



Cambridge International AS & A Level

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MATHEMATICS

9709/51

Paper 5 Probability & Statistics 1

May/June 2025

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.
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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.

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[3]

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- 2 (a) Find the number of different arrangements of the 8 letters in the word KANGAROO in which the two As are together and the two Os are **not** together. [3]

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A fair 8-sided dice has faces labelled K, A, N, G, A, R, O, O. The dice is rolled repeatedly.

- (b) Find the probability that fewer than 6 rolls of this dice are required to obtain an A. [2]

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- (c) Find the probability that the second A is obtained on the 6th roll of the dice. [2]

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- 3 Last Sunday, teams of runners took part in a charity event. The time taken, in seconds, to run 50 m was recorded, correct to 1 decimal place, for each runner. The times recorded for 11 runners from each of the Gulls and the Herons are shown in the table.

Gulls	7.9	8.2	8.3	8.6	8.6	8.8	9.2	9.7	9.8	10.0	10.4
Herons	9.5	9.9	8.5	8.1	9.2	10.8	8.3	9.7	9.3	9.9	8.7

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

- (b) Find the median and the interquartile range of the times of the runners from the Gulls. [3]

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Two other teams of runners, the Eagles and the Swifts, also took part in the event. The recorded times in seconds for 20 runners from the Eagles and 30 runners from the Swifts are denoted by x and y respectively.

It is given that $\sum x = 175.0$ and that the mean of y is 8.4.

- (c) Find the mean of the times taken by all 50 runners. [2]

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It is given that $\sum x^2 = 1823.0$.

It is also known that the standard deviation of the times taken by all 50 runners is 1.38 seconds.

- (d) Find the value of $\sum y^2$, correct to 1 decimal place. [3]

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- 4 Every Saturday, a particular community holds a ‘Puzzle’ event to raise money for a new Leisure Centre. Competitors attempt to solve a puzzle as quickly as possible.

Last Saturday, 600 competitors took part. The times taken to complete the puzzle were normally distributed with mean 32.4 minutes and standard deviation 2.5 minutes.

- (a) How many competitors would you expect to have times within 1.2 minutes of the mean time? [4]

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In this Saturday’s event, 60% of the competitors had times less than 36.0 minutes.

- (b) 9 competitors who took part in this Saturday’s event are selected at random.

Find the probability that at least 2 and fewer than 8 of these competitors had times less than 36.0 minutes. [3]

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- (c) 80 competitors who took part in this Saturday's event are selected at random.

Use a suitable approximation to find the probability that more than 50 of these competitors had times less than 36.0 minutes. [5]



- 6 musicians are selected from these 20 to perform at a concert.

- [illegible]



(b) Find the number of different ways in which these three bands can be selected. [3]

[illegible]



- 6 A bag contains 10 marbles, of which 4 are red and 6 are blue. Four marbles are selected from the bag at random, without replacement. The random variable X denotes the number of blue marbles selected.

(a) Show that $P(X = 2) = \frac{3}{7}$. [2]

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(b) Draw up the probability distribution table for X . [4]

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- (c) Find the probability that at least 2 of the marbles chosen are blue, given that at least 1 red marble and at least 1 blue marble are chosen. [3]



[illegible]

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Cambridge International AS & A Level

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MATHEMATICS

9709/52

Paper 5 Probability & Statistics 1

May/June 2025

1 hour 15 minutes

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You will need: List of formulae (MF19)

INSTRUCTIONS

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Use a suitable approximation to find the probability that more than 120 of these residents own a bicycle. [5]

This image shows a full page of a handwriting practice worksheet. It consists of approximately 20 horizontal rows. Each row is defined by two parallel dotted lines, creating a series of uniform gaps for writing. The lines are evenly spaced across the entire page, providing a guide for letter height and placement. There is no text or other markings on the page.



- 3 A bag contains 4 blue marbles and 12 red marbles. One marble is selected at random from the bag. If this marble is blue, it is replaced in the bag, but if it is red, it is not replaced. A second marble is now selected at random from the bag.

(a) Find the probability that both marbles selected are the same colour. [2]

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(b) Find the probability that the first marble is blue given that the second marble is red. [3]

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- 4 Vehicles approaching a certain road junction from Bromley must go either left, right or straight on. Over time, it is known that 30% turn left, 25% turn right and 45% go straight on. The driver of each vehicle chooses a direction independently of all other drivers.

- (a) Find the probability that the next three vehicles approaching this junction from Bromley all go in different directions. [2]

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- (b) Find the probability that, from the vehicles approaching this junction from Bromley today, the 1st vehicle to go left is before the 9th vehicle. [2]

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- (c) Find the probability that, from the vehicles approaching this junction from Bromley today, the 2nd vehicle to go left is the 7th vehicle. [2]

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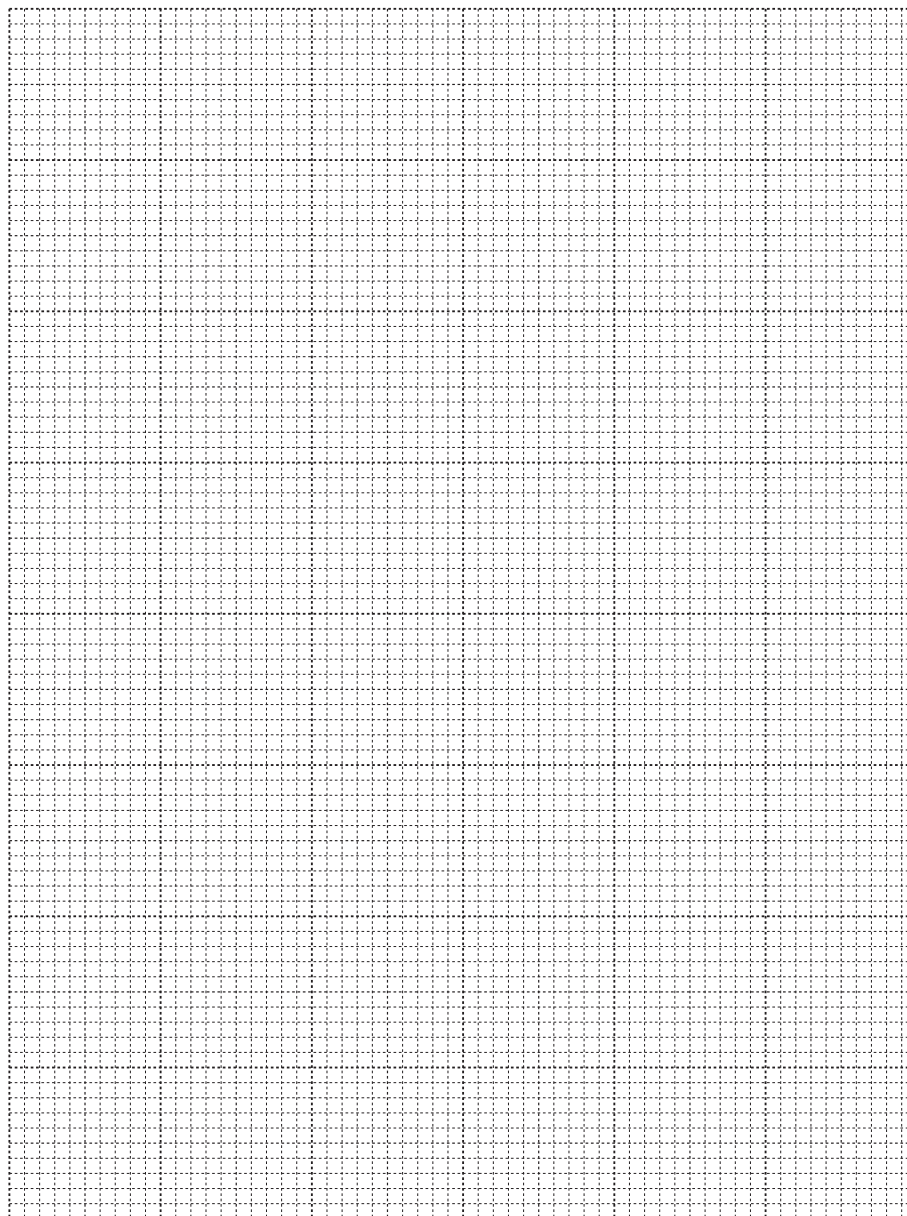




- 5 The times taken, t minutes, by 300 students to travel to Hollowton College are recorded. The results are summarised in the table below.

Time (t minutes)	$t \leq 10$	$t \leq 20$	$t \leq 30$	$t \leq 40$	$t \leq 60$	$t \leq 90$
Cumulative frequency	34	86	142	208	265	300

- (a) On the grid, draw a cumulative frequency graph to illustrate this information. [2]



- (b) 120 students take more than k minutes to travel to college. Use your graph to estimate the value of k . [2]

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- This image shows a full page of a document template designed for handwriting practice or general note-taking. It consists of approximately 28 evenly spaced horizontal dotted lines across the entire width of the page. The background is plain white, and there are no margins, headers, footers, or other markings present.



- 6 (a) Find the number of different ways in which the 10 letters in the word AMALGAMATE can be arranged so that there is an M at the beginning, an M at the end and no As are together. [3]

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- (b) Find the number of different ways in which the 10 letters in the word AMALGAMATE can be arranged with exactly 3 letters between the two Ms. [3]

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Five letters are selected from the 10 letters in the word AMALGAMATE.

- (c) Find the number of different selections in which the five letters include at least one M and at least two As. [3]

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- 7 Kestrels are birds whose adult wingspans are normally distributed with mean 74.8 cm and standard deviation 3.2 cm. A random sample of 120 adult kestrels is selected.

- (a) How many of these 120 adult kestrels would you expect to have wingspan between 72.4 cm and 76.3 cm? [4]

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The masses of adult kestrels are normally distributed with mean μ kg and standard deviation σ kg. It is known that 20% of adult kestrels have mass greater than 0.202 kg and 28% have mass less than 0.185 kg.

- (b) Find the value of μ and the value of σ . [5]

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10 adult kestrels are selected at random.

- (c) Find the probability that fewer than 3 have masses greater than 0.202 kg. [3]

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MATHEMATICS

9709/53

Paper 5 Probability & Statistics 1

May/June 2025

1 hour 15 minutes

You must answer on the question paper.

You will need: List of formulae (MF19)

INSTRUCTIONS

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- 1 For a set of 40 values of x , it is found that

$$\Sigma(x - k) = 836.0, \quad \Sigma(x - k)^2 = 25410.8,$$

where k is a constant.

- (a) Given that the mean of these 40 values is 124.0, find the value of k . [2]

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- (b) Find the standard deviation of these 40 values of x . [2]

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- (a)** 3 students are selected at random from the students who study Science.

[illegible]

- [illegible]



- 3 A fair six-sided dice with faces labelled 1, 2, 3, 4, 5, 6 is thrown repeatedly until a 3 is obtained. The number of throws taken is denoted by the random variable X .

(a) Find $P(X = 8)$. [1]

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(b) Find $P(X < 9)$. [2]

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(c) Find the probability that a 3 is obtained for the second time before the 6th throw. [3]

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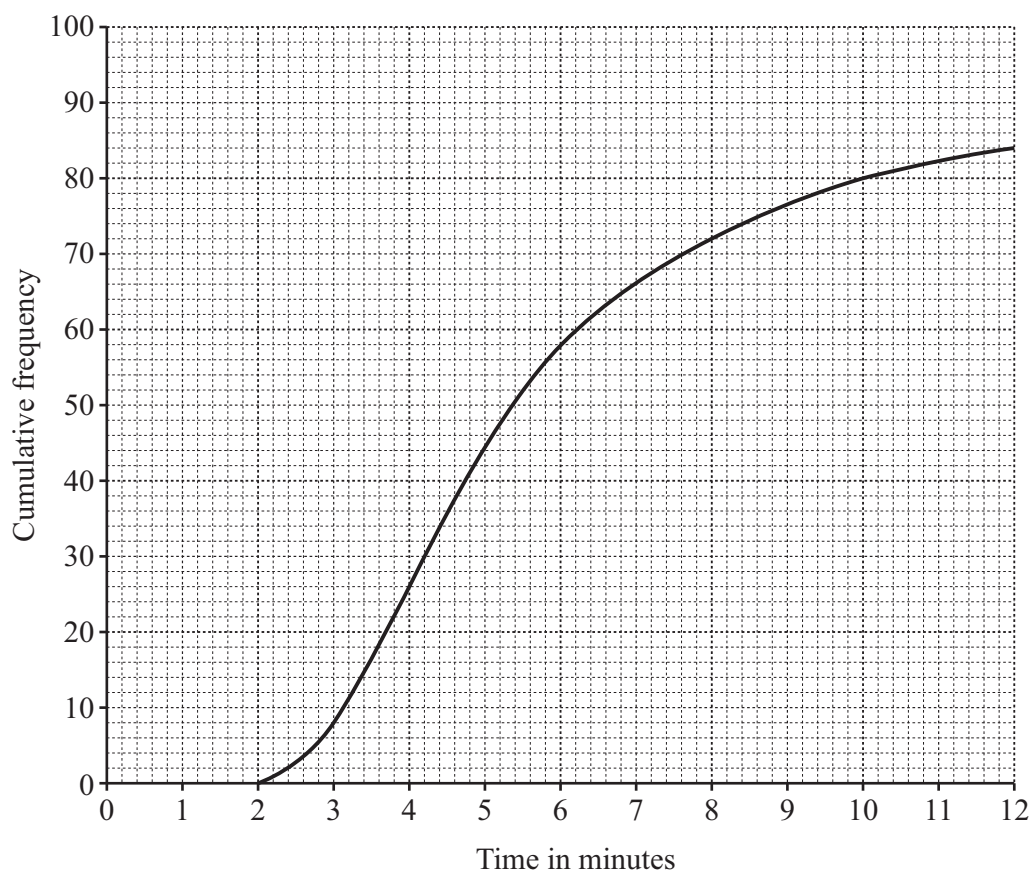
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- 4 84 people attempt a particular puzzle. The times taken, in minutes, to complete the puzzle are recorded. These times are represented in the cumulative frequency graph below.



- (a) Use the graph to estimate how many people took between 4 and 7.5 minutes to complete the puzzle. [1]

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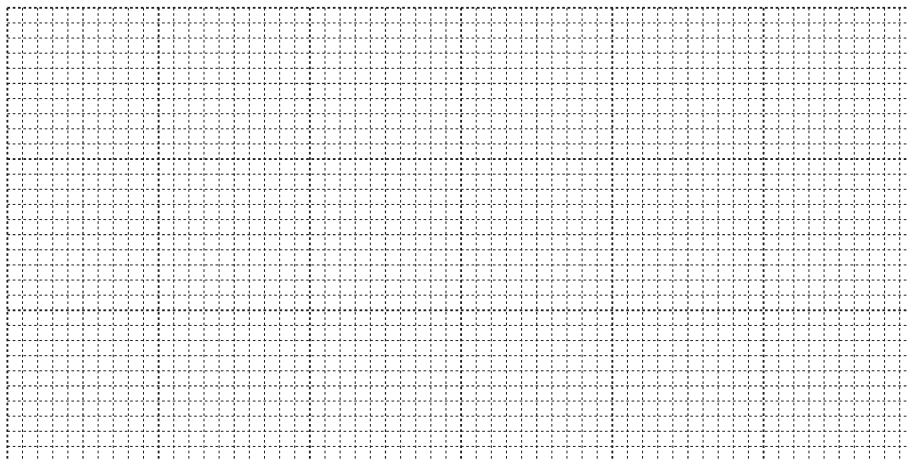
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- (b) On the grid below, draw a box-and-whisker plot to summarise the information in the cumulative frequency graph. [4]



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5 Bag A contains 6 red marbles, 5 blue marbles and 1 green marble.

Bag B contains 5 red marbles and 3 blue marbles.

A marble is chosen at random from bag A and placed in bag B .

A marble is now chosen at random from bag B .

(a) Draw a tree diagram to represent this information, giving the probability on each branch.

[3]





(b) Find the probability that both marbles chosen are the same colour.

[2]

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(c) Find the probability that the marble chosen from bag A is blue, given that the marble chosen from bag B is blue.

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- 6 A company sells bags of pasta. The masses of large bags of pasta are normally distributed with mean 2.50 kg and standard deviation 0.12 kg.

(a) Find the probability that the mass of pasta in a randomly chosen large bag is less than 2.65 kg. [2]

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A restaurant manager buys 160 of these large bags of pasta.

(b) Find the number of bags for which you would expect the mass of pasta to be more than 1.65 standard deviations above the mean. [3]

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(c) Find, in either order, the value of μ and the value of σ . [5]

[illegible]



7 A set of friends consists of 7 men and 4 women. Three of the men are brothers: Ali, Ben and Charlie.

- (a) Find the number of different arrangements of the 7 men in a line in which Ali and Ben do **not** stand next to each other. [3]

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- (b) Find the number of different arrangements of the 7 men and 4 women in a line in which all the men stand together and all the women stand together. [3]

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- (c) In how many ways can the 7 men and 4 women be divided into a group of 6, a group of 3 and a group of 2 if there are no restrictions? [2]

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- (d) The 7 men and 4 women are divided at random into a group of 6, a group of 3 and a group of 2. Find the probability that Ali, Ben and Charlie are all in the same group. [4]

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[illegible]





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MATHEMATICS**9709/55**

Paper 5 Probability & Statistics 1

May/June 2025**1 hour 15 minutes**

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1 Two fair 6-sided dice with faces labelled 1, 2, 3, 4, 5, 6 are thrown. The two scores are noted. The random variable X is defined as follows.

- If the two scores are equal, $X = 0$
- If the scores are not equal, X is the larger score minus the smaller score

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

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

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- This image shows a single sheet of white paper with ten horizontal dashed lines, typical of primary-ruled notebook paper. The lines are evenly spaced and extend across the width of the page. There is no handwriting or other markings on the paper.



3 In a certain large school, on average, two pupils in five have music lessons.

A random sample of 80 pupils from this school is chosen.

(a) Use an approximation to find the probability that fewer than 27 pupils have music lessons. [5]

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A random sample of 10 pupils from this school is now chosen.

(b) Find the probability that no more than 2 pupils have music lessons. [3]

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- 4 Students applying to Drydale College take an entrance test. A student is either accepted or rejected or required to take another test with probabilities 0.3, 0.2 and 0.5 respectively. When a student takes a second test the outcomes and probabilities are exactly the same as for the first test. A student who has to take a third test is accepted with probability 0.25 and rejected with probability 0.75.

(a) Draw a tree diagram to illustrate this information, showing all the probabilities. [2]

(b) Find the probability that a randomly chosen student who applies to Drydale College is accepted. [2]

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- (c) Find the probability that a randomly chosen student who applies to Drydale College takes at least two tests given that the student is accepted. [3]

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Three friends apply to Drydale College.

- (d) Find the probability that all three are rejected. [2]

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- 5 The Smarts and the Teasers are two quiz teams that each contain 11 members. Both complete a puzzle and the following table gives the times taken, in minutes, by the members of each team.

Smarts	38	30	13	29	18	22	28	18	11	9	41
Teasers	39	37	18	36	25	25	32	21	15	12	39

- (a) Represent this information in a back-to-back stem-and-leaf diagram with Smarts on the left-hand side. [4]

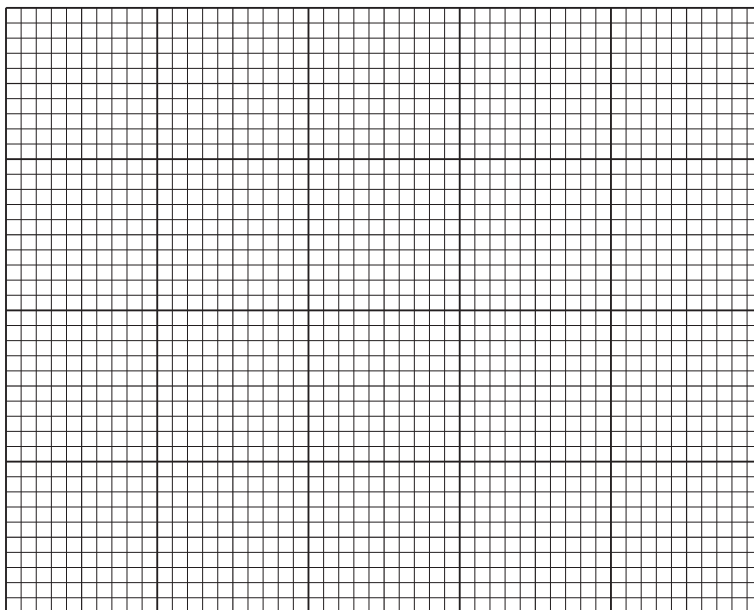




For the Teasers, the values of the lower quartile, median and upper quartile are 18, 25 and 37 minutes respectively.

(b) On a single diagram draw box-and-whisker plots for the two teams.

[4]



(c) Make two comparisons between the times for the two teams.

[2]

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- 6 A darts club has 12 members made up of 7 men and 5 women.

Every Monday, a team of 4 is chosen at random to represent the club in a competition.

- (a) Find the probability that, on a particular Monday, the team consists of 1 man and 3 women. [3]

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Every Tuesday, the darts club chooses 3 teams of 4. Each team enters a competition in a different town.

- (b) In how many different ways can the teams be chosen if there are no restrictions? [2]

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- (c) In how many different ways can the teams be chosen if each team must contain at least 1 man and at least 1 woman? [3]

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The 7 men stand in a line for a photograph. Two of them are brothers, George and Harry.

- (d) How many different arrangements are there of the 7 men in which there are exactly 2 men between George and Harry? [2]

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