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Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

* 1 4 5 9 9 4 2 3 2 6 *

MATHEMATICS **9709/51**

Paper 5 Probability & Statistics 1 **October/November 2024**

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 Nicola throws an ordinary fair six-sided dice. The random variable X is the number of throws that she takes to obtain a 6.

(a) Find $P(X < 8)$. [2]

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(b) Find the probability that Nicola obtains a 6 for the second time on her 8th throw. [2]

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2 The random variable X takes the values $-2, -1, 0, 2, 3$. It is given that $P(X = x) = k(x^2 + 2)$, where k is a positive constant.

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

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

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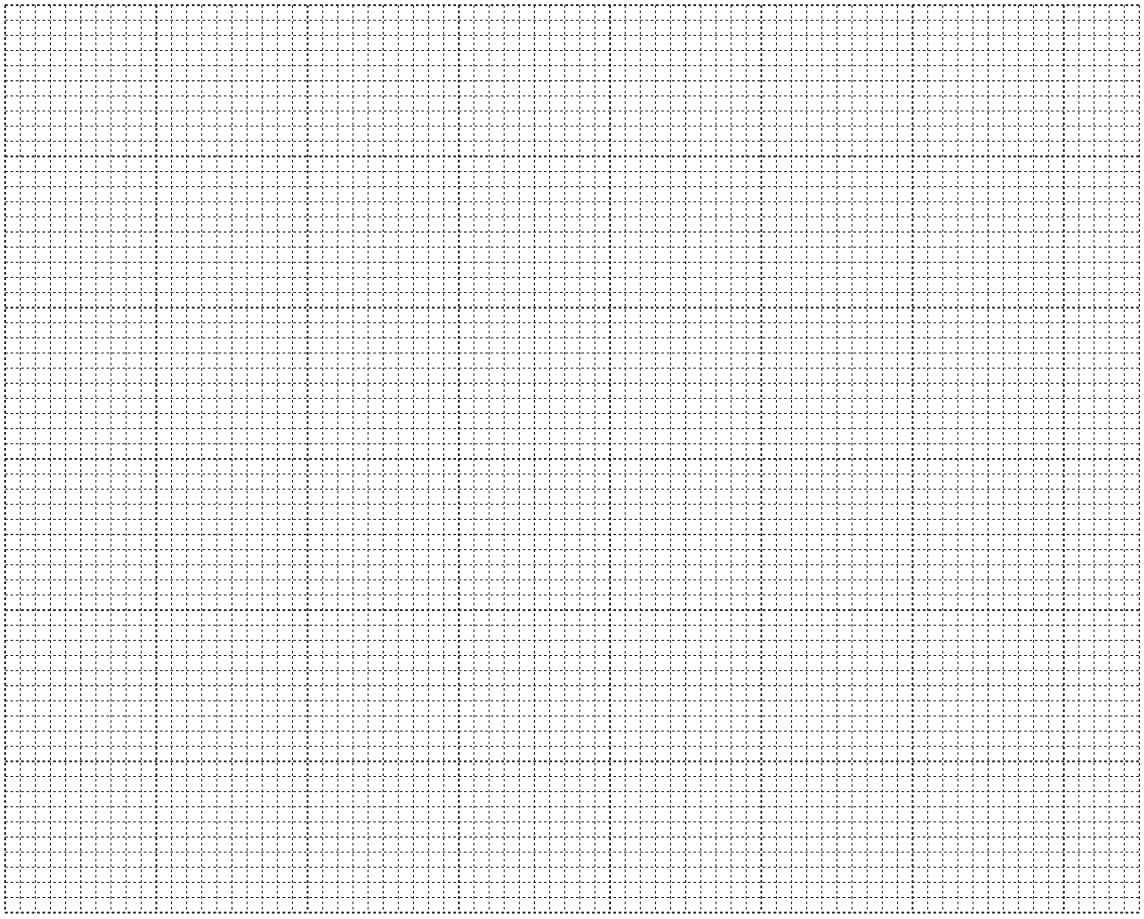
3 The time taken, in minutes, to walk to school was recorded for 200 pupils at a certain school. These times are summarised in the following table.

Time taken (t minutes)	$t \leqslant 15$	$t \leqslant 25$	$t \leqslant 30$	$t \leqslant 40$	$t \leqslant 50$	$t \leqslant 70$
Cumulative frequency	18	46	88	140	176	200

(a) Draw a cumulative frequency graph to illustrate the data. [2]



(b) Use your graph to estimate the median and the interquartile range of the data. [3]

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(c) Calculate an estimate for the mean value of the times taken by the 200 pupils to walk to school. [3]

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4 Rahul has two bags, X and Y. Bag X contains 4 red marbles and 2 blue marbles. Bag Y contains 3 red marbles and 4 blue marbles. Rahul also has a coin which is biased so that the probability of obtaining a head when it is thrown is $\frac{1}{4}$.

Rahul throws the coin.

- If he obtains a head, he chooses at random a marble from bag X. He notes the colour and replaces the marble in bag X. He then chooses at random a second marble from bag X.
- If he obtains a tail, he chooses at random a marble from bag Y. He notes the colour and discards the marble. He then chooses at random a second marble from bag Y.

(a) Find the probability that the two marbles that Rahul chooses are the same colour. [3]

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(b) Find the probability that the two marbles that Rahul chooses are both from bag *Y* given that both marbles are blue. [3]

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5 The weights of the green apples sold by a shop are normally distributed with mean 90 grams and standard deviation 8 grams.

(a) Find the probability that a randomly chosen green apple weighs between 83 grams and 95 grams. [4]

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(b) The shop also sells red apples. 60% of the red apples sold by the shop weigh more than 80 grams. 160 red apples are chosen at random from the shop.

Use a suitable approximation to find the probability that fewer than 105 of the chosen red apples weigh more than 80 grams. [5]

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6 The heights of the female students at Breven college are normally distributed:
- 90% of the female students have heights less than 182.7 cm.
- 40% of the female students have heights less than 162.5 cm.

(a) Find the mean and the standard deviation of the heights of the female students at Breven college. [5]

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Ten female students are chosen at random from those at Breven college.

(b) Find the probability that fewer than 8 of these 10 students have heights more than 162.5 cm. [3]

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7 **(a)** How many different arrangements are there of the 9 letters in the word INTELLECT in which the two Ts are together? [2]

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(b) How many different arrangements are there of the 9 letters in the word INTELLECT in which there is a T at each end and the two Es are not next to each other? [3]

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Four letters are selected at random from the 9 letters in the word INTELLECT.

(c) Find the percentage of the possible selections which contain at least one E and exactly one T. [4]

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