < k) = \frac{3}{4}$. [4]

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