



## Cambridge International AS & A Level

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**MATHEMATICS**

**9709/53**

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 **12** pages.

**1** Two fair coins are thrown at the same time repeatedly until a pair of heads is obtained. The number of throws taken is denoted by the random variable  $X$ .

(a) State the value of  $E(X)$ . [1]

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(b) Find the probability that exactly 5 throws are required to obtain a pair of heads. [1]

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(c) Find the probability that fewer than 7 throws are required to obtain a pair of heads. [2]

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(b) Draw up the probability distribution table for  $X$ , giving the probabilities as numerical fractions. [1]

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(c) Given that  $E(X) = 3.2$ , find  $\text{Var}(X)$ . [2]

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- 4 The times taken, in minutes, to complete a cycle race by 19 cyclists from each of two clubs, the Cheetahs and the Panthers, are represented in the following back-to-back stem-and-leaf diagram.

| Cheetahs  |    | Panthers    |
|-----------|----|-------------|
| 9 8       | 7  | 4           |
| 8 7 3 2 0 | 8  | 6 8         |
| 9 8 7     | 9  | 1 7 8 9 9   |
| 6 5 3 3 1 | 10 | 2 3 4 4 5 6 |
| 9 8 2     | 11 | 1 2 8       |
| 4         | 12 | 0 6         |

Key: 7 | 9 | 1 means 97 minutes for Cheetahs and 91 minutes for Panthers

- (a) Find the median and the interquartile range of the times of the Cheetahs. [3]

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The median and interquartile range for the Panthers are 103 minutes and 14 minutes respectively.

- (b) Make two comparisons between the times taken by the Cheetahs and the times taken by the Panthers. [2]

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Another cyclist, Kenny, from the Cheetahs also took part in the race. The mean time taken by the 20 cyclists from the Cheetahs was 99 minutes.

- (c) Find the time taken by Kenny to complete the race. [3]

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5 Jasmine throws two ordinary fair 6-sided dice at the same time and notes the numbers on the uppermost faces. The events  $A$  and  $B$  are defined as follows.

$A$ : The sum of the two numbers is less than 6.

$B$ : The difference between the two numbers is at most 2.

(a) Determine whether or not the events  $A$  and  $B$  are independent. [4]

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(b) Find  $P(B | A')$ . [3]

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**6** The mass of grapes sold per day by a large shop can be modelled by a normal distribution with mean 28 kg. On 10% of days less than 16 kg of grapes are sold.

**(a)** Find the standard deviation of the mass of grapes sold per day. [3]

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The mass of grapes sold on any day is independent of the mass sold on any other day.

**(b)** 12 days are chosen at random.

Find the probability that less than 16 kg of grapes are sold on more than 2 of these 12 days. [3]

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- (c) In a random sample of 365 days, on how many days would you expect the mass of grapes sold to be within 1.3 standard deviations of the mean? [4]

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- 7 (a) Find the number of different arrangements of the 10 letters in the word CASABLANCA in which the two Cs are **not** together. [3]

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- (b) Find the number of different arrangements of the 10 letters in the word CASABLANCA which have an A at the beginning, an A at the end and exactly 3 letters between the 2 Cs. [3]

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Five letters are selected from the 10 letters in the word CASABLANCA.

- (c) Find the number of different selections in which the five letters include at least two As and at most one C. [3]

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**Additional Page**

If you use the following lined page to complete the answer(s) to any question(s), the question number(s) must be clearly shown.

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