



# Cambridge International AS & A Level

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NAME

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**MATHEMATICS**

**9709/51**

Paper 5 Probability & Statistics 1

**October/November 2020**

**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. Blank pages are indicated.

1 Two ordinary fair dice, one red and the other blue, are thrown.

Event  $A$  is 'the score on the red die is divisible by 3'.

Event  $B$  is 'the sum of the two scores is at least 9'.

(a) Find  $P(A \cap B)$ . [2]

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(b) Hence determine whether or not the events  $A$  and  $B$  are independent. [2]

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2 The probability that a student at a large music college plays in the band is 0.6. For a student who plays in the band, the probability that she also sings in the choir is 0.3. For a student who does not play in the band, the probability that she sings in the choir is  $x$ . The probability that a randomly chosen student from the college does not sing in the choir is 0.58.

(a) Find the value of  $x$ . [3]

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Two students from the college are chosen at random.

(b) Find the probability that both students play in the band and both sing in the choir. [2]

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**3** Kayla is competing in a throwing event. A throw is counted as a success if the distance achieved is greater than 30 metres. The probability that Kayla will achieve a success on any throw is 0.25.

**(a)** Find the probability that Kayla takes more than 6 throws to achieve a success. [2]

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**(b)** Find the probability that, for a random sample of 10 throws, Kayla achieves at least 3 successes. [3]

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4 The random variable  $X$  takes each of the values 1, 2, 3, 4 with probability  $\frac{1}{4}$ . Two independent values of  $X$  are chosen at random. If the two values of  $X$  are the same, the random variable  $Y$  takes that value. Otherwise, the value of  $Y$  is the larger value of  $X$  minus the smaller value of  $X$ .

(a) Draw up the probability distribution table for  $Y$ . [4]

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(b) Find the probability that  $Y = 2$  given that  $Y$  is even. [2]

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5 The time in hours that Davin plays on his games machine each day is normally distributed with mean 3.5 and standard deviation 0.9.

(a) Find the probability that on a randomly chosen day Davin plays on his games machine for more than 4.2 hours. [3]

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(b) On 90% of days Davin plays on his games machine for more than  $t$  hours. Find the value of  $t$ . [3]

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- (c) Calculate an estimate for the number of days in a year (365 days) on which Davin plays on his games machine for between 2.8 and 4.2 hours. [3]

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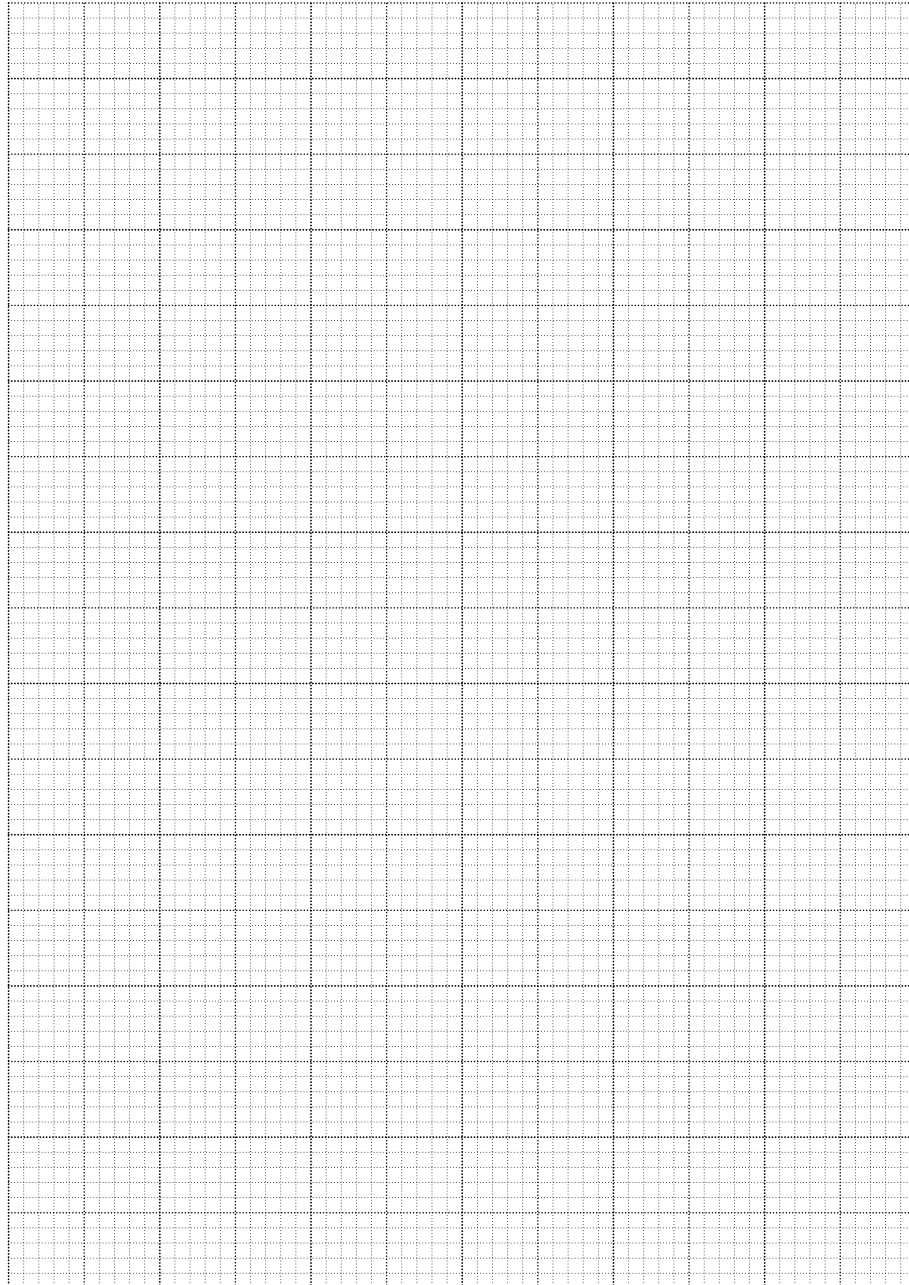
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- 6 The times,  $t$  minutes, taken by 150 students to complete a particular challenge are summarised in the following cumulative frequency table.

Time taken ( $t$ minutes)	$t \leq 20$	$t \leq 30$	$t \leq 40$	$t \leq 60$	$t \leq 100$
Cumulative frequency	12	48	106	134	150

- (a) Draw a cumulative frequency graph to illustrate the data.

[2]





- (b) 24% of the students take  $k$  minutes or longer to complete the challenge. Use your graph to estimate the value of  $k$ . [2]

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- (c) Calculate estimates of the mean and the standard deviation of the time taken to complete the challenge. [6]

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- 7 (a) Find the number of different ways in which the 10 letters of the word SHOPKEEPER can be arranged so that all 3 Es are together. [2]

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- (b) Find the number of different ways in which the 10 letters of the word SHOPKEEPER can be arranged so that the Ps are not next to each other. [4]

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- (c) Find the probability that a randomly chosen arrangement of the 10 letters of the word SHOPKEEPER has an E at the beginning and an E at the end. [2]

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Four letters are selected from the 10 letters of the word SHOPKEEPER.

- (d) Find the number of different selections if the four letters include exactly one P. [3]

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