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Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

* 9559679900 86 *

MATHEMATICS **9709/62**

Paper 6 Probability & Statistics 2 **February/March 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 [ ].

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1 The random variables X and Y have the independent distributions N(44, 16) and N(30, 9) respectively.

Find $\mathrm{P}(X - Y < 15)$. [5]

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2 A researcher records the time, T seconds, taken by adults to complete a questionnaire.

The results for a random sample of 60 adults who completed the questionnaire this year are summarised as follows.

$$n = 60 \qquad \Sigma t = 3678 \qquad \Sigma t^2 = 226\,313.36$$

(a) Find an unbiased estimate of $\mathrm{E}(T)$, and show that an unbiased estimate of $\mathrm{Var}(T)$ is 14.44. [3]

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In the past, the population mean time was 62.4 seconds.

(b) Test at the 2% significance level whether the population mean time for this year is less than 62.4 seconds. [5]

(c) State, with a reason, whether it was necessary to use the Central Limit Theorem in your answer to part **(b)**. [1]

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3 The random variable X has the distribution Po(1.5).

(a) Find $P(X \geqslant 3)$. [2]

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(b) Find the probability that the sum of three independent values of X is between 3 and 5 inclusive. [3]

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(c) The sum of a large number, n, of values of X is denoted by T. Using a suitable approximation, it was found that $P(T > 330) = 0.0391$, correct to 3 significant figures.

Find the value of n. [5]

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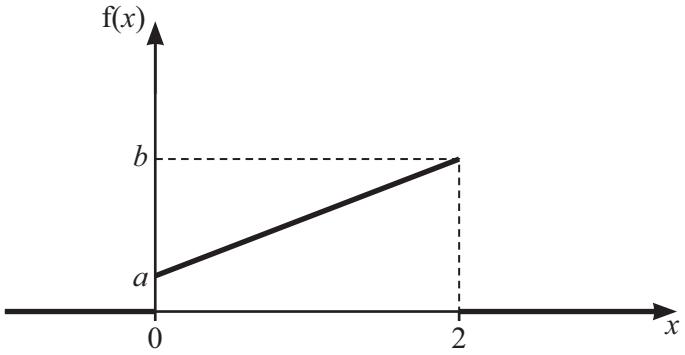
4 (a)



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 $(2, b)$, where a and b are positive constants. Elsewhere, $f(x) = 0$.

(i) Show that $b = 1 - a$. [2]

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(ii) Given that $E(X) = 1.2$, find the value of a. [5]

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(b) A random variable T has probability density function given by

$$g(t) = \begin{cases} \frac{1}{2}\cos t & -\frac{1}{2}\pi \leqslant t \leqslant \frac{1}{2}\pi, \\ 0 & \text{otherwise.} \end{cases}$$

Find the value of c such that $P(-c < t < c) = \frac{1}{2}$. [4]

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5 Amir believes that 20% of the students at his college are left-handed. His friend believes that the true proportion, p, is less than 20%. Amir plans to use the binomial distribution to test the null hypothesis, H_0: $p = 0.2$, against the alternative hypothesis, H_1: $p < 0.2$.

He decides to choose 35 students at random. If 3 or fewer of these students are left-handed, Amir will reject his belief.

(a) Find the significance level of the test. [3]

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(b) State the probability of a Type I error. [1]

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It is now given that the true value of p is 0.05.

(c) Find the probability of a Type II error. [3]

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6 Nikki is investigating the views of students at her school about the school sports facilities. She plans to give a survey to a sample of students.

Nikki's friend says, "This survey is about sports facilities, so you should choose a sample of students from the school sports teams."

(a) State, with a reason, whether you agree with Nikki's friend. [1]

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Nikki chooses an appropriate random sample of 60 students. She finds that 45 of these students think that the sports facilities are good.

(b) Calculate an approximate 95% confidence interval for the proportion of students who think that the sports facilities are good. [3]

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For a different investigation, Nikki uses another large random sample to calculate a 99% confidence interval and an x% confidence interval.

The width of the 99% confidence interval is double the width of the x% confidence interval.

(c) Calculate the value of x. [4]

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