Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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6035393307

MATHEMATICS **9709/51**

Paper 5 Probability & Statistics 1 **May/June 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.

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1 A summary of 50 values of x gives

$$\Sigma(x - q) = 700, \qquad \Sigma(x - q)^2 = 14\,235,$$

where q is a constant.

(a) Find the standard deviation of these values of x. [2]

(b) Given that $\Sigma x = 2865$, find the value of q. [2]

2 **(a)** Find the number of ways in which a committee of 6 people can be chosen from 6 men and 8 women if it must include 3 men and 3 women. [2]

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A different committee of 6 people is to be chosen from 6 men and 8 women. Three of the 6 men are brothers.

(b) Find the number of ways in which this committee can be chosen if there are no restrictions on the numbers of men and women, but it must include no more than two of the brothers. [3]

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3 **(a)** Find the number of different arrangements of the 8 letters in the word COCOONED. [1]

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(b) Find the number of different arrangements of the 8 letters in the word COCOONED in which the first letter is O and the last letter is N. [2]

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(c) Find the probability that a randomly chosen arrangement of the 8 letters in the word COCOONED has all three Os together given that the two Cs are next to each other. [3]

4 A mathematical puzzle is given to a large number of students. The times taken to complete the puzzle are normally distributed with mean 14.6 minutes and standard deviation 5.2 minutes.

(a) In a random sample of 250 of the students, how many would you expect to have taken more than 20 minutes to complete the puzzle? [4]

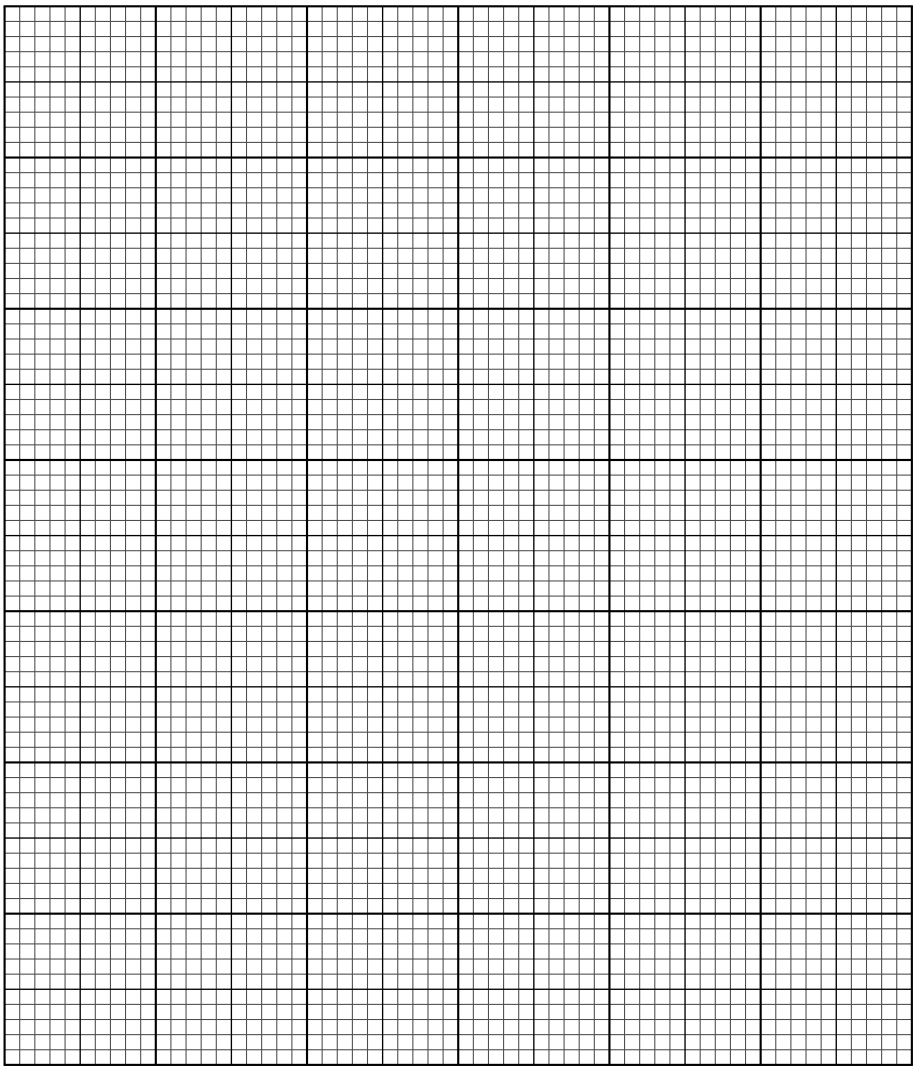
All the students are given a second puzzle to complete. Their times, in minutes, are normally distributed with mean μ and standard deviation σ. It is found that 20% of the students have times less than 14.5 minutes and 67% of the students have times greater than 18.5 minutes.

(b) Find the value of μ and the value of σ. [5]

5 The populations of 150 villages in the UK, to the nearest hundred, are summarised in the table.

Population	100 – 800	900 – 1200	1300 – 2000	2100 – 3200	3300 – 4800
Number of villages	8	12	50	48	32

(a) Draw a histogram to represent this information. [4]



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(b) Write down the class interval which contains the median for this information. [1]

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(c) Find the greatest possible value of the interquartile range for the populations of the 150 villages. [2]

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6 Eli has four fair 4-sided dice with sides labelled 1, 2, 3, 4. He throws all four dice at the same time. The random variable X denotes the number of 2s obtained.

(a) Show that $P(X = 3) = \frac{3}{64}$. [2]

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(b) Complete the following probability distribution table for X. [2]

x	0	1	2	3	4
$P(X = x)$	$\frac{81}{256}$			$\frac{3}{64}$	$\frac{1}{256}$

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(c) Find E(X). [2]

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Eli throws the four dice at the same time on 96 occasions.

(d) Use an approximation to find the probability that he obtains at least two 2s on fewer than 20 of these occasions. [5]

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7 A children's wildlife magazine is published every Monday. For the next 12 weeks it will include a model animal as a free gift. There are five different models: tiger, leopard, rhinoceros, elephant and buffalo, each with the same probability of being included in the magazine.

Sahim buys one copy of the magazine every Monday.

(a) Find the probability that the first time that the free gift is an elephant is before the 6th Monday. [2]

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(b) Find the probability that Sahim will get more than two leopards in the 12 magazines. [3]

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(c) Find the probability that after 5 weeks Sahim has exactly one of each animal. [3]

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Additional Page

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