

# Cambridge International AS & A Level

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## MATHEMATICS

9709/51

Paper 5 Probability &amp; Statistics 1

October/November 2022

**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. Any blank pages are indicated.

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- 1** The probability distribution table for a random variable  $X$  is shown below.

|            |      |     |     |      |     |
|------------|------|-----|-----|------|-----|
| $x$        | -2   | -1  | 0.5 | 1    | 2   |
| $P(X = x)$ | 0.12 | $p$ | $q$ | 0.16 | 0.3 |

Given that  $E(X) = 0.28$ , find the value of  $p$  and the value of  $q$ . [4]

[illegible]

- 2** The residents of Persham were surveyed about the reliability of their internet service. 12% rated the service as 'poor', 36% rated it as 'satisfactory' and 52% rated it as 'good'.

A random sample of 8 residents of Persham is chosen.

- (a)** Find the probability that more than 2 and fewer than 8 of them rate their internet service as poor or satisfactory. [3]

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A random sample of 125 residents of Persham is now chosen.

- (b)** Use an approximation to find the probability that more than 72 of these residents rate their internet service as good. [5]

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- 3 The Lions and the Tigers are two basketball clubs. The heights, in cm, of the 11 players in each of their first team squads are given in the table.

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|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Lions  | 178 | 186 | 181 | 187 | 179 | 190 | 189 | 190 | 180 | 169 | 196 |
| Tigers | 194 | 179 | 187 | 190 | 183 | 201 | 184 | 180 | 195 | 191 | 197 |

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

- (b) Find the median and the interquartile range of the heights of the Lions first team squad. [3]

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It is given that for the Tigers, the lower quartile is 183 cm, the median is 190 cm and the upper quartile is 195 cm.

- (c) Make two comparisons between the heights of the players in the Lions first team squad and the heights of the players in the Tigers first team squad. [2]

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- 4** In a large population, the systolic blood pressure (SBP) of adults is normally distributed with mean 125.4 and standard deviation 18.6.

(a) Find the probability that the SBP of a randomly chosen adult is less than 132. [2]

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The SBP of 12-year-old children in the same population is normally distributed with mean 117. Of these children 88% have SBP more than 108.

(b) Find the standard deviation of this distribution. [3]

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Three adults are chosen at random from this population.

- (c) Find the probability that each of these three adults has SBP within 1.5 standard deviations of the mean. [4]

[illegible]

- 5** A game is played with an ordinary fair 6-sided die. A player throws the die once. If the result is 2, 3, 4 or 5, that result is the player's score and the player does not throw the die again. If the result is 1 or 6, the player throws the die a second time and the player's score is the sum of the two numbers from the two throws.

**(a)** Draw a fully labelled tree diagram to represent this information. [2]

Events  $A$  and  $B$  are defined as follows.

$A$ : the player's score is 5, 6, 7, 8 or 9

$B$ : the player has two throws

**(b)** Show that  $P(A) = \frac{1}{3}$ . [3]

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- (c) Determine whether or not events  $A$  and  $B$  are independent. [2]

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- (d) Find  $P(B \mid A')$ . [3]

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- 6** A Social Club has 15 members, of whom 8 are men and 7 are women. The committee of the club consists of 5 of its members.
- (a)** Find the number of different ways in which the committee can be formed from the 15 members if it must include more men than women. [4]

[illegible]

The 15 members are having their photograph taken. They stand in three rows, with 3 people in the front row, 5 people in the middle row and 7 people in the back row.

- (b) In how many different ways can the 15 members of the club be divided into a group of 3, a group of 5 and a group of 7? [3]

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In one photograph Abel, Betty, Cally, Doug, Eve, Freya and Gino are the 7 members in the back row.

- (c) In how many different ways can these 7 members be arranged so that Abel and Betty are next to each other and Freya and Gino are not next to each other? [3]

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[illegible]

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