Cambridge Assessment International Education

# Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

*4124937800*

**MATHEMATICS** **9709/52**

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** The random variable $X$ takes the values $-2$, 2 and 3. It is given that

$$\mathrm{P}(X = x) = k(x^2 - 1),$$

where $k$ is a constant.

**(a)** Draw up the probability distribution table for $X$, giving the probabilities as numerical fractions. [3]

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**(b)** Find $\mathrm{E}(X)$ and $\mathrm{Var}(X)$. [3]

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**2** A sports event is taking place for 4 days, beginning on Sunday. The probability that it will rain on Sunday is 0.4. On any subsequent day, the probability that it will rain is 0.7 if it rained on the previous day and 0.2 if it did not rain on the previous day.

**(a)** Find the probability that it does **not** rain on any of the 4 days of the event. [1]

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**(b)** Find the probability that the first day on which it rains during the event is Tuesday. [2]

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**(c)** Find the probability that it rains on exactly one of the 4 days of the event. [3]

**3** The following back-to-back stem-and-leaf diagram represents the monthly salaries, in dollars, of 27 employees at each of two companies, *A* and *B*.

| Company *A* | | | | | | | | Company *B* | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 5 | 4 | 1 | 1 | 0 | 25 | 4 | 4 | 5 | 6 | 6 | 7 | | |
| 9 | 9 | 8 | 7 | 2 | 1 | 0 | 26 | 0 | 1 | 3 | 5 | 5 | 7 | 9 | 9 |
| | 8 | 6 | 4 | 2 | 1 | 0 | 27 | 1 | 3 | 4 | 6 | 6 | 8 | 8 | |
| | | 6 | 5 | 4 | 2 | 0 | 28 | 0 | 1 | 2 | 2 | 2 | | | |
| | | | | 9 | 8 | 5 | 29 | | | | | | | | |
| | | | | | | 1 | 30 | 9 | | | | | | | |

Key: 1 $\left|27\right|$ 6 means \$2710 for company *A* and \$2760 for company *B*

**(a)** Find the median and the interquartile range of the monthly salaries of employees in company *A*. [3]

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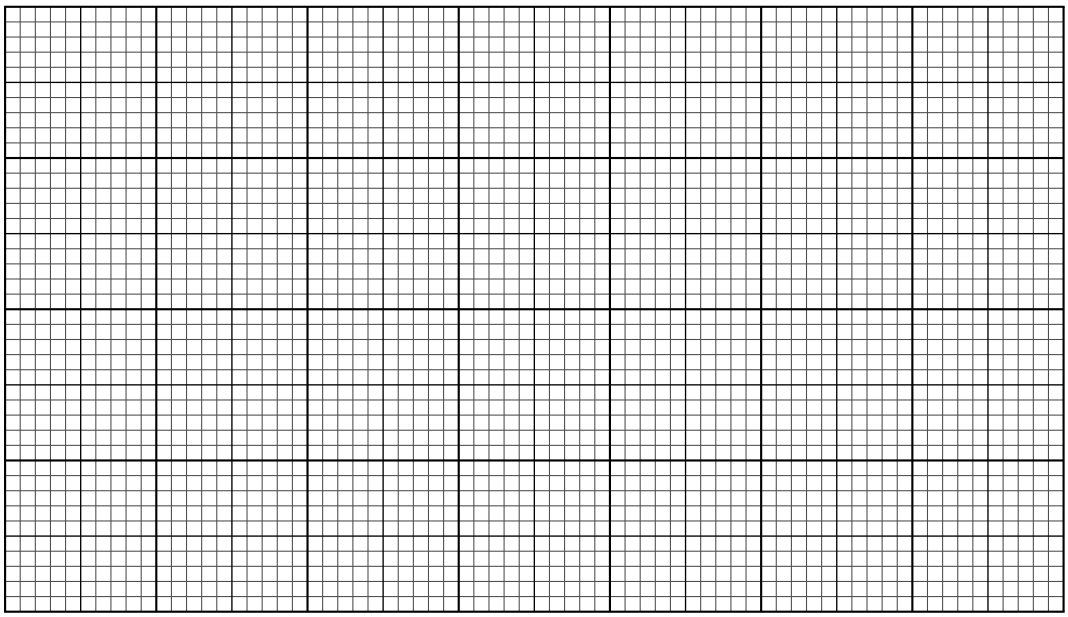
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The lower quartile, median and upper quartile for company *B* are \$2600, \$2690 and \$2780 respectively.

**(b)** Draw two box-and-whisker plots in a single diagram to represent the information for the salaries of employees at companies *A* and *B*. [3]



**(c)** Comment on whether the mean would be a more appropriate measure than the median for comparing the given information for the two companies. [1]

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**4** A fair 5-sided spinner has sides labelled 1, 2, 3, 4, 5. The spinner is spun repeatedly until a 2 is obtained on the side on which the spinner lands. The random variable $X$ denotes the number of spins required.

**(a)** Find $P(X = 4)$. [1]

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**(b)** Find $P(X < 6)$. [2]

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Two fair 5-sided spinners, each with sides labelled 1, 2, 3, 4, 5, are spun at the same time. If the numbers obtained are equal, the score is 0. Otherwise, the score is the higher number minus the lower number.

**(c)** Find the probability that the score is greater than 0 given that the score is **not** equal to 2. [3]

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The two spinners are spun at the same time repeatedly .

**(d)** For 9 randomly chosen spins of the two spinners, find the probability that the score is greater than 2 on at least 3 occasions. [3]

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**5** The lengths of Western bluebirds are normally distributed with mean 16.5 cm and standard deviation 0.6 cm.

A random sample of 150 of these birds is selected.

**(a)** How many of these 150 birds would you expect to have length between 15.4 cm and 16.8 cm? [4]

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The lengths of Eastern bluebirds are normally distributed with mean 18.4 cm and standard deviation $\sigma$ cm. It is known that 72% of Eastern bluebirds have length greater than 17.1 cm.

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

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A random sample of 120 Eastern bluebirds is chosen.

**(c)** Use an approximation to find the probability that fewer than 80 of these 120 bluebirds have length greater than 17.1 cm. [5]

**6** In a group of 25 people there are 6 swimmers, 8 cyclists and 11 runners. Each person competes in only one of these sports. A team of 7 people is selected from these 25 people to take part in a competition.

**(a)** Find the number of different ways in which the team of 7 can be selected if it consists of exactly 1 swimmer, at least 4 cyclists and at most 2 runners. [4]

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For another competition, a team of 9 people consists of 2 swimmers, 3 cyclists and 4 runners. The team members stand in a line for a photograph.

**(b)** How many different arrangements are there of the 9 people if the swimmers stand together, the cyclists stand together and the runners stand together? [2]

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**(c)** How many different arrangements are there of the 9 people if none of the cyclists stand next to each other? [4]

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## Additional Page

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