



CANDIDATE  
NAME

|  |
|--|
|  |
|--|

CENTRE  
NUMBER

|  |  |  |  |  |
|--|--|--|--|--|
|  |  |  |  |  |
|--|--|--|--|--|

CANDIDATE  
NUMBER

|  |  |  |  |
|--|--|--|--|
|  |  |  |  |
|--|--|--|--|

## 9709/51

May/June 2024

**1 hour 15 minutes**

You will need: List of formulae (MF19)

- 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.

- 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.

- 1 A summary of 20 values of  $x$  gives

$$\Sigma(x - 30) = 439, \quad \Sigma(x - 30)^2 = 12\,405.$$

A summary of another 25 values of  $x$  gives

$$\Sigma(x - 30) = 470, \quad \Sigma(x - 30)^2 = 11\,346.$$

- (a) Find the mean of all 45 values of  $x$ . [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (b) Find the standard deviation of all 45 values of  $x$ . [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- 2 The lengths of the tails of adult raccoons of a certain species are normally distributed with mean 28 cm and standard deviation 3.3 cm.

- (a) Find the probability that a randomly chosen adult raccoon of this species has a tail length between 23 cm and 35 cm. [4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

The masses of adult raccoons of this species are normally distributed with mean 8.5 kg and standard deviation  $\sigma$  kg. 75% of adult raccoons of this species have mass greater than 7.6 kg.

- (b) Find the value of  $\sigma$ . [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

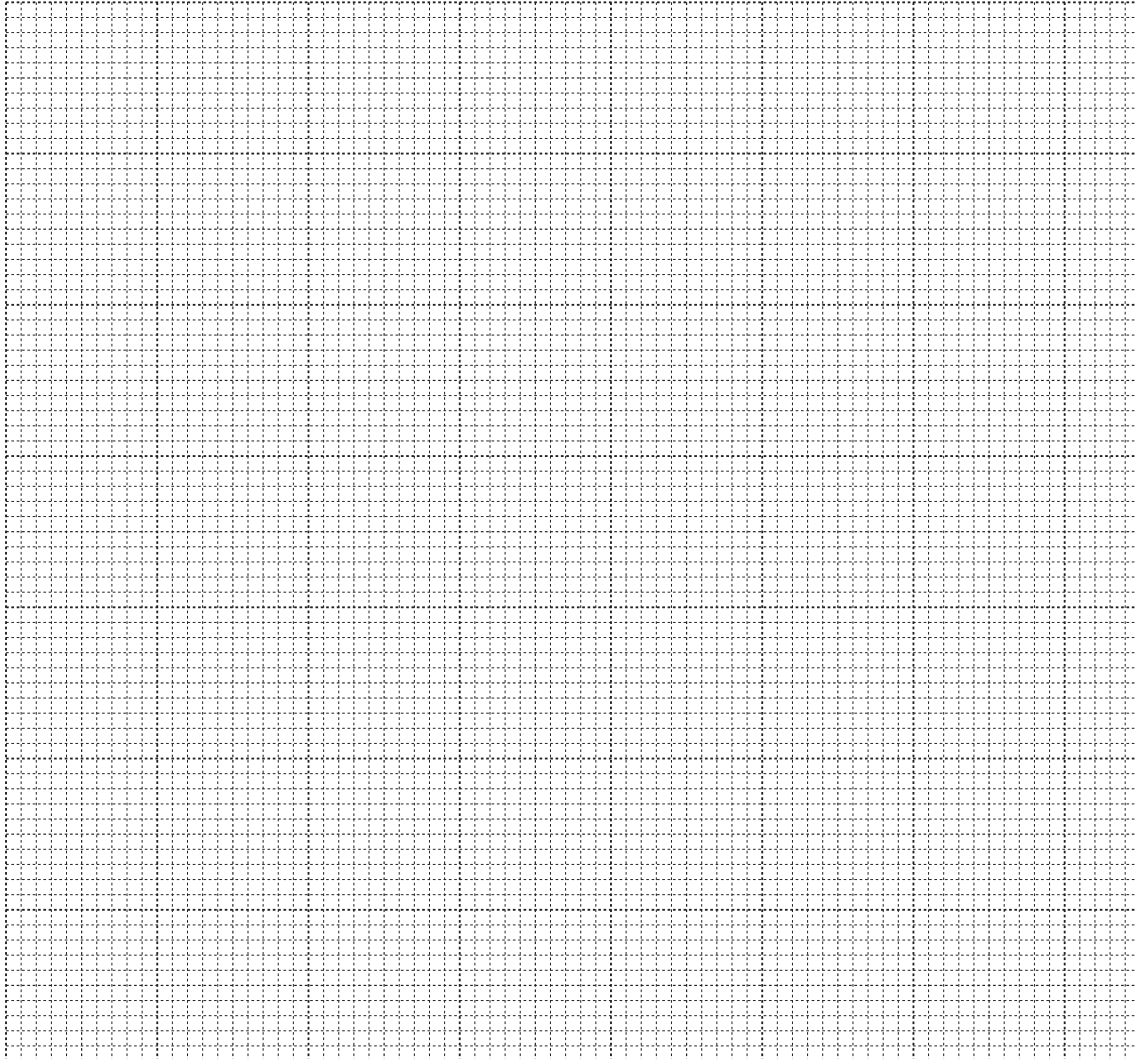
.....

3 The heights, in cm, of 200 adults in Barimba are summarised in the following table.

| Height ( $h$ cm) | $130 \leq h < 150$ | $150 \leq h < 160$ | $160 \leq h < 170$ | $170 \leq h < 175$ | $175 \leq h < 195$ |
|------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| Frequency        | 16                 | 32                 | 76                 | 64                 | 12                 |

(a) Draw a histogram to represent this information.

[4]



[illegible]

- 4 A game for two players is played using a fair 4-sided dice with sides numbered 1, 2, 3 and 4. One turn consists of throwing the dice repeatedly up to a maximum of three times. When a 4 is obtained, no further throws are made during that turn. A player who obtains a 4 in their turn scores 1 point.

(a) Show that the probability that a player obtains a 4 in one turn is  $\frac{37}{64}$ . [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Xeno and Yao play this game.

(b) Find the probability that neither Xeno nor Yao score any points in their first two turns. [1]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (c) Xeno and Yao each have three turns.

Find the probability that Xeno scores 2 more points than Yao.

[3]

[illegible]

- 5** In a certain area in the Arctic the probability that it snows on any given day is 0.7, independent of all other days.

- (a)** Find the probability that in a week (7 days) it snows on at least five days. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

A week in which it snows on at least five days out of seven is called a 'white' week.

- (b)** Find the probability that in three randomly chosen weeks at least one is a white week. [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

In a different area in the Arctic, the probability that a week is a white week is 0.8 .

- (c) Use a suitable approximation to find the probability that in 60 randomly chosen weeks fewer than 47 are white weeks. [5]

[illegible]

**6** Harry has three coins:

- One coin is biased so that the probability of obtaining a head when it is thrown is  $\frac{1}{3}$ .
- The second coin is biased so that the probability of obtaining a head when it is thrown is  $\frac{1}{4}$ .
- The third coin is biased so that the probability of obtaining a head when it is thrown is  $\frac{1}{5}$ .

Harry throws the three coins. The random variable  $X$  is the number of heads that he obtains.

**(a)** Draw up the probability distribution table for  $X$ .

[4]

[illegible]

Harry has two other coins, each of which is biased so that the probability of obtaining a head when it is thrown is  $p$ . He throws all five coins at the same time. The random variable  $Y$  is the number of heads that he obtains.

- (b) Given that  $P(Y = 0) = 6P(Y = 5)$ , find the value of  $p$ . [3]

This image shows a full page of a handwriting practice worksheet. It consists of multiple rows of horizontal dotted lines spaced evenly down the page, providing a guide for letter height and placement. There are no margins, text, or other markings on the page.

- 7 The eight digits 1, 2, 2, 3, 4, 4, 4, 5 are arranged in a line.

**(a)** How many different arrangements are there of these 8 digits?

[1]

[illegible]

(b) Find the number of different arrangements of the 8 digits in which there is a 2 at the beginning, a 2 at the end and the three 4s are not all together. [4]

[illegible]

Three digits are selected at random from the eight digits 1, 2, 2, 3, 4, 4, 4, 5.

(c) Find the probability that the three digits are all different. [5]

[illegible]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting or typing. There are no margins, text, or other markings on the page.



**BLANK PAGE**

---

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at [www.cambridgeinternational.org](http://www.cambridgeinternational.org) after the live examination series.

Cambridge Assessment International Education is part of Cambridge Assessment. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which is a department of the University of Cambridge.