



CANDIDATE
NAME

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CENTRE
NUMBER

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CANDIDATE
NUMBER

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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.
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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]

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

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- 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]

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

- (b) Find the value of σ . [3]

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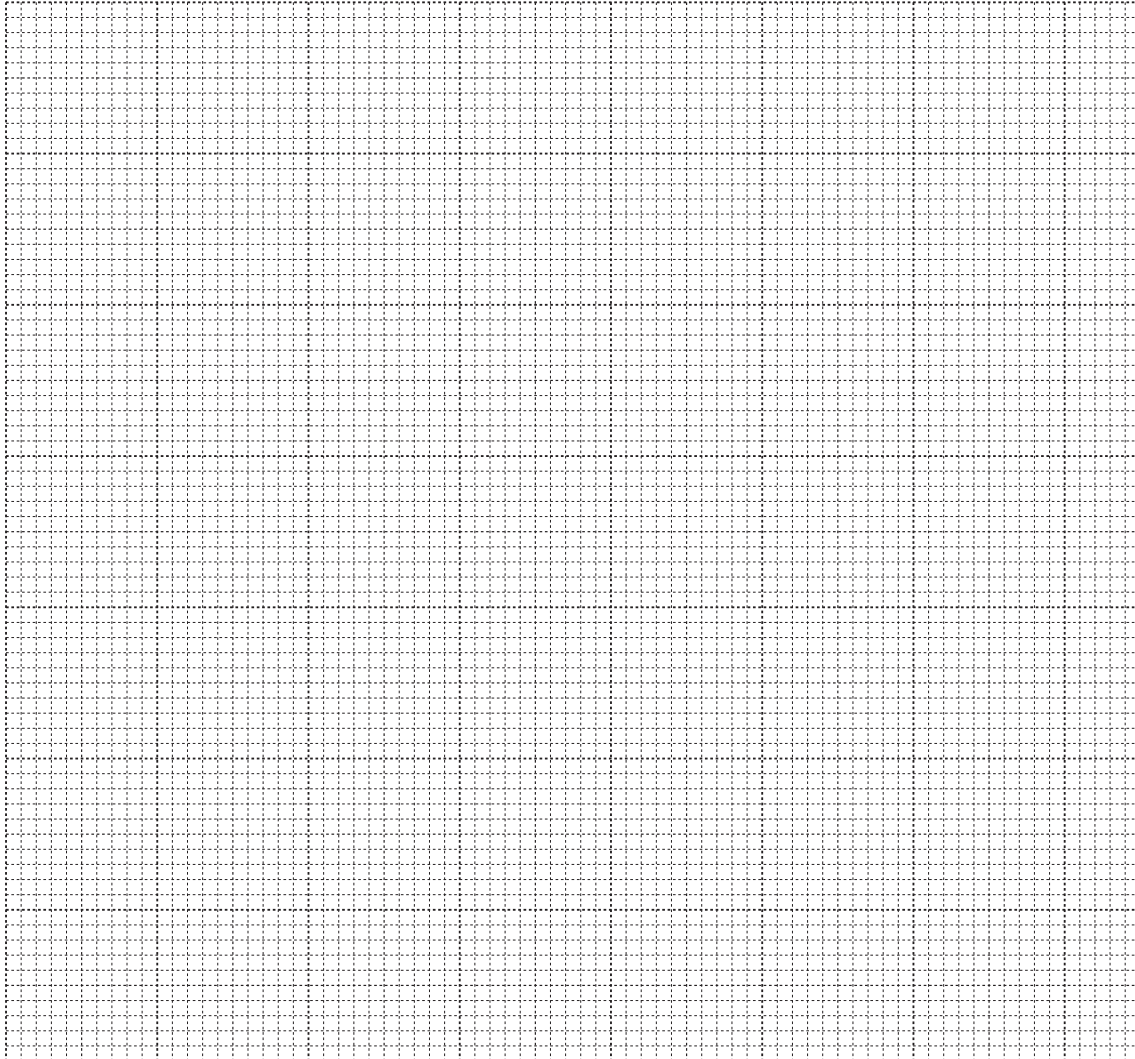
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3 The heights, in cm, of 200 adults in Barimba are summarised in the following table.

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]



- (b) The interquartile range is R cm. Show that R is **not** greater than 15.

[2]

This image shows a full page of white paper with horizontal dotted lines, typical of primary school writing paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

- 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]

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Xeno and Yao play this game.

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

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

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

[3]

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 practice. There are no margins, text, or other markings on the page.

- 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]

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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]

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- [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]

[illegible]

- 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]

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

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]

This image shows a full page of white paper with horizontal dashed lines, typical of primary school handwriting practice paper. The lines are evenly spaced and run across the entire width of the page. There are no margins, text, or other markings present.

[illegible]

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9709/52

May/June 2024

1 hour 15 minutes

You must answer on the question paper.

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- 1 Rajesh applies once every year for a ticket to a music festival. The probability that he is successful in any particular year is 0.3, independently of other years.

(a) Find the probability that Rajesh is successful for the first time on his 7th attempt. [1]

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(b) Find the probability that Rajesh is successful for the first time before his 6th attempt. [2]

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(c) Find the probability that Rajesh is successful for the second time on his 10th attempt. [2]

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- 2 Seva has a coin which is biased so that when it is thrown the probability of obtaining a head is $\frac{1}{3}$. He also has a bag containing 4 red marbles and 5 blue marbles.

Seva throws the coin. If he obtains a head, he selects one marble from the bag at random. If he obtains a tail, he selects two marbles from the bag at random and without replacement.

- (a) Find the probability that Seva selects at least one red marble. [3]

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- (b) Find the probability that Seva obtains a head given that he selects no red marbles. [2]

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- 3 The weights of oranges can be modelled by a normal distribution with mean 131 grams and standard deviation 54 grams. Oranges are classified as small, medium or large. A large orange weighs at least 184 grams and 20% of oranges are classified as small.

(a) Find the percentage of oranges that are classified as large.

[3]

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(b) Find the greatest possible weight of a small orange.

[3]

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- 4 The back-to-back stem-and-leaf diagram shows the annual salaries of 19 employees at each of two companies, Petral and Ravon.

Petal							Ravon				
3 0 0						30	2 6				
9	9	8	2	2	1	31	1 5				
5 5 4 0						32	0 0 2				
7 5 3						33	0 4 8 9				
1 0						34	1 1 3 4 6				
						35	3				
8						36	7 9				

Key: 2 | 31 | 5 means \$31 200 for a Petral employee and \$31 500 for a Ravon employee.

- (a) Find the median and the interquartile range of the salaries of the Petral employees. [3]

[illegible]

The median salary of the Ravon employees is \$33 800, the lower quartile is \$32 000 and the upper quartile is \$34 400.

- (b)** Represent the data shown in the back-to-back stem-and-leaf diagram by a pair of box-and-whisker plots in a single diagram. [3]

[illegible]

- (c) Comment on whether the mean or the median would be a better representation of the data for the employees at Petral. [1]

[illegible]

- 5 Jasmine has one \$5 coin, two \$2 coins and two \$1 coins. She selects two of these coins at random. The random variable X is the total value, in dollars, of these two coins.

(a) Show that $P(X = 7) = 0.2$.

[1]

(b) Draw up the probability distribution table for X .

[3]

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[Turn over

6 The residents of Mahjing were asked to classify their local bus service:

- 25% of residents classified their service as good.
- 60% of residents classified their service as satisfactory.
- 15% of residents classified their service as poor.

(a) A random sample of 110 residents of Mahjing is chosen.

Use a suitable approximation to find the probability that fewer than 22 residents classified their bus service as good. [5]

[illegible]

- (b) For a random sample of 10 residents of Mahjing, find the probability that fewer than 8 classified their bus service as good or satisfactory. [3]

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- (c) Three residents of Mahjing are selected at random.

Find the probability that one resident classified the bus service as good, one as satisfactory and one as poor. [2]

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- 7 (a) How many different arrangements are there of the 10 letters in the word REGENERATE? [1]

- (b) How many different arrangements are there of the 10 letters in the word REGENERATE in which the 4 Es are together and the 2 Rs have exactly 3 letters in between them? [4]

This image shows a single page of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page, leaving small margins at the top and bottom. There are no vertical margin lines or other markings on the page.

- (c) Find the probability that a randomly chosen arrangement of the 10 letters in the word REGENERATE is one in which the consonants (G, N, R, R, T) and vowels (A, E, E, E, E) alternate, so that no two consonants are next to each other and no two vowels are next to each other. [5]

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[illegible]

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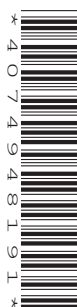
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MATHEMATICS
9709/53

Paper 5 Probability & Statistics 1

May/June 2024
1 hour 15 minutes

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You will need: List of formulae (MF19)

INSTRUCTIONS

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- 1 The numbers on the faces of a fair six-sided dice are 1, 2, 2, 3, 3, 3. The random variable X is the total score when the dice is rolled twice.

(a) Draw up the probability distribution table for X . [3]

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(b) Find the value of $\text{Var}(X)$. [3]

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[2]

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(b) Find the mean and the standard deviation of this distribution. [5]

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3 Box A contains 6 green balls and 3 yellow balls.

Box B contains 4 green balls and x yellow balls.

A ball is chosen at random from box A and placed in box B . A ball is then chosen at random from box B .

(a) Draw a tree diagram to represent this information, showing the probability on each of the branches. [4]

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(b) Find the value of x .

[3]

[illegible]



- 4 The times taken, in seconds, by 15 members of each of two swimming clubs, the Penguins and the Dolphins, to swim 50 metres are shown in the following table.

Penguins	35	39	42	44	45	45	48	50	56	58	59	61	66	68	72
Dolphins	36	41	43	48	49	49	50	51	54	56	56	60	61	64	71

- (a) Draw a back-to-back stem-and-leaf diagram to represent this information, with Penguins on the left-hand side. [4]





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- Box plot for Penguins showing times in seconds. The plot shows a median around 50 seconds, with a box from approximately 44 to 61 seconds, and whiskers extending from 35 to 72 seconds.

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[illegible]



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[illegible]

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