Cambridge A Level 9709

MATHEMATICS

PAPER 5 (S1)
STATISTICS 1 TOPICAL

WITH ANSWERS

JUNE 2012 – NOVEMBER 2022

FOR CAMBRIDGE 2023 -2025 and onwards EXAMS

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A LEVEL MATHEMATICS P5 S1

Preface

This a l·ŭKŜY l·ŭλŎă {ŭ l·ŭλăŭλŎă {1 Question Bank is the est reparation tool for ractice 2f Cambridge 2022 and onwards exams.

This new series covers the entire new syllabus for CAIE Mathematics (9709/{1). All the Questions are extracted from the past papers of Cambridge Assessment International Examinations A-Level from 2002 to 2020, including all variants as I tried to provide maximum number of questions in each topic for their detailed practice.

I am also thankful to all my friends and colleagues who encouraged me, especially **Sir Jawad Saeed** who gave me some valuable suggestions for developing this book.

I have added formulae sheets and tables at the start of every topic as helping tool for students., if there is any mistake or suggestion for improvement, please don't hesitate, come forward and take part in this Noble cause for future generations

Thanks,

Mirza Mubbashir Baig.
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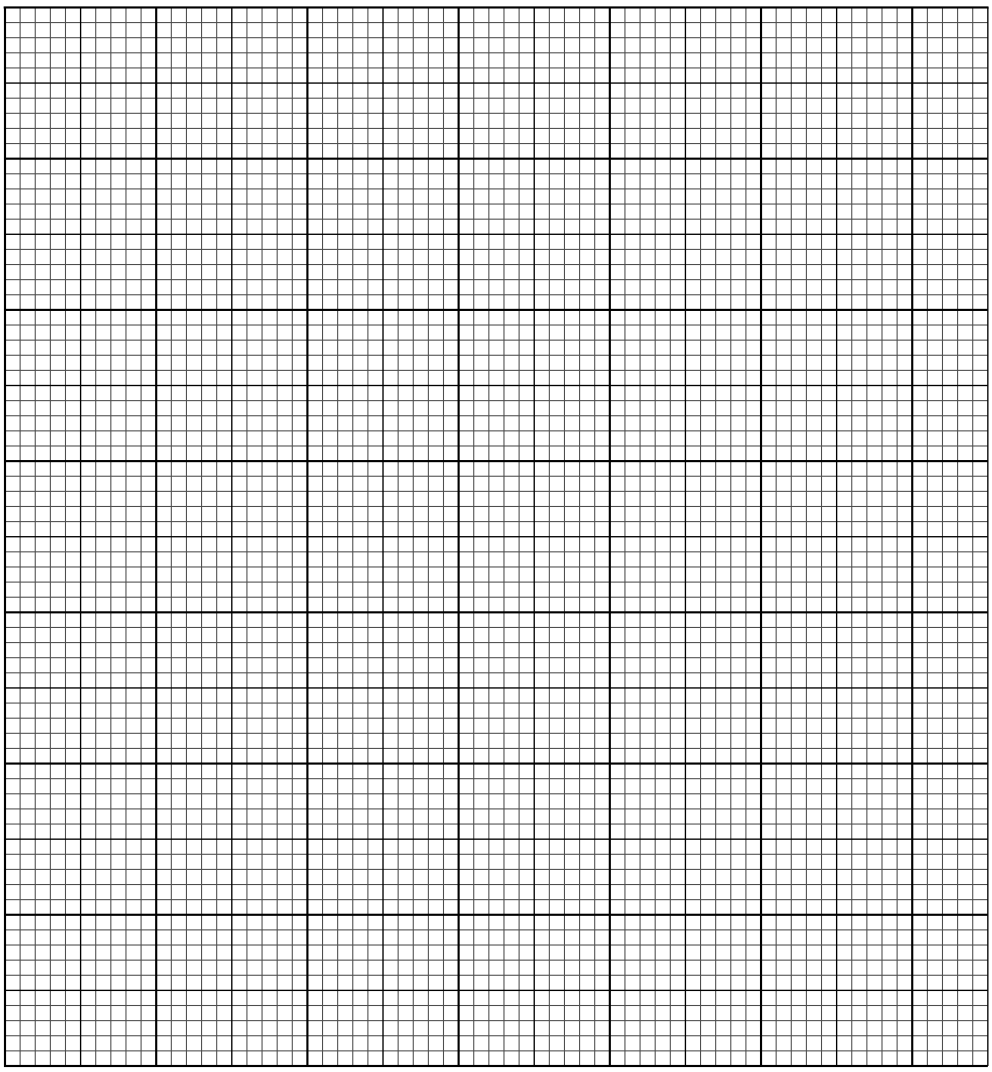
Topic 1. Representation of Data

1 ON 2022/ P53/Q3

The times, t minutes, taken to complete a walking challenge by 250 members of a club are summarised in the table.

Time taken (t minutes)	$t \leqslant 20$	$t \leqslant 30$	$t \leqslant 35$	$t \leqslant 40$	$t \leqslant 50$	$t \leqslant 60$
Cumulative frequency	32	66	112	178	228	250

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



(b) Use your graph to estimate the 60th percentile of the data. [1]

It is given that an estimate for the mean time taken to complete the challenge by these 250 members is 34.4 minutes.

(c) Calculate an estimate for the standard deviation of the times taken to complete the challenge by these 250 members. [4]

2 **ON 2022/ P53/Q1**

50 values of the variable x are summarised by

$$\Sigma(x - 20) = 35 \qquad \text{and} \qquad \Sigma x^2 = 25\,036.$$

Find the variance of these 50 values. [3]

3 **ON 2022/ P51/Q3**

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.

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]

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]

4 **MJ 2022/ P53/Q2**

Twenty children were asked to estimate the height of a particular tree. Their estimates, in metres, were as follows.

4.1	4.2	4.4	4.5	4.6	4.8	5.0	5.2	5.3	5.4
5.5	5.8	6.0	6.2	6.3	6.4	6.6	6.8	6.9	19.4

(a) Find the mean of the estimated heights. [1]

(b) Find the median of the estimated heights. [1]

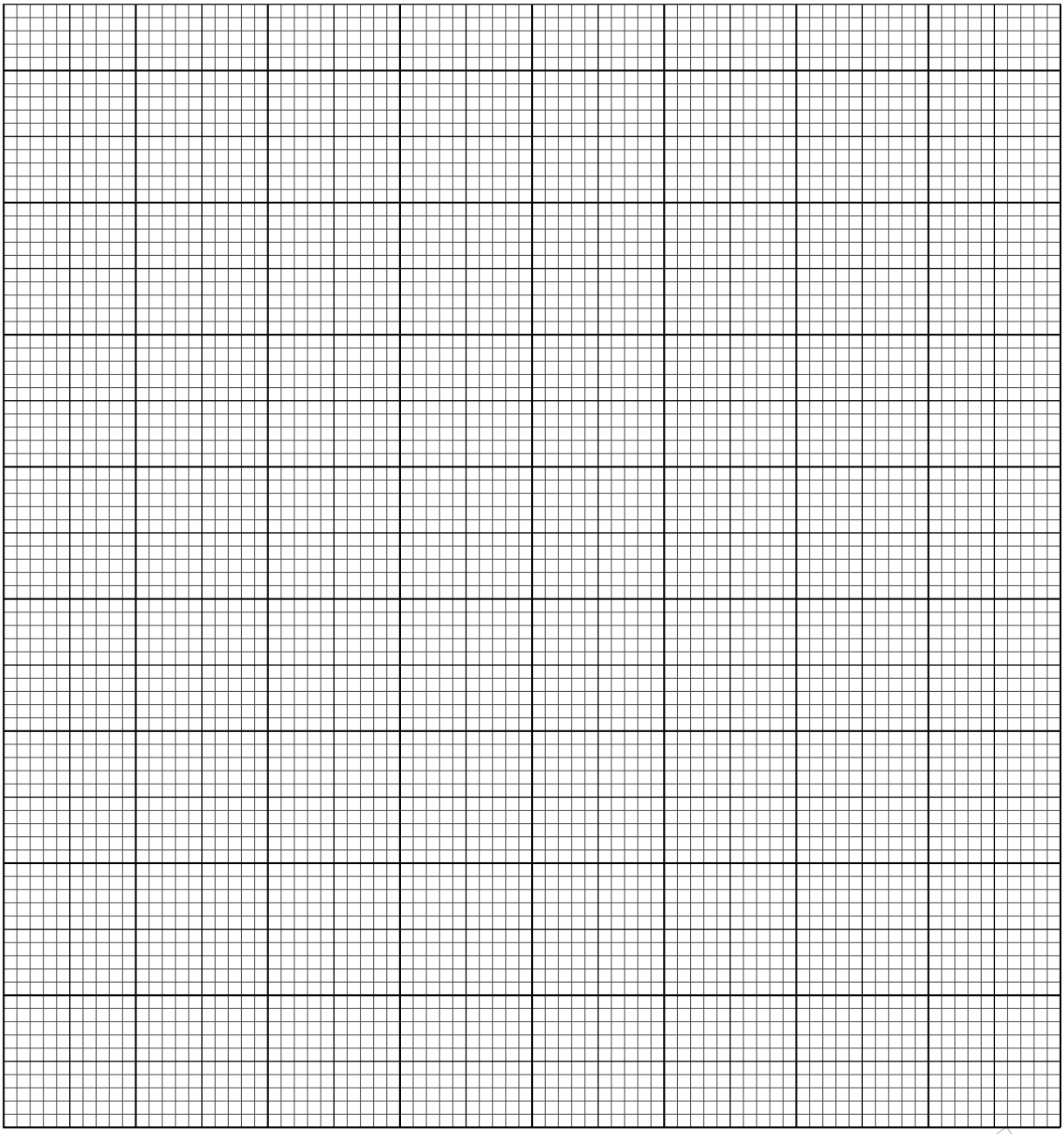
(c) Give a reason why the median is likely to be more suitable than the mean as a measure of the central tendency for this information. [1]

5 **MJ 2022/ P53/Q1**

The time taken, t minutes, to complete a puzzle was recorded for each of 150 students. These times are summarised in the table.

Time taken (t minutes)	$t \leqslant 25$	$t \leqslant 50$	$t \leqslant 75$	$t \leqslant 100$	$t \leqslant 150$	$t \leqslant 200$
Cumulative frequency	16	44	86	104	132	150

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



(b) Use your graph to estimate the 20th percentile of the data. [1]

6 **MJ 2022/ P52/Q3**

The back-to-back stem-and-leaf diagram shows the diameters, in cm, of 19 cylindrical pipes produced by each of two companies, A and B.

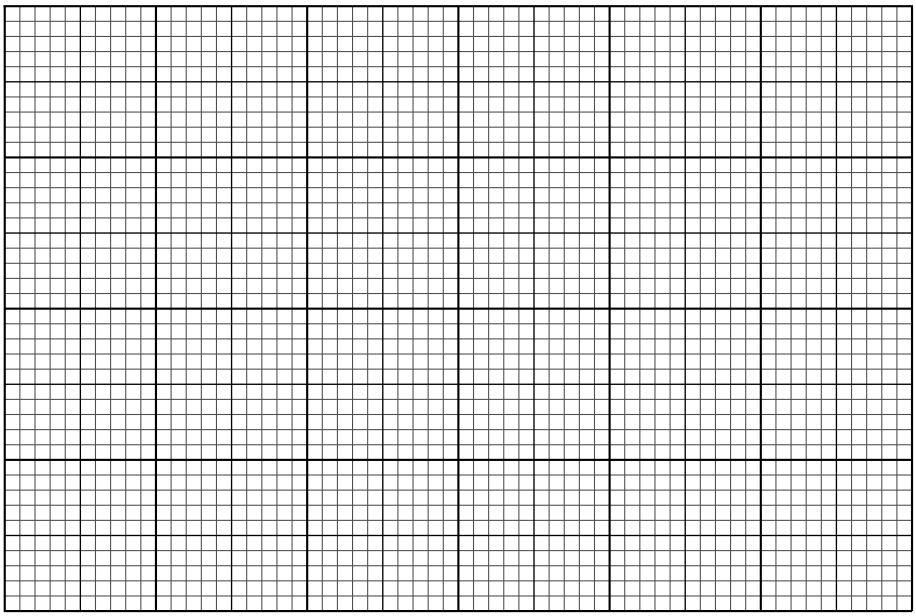
Company A							Company B				
					4	33	1	2	8		
	9	8	3	2	0	34	1	6	8	9	9
8	7	5	4	1	1	35	1	2	2	3	
		9	6	5	2	36	5	6			
			4	3	1	37	0	3	4		
						38	2	8			

Key: $1 \mid 35 \mid 3$ means the pipe diameter from company A is 0.351 cm and from company B is 0.353 cm.

(a) Find the median and interquartile range of the pipes produced by company A. [3]

It is given that for the pipes produced by company B the lower quartile, median and upper quartile are 0.346 cm, 0.352 cm and 0.370 cm respectively.

(b) Draw box-and-whisker plots for companies A and B on the grid below. [3]



(c) Make one comparison between the diameters of the pipes produced by companies A and B. [1]

7 **MJ 2022/ P52/Q1**

For n values of the variable x, it is given that

$$\Sigma(x - 200) = 446 \quad \text{and} \quad \Sigma x = 6846.$$

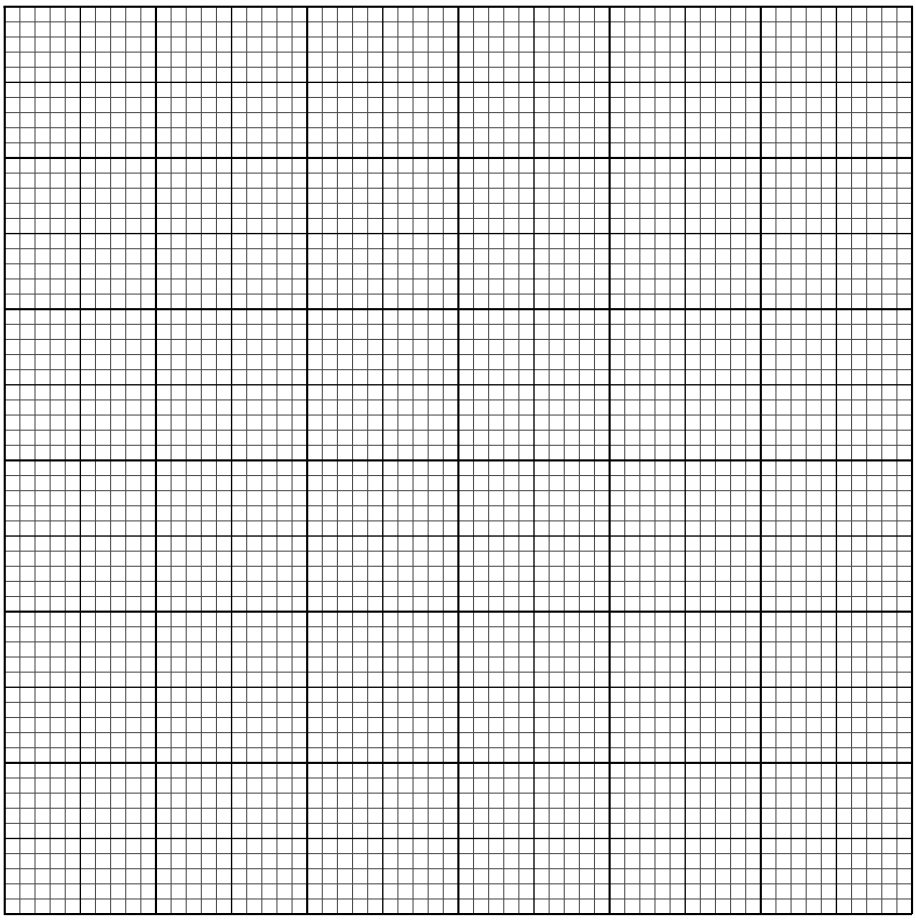
Find the value of n. [3]

8 **MJ 2022/ P51/Q3**

The times taken to travel to college by 2500 students are summarised in the table.

Time taken (t minutes)	$0 \leqslant t < 20$	$20 \leqslant t < 30$	$30 \leqslant t < 40$	$40 \leqslant t < 60$	$60 \leqslant t < 90$
Frequency	440	720	920	300	120

(a) Draw a histogram to represent this information. [4]



From the data, the estimate of the mean value of t is 31.44.

(b) Calculate an estimate of the standard deviation of the times taken to travel to college. [3]

(c) In which class interval does the upper quartile lie? [1]

It was later discovered that the times taken to travel to college by two students were incorrectly recorded. One student's time was recorded as 15 instead of 5 and the other's time was recorded as 65 instead of 75.

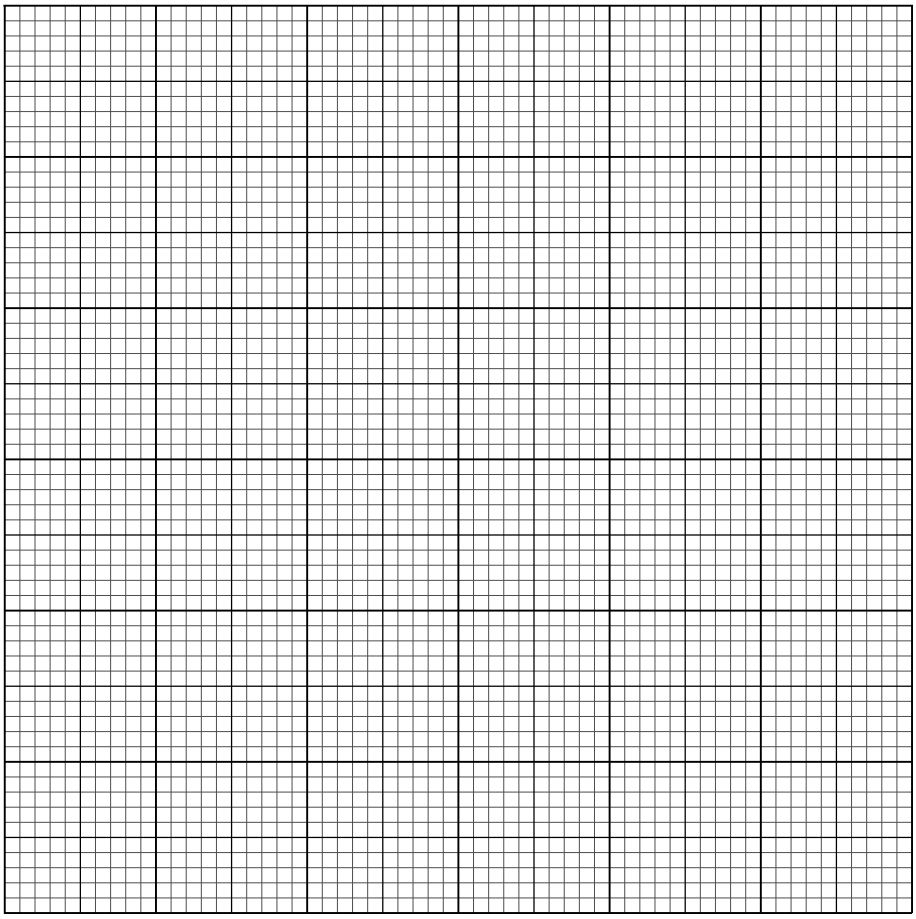
(d) Without doing any further calculations, state with a reason whether the estimate of the standard deviation in part **(b)** would be increased, decreased or stay the same. [1]

9 **ON 2021/ P53/Q3**

The times taken, in minutes, by 360 employees at a large company to travel from home to work are summarised in the following table.

Time, t minutes	$0 \leqslant t < 5$	$5 \leqslant t < 10$	$10 \leqslant t < 20$	$20 \leqslant t < 30$	$30 \leqslant t < 50$
Frequency	23	102	135	76	24

(a) Draw a histogram to represent this information. [4]



(b) Calculate an estimate of the mean time taken by an employee to travel to work. [2]

10 **ON 2021/ P53/Q2**

Lakeview and Riverside are two schools. The pupils at both schools took part in a competition to see how far they could throw a ball. The distances thrown, to the nearest metre, by 11 pupils from each school are shown in the following table.

Lakeview	10	14	19	22	26	27	28	30	32	33	41
Riverside	23	36	21	18	37	25	18	20	24	30	25

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

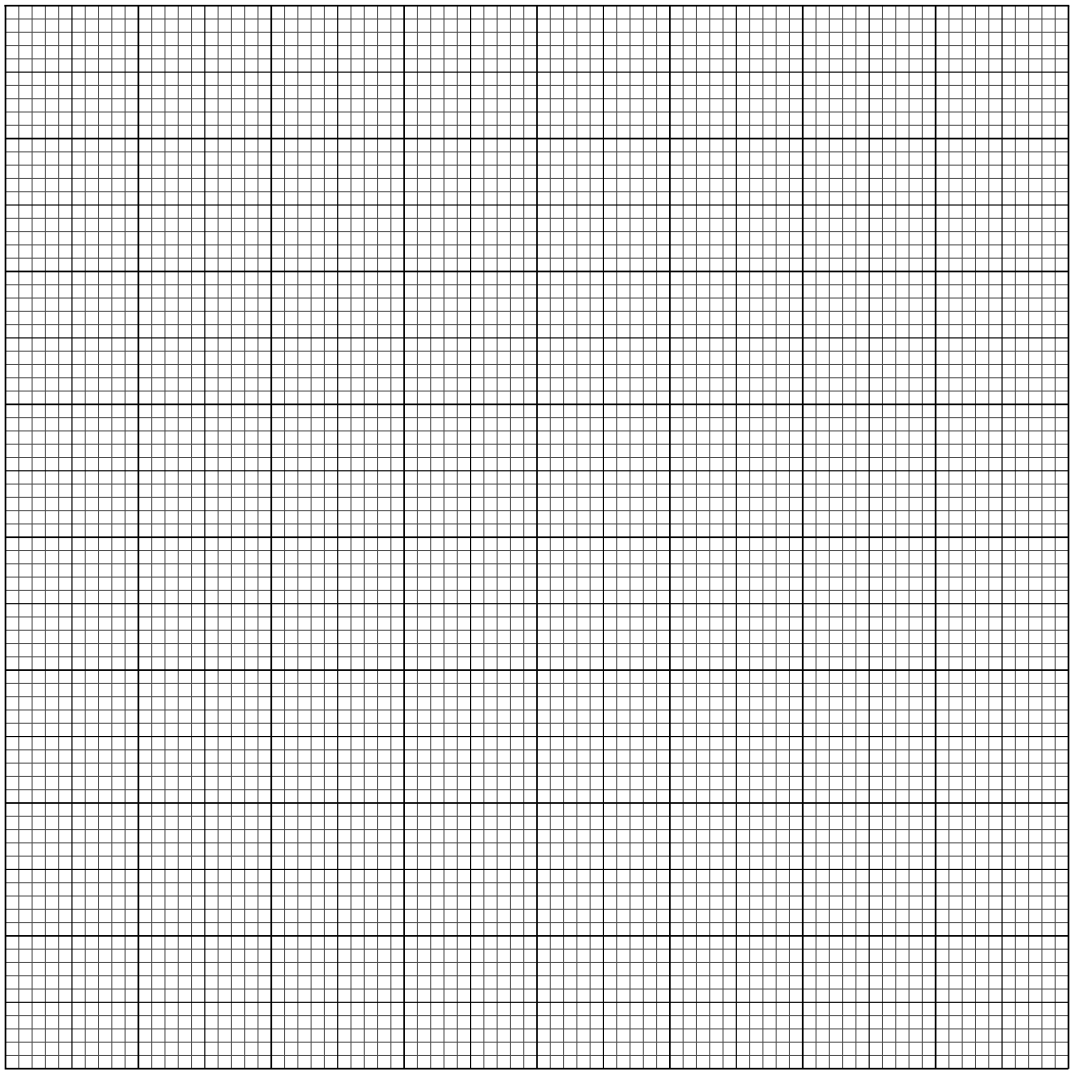
(b) Find the interquartile range of the distances thrown by the 11 pupils at Lakeview school. [2]

11 **ON 2021/ P52/Q7**

The distances, x m, travelled to school by 140 children were recorded. The results are summarised in the table below.

Distance, x m	$x \leqslant 200$	$x \leqslant 300$	$x \leqslant 500$	$x \leqslant 900$	$x \leqslant 1200$	$x \leqslant 1600$
Cumulative frequency	16	46	88	122	134	140

(a) On the grid, draw a cumulative frequency graph to represent these results. [2]



(b) Use your graph to estimate the interquartile range of the distances. [2]

(c) Calculate estimates of the mean and standard deviation of the distances. [6]

12 **ON 2021/ P51/Q6**

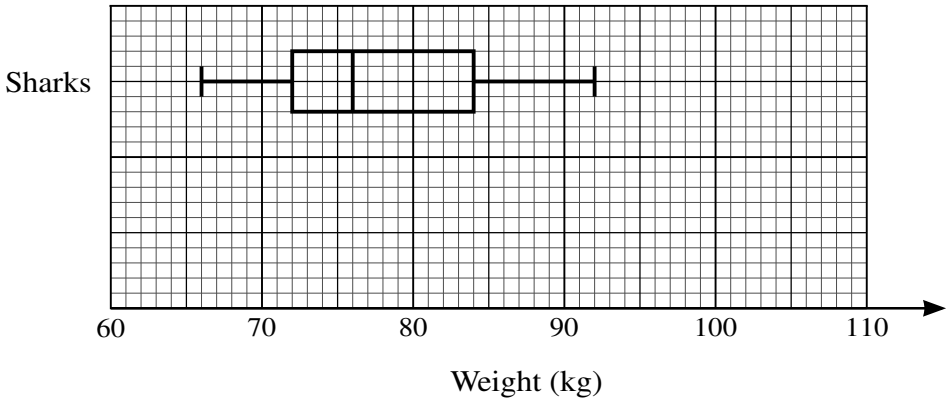
The weights, in kg, of 15 rugby players in the Rebels club and 15 soccer players in the Sharks club are shown below.

Rebels	75	78	79	80	82	82	83	84	85	86	89	93	95	99	102
Sharks	66	68	71	72	74	75	75	76	78	83	83	84	85	86	92

(a) Represent the data by drawing a back-to-back stem-and-leaf diagram with Rebels on the left-hand side of the diagram. [4]

(b) Find the median and the interquartile range for the Rebels. [3]

A box-and-whisker plot for the Sharks is shown below.



(c) On the same diagram, draw a box-and-whisker plot for the Rebels. [2]

(d) Make one comparison between the weights of the players in the Rebels club and the weights of the players in the Sharks club. [1]

13 **ON 2021/ P51/Q2**

A summary of 40 values of x gives the following information:

$$\Sigma(x-k) = 520, \qquad \Sigma(x-k)^2 = 9640,$$

where k is a constant.

(a) Given that the mean of these 40 values of x is 34, find the value of k. [2]

(b) Find the variance of these 40 values of x. [2]

14 **MJ 2021/ P53/Q3**

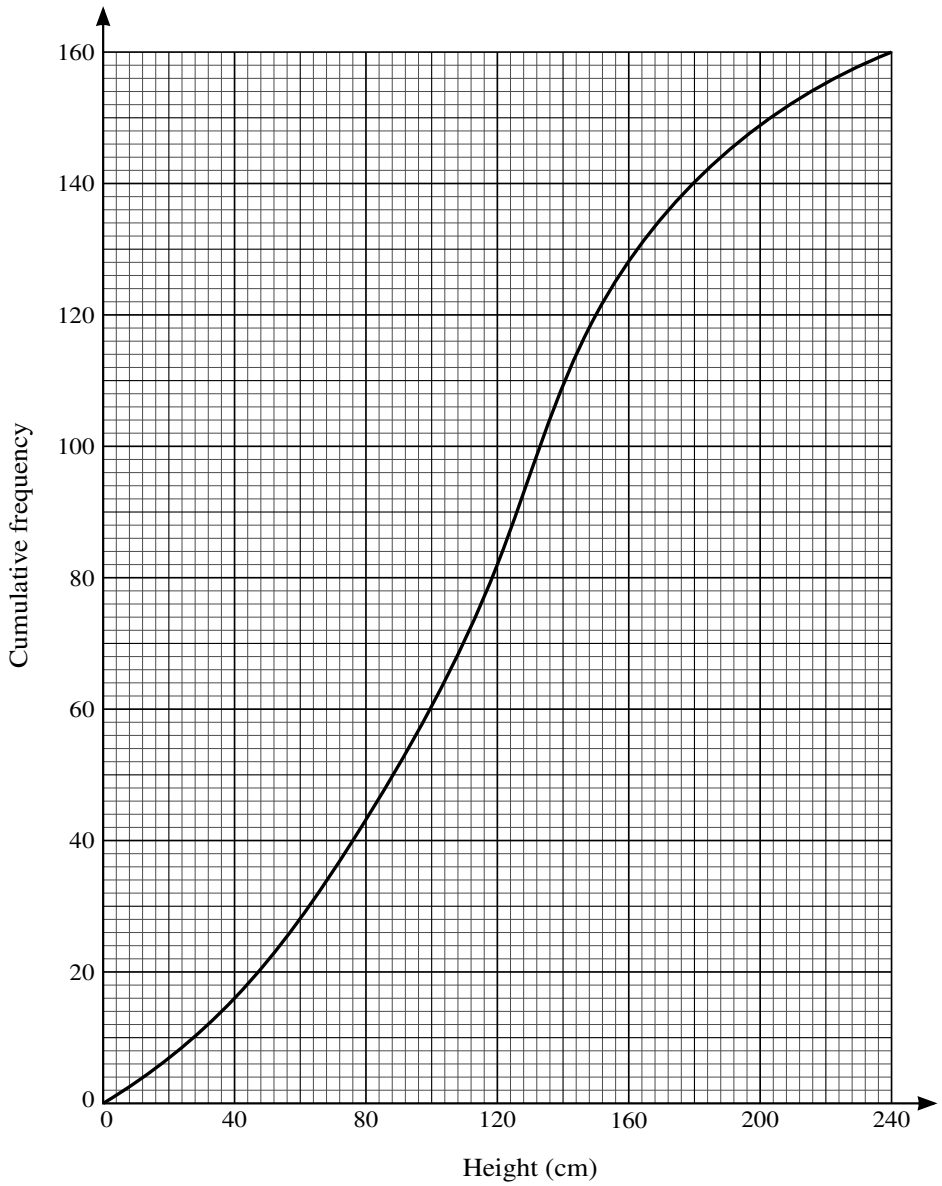
A sports club has a volleyball team and a hockey team. The heights of the 6 members of the volleyball team are summarised by $\Sigma x = 1050$ and $\Sigma x^2 = 193\,700$, where x is the height of a member in cm. The heights of the 11 members of the hockey team are summarised by $\Sigma y = 1991$ and $\Sigma y^2 = 366\,400$, where y is the height of a member in cm.

(a) Find the mean height of all 17 members of the club. [2]

(b) Find the standard deviation of the heights of all 17 members of the club. [3]

15 **MJ 2021/ P53/Q1**

The heights in cm of 160 sunflower plants were measured. The results are summarised on the following cumulative frequency curve.



(a) Use the graph to estimate the number of plants with heights less than 100 cm. [1]

(b) Use the graph to estimate the 65th percentile of the distribution. [2]

(c) Use the graph to estimate the interquartile range of the heights of these plants. [2]

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16 **MJ 2021/ P52/Q7**

The heights, in cm, of the 11 basketball players in each of two clubs, the Amazons and the Giants, are shown below.

Amazons	205	198	181	182	190	215	201	178	202	196	184
Giants	175	182	184	187	189	192	193	195	195	195	204

(a) State an advantage of using a stem-and-leaf diagram compared to a box-and-whisker plot to illustrate this information. [1]

(b) Represent the data by drawing a back-to-back stem-and-leaf diagram with Amazons on the left-hand side of the diagram. [4]

(c) Find the interquartile range of the heights of the players in the Amazons. [2]

Four new players join the Amazons. The mean height of the 15 players in the Amazons is now 191.2 cm. The heights of three of the new players are 180 cm, 185 cm and 190 cm.

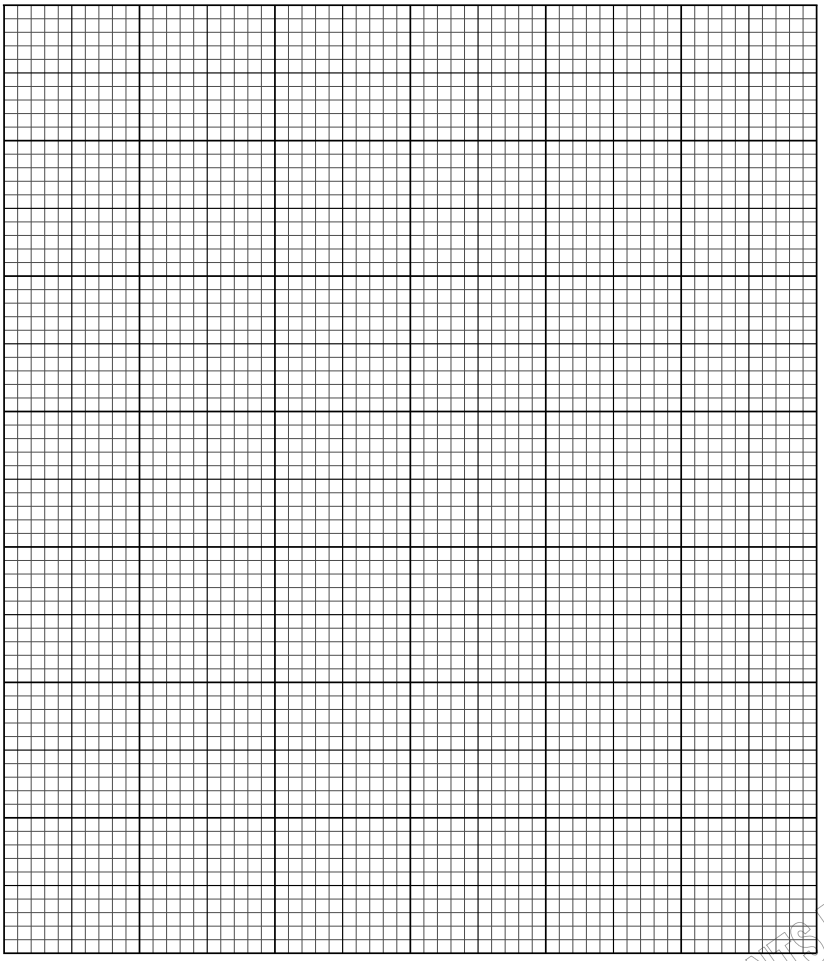
(d) Find the height of the fourth new player. [3]

17 **MJ 2021/ P51/Q5**

The times taken by 200 players to solve a computer puzzle are summarised in the following table.

Time (t seconds)	$0 \leqslant t < 10$	$10 \leqslant t < 20$	$20 \leqslant t < 40$	$40 \leqslant t < 60$	$60 \leqslant t < 100$
Number of players	16	54	78	32	20

(a) Draw a histogram to represent this information. [4]



(b) Calculate an estimate of the mean time taken by these 200 players. [2]

(c) Find the greatest possible value of the interquartile range of these times. [2]

18 **ON 2019/ P62/Q1**

Twelve tourists were asked to estimate the height, in metres, of a new building. Their estimates were as follows.

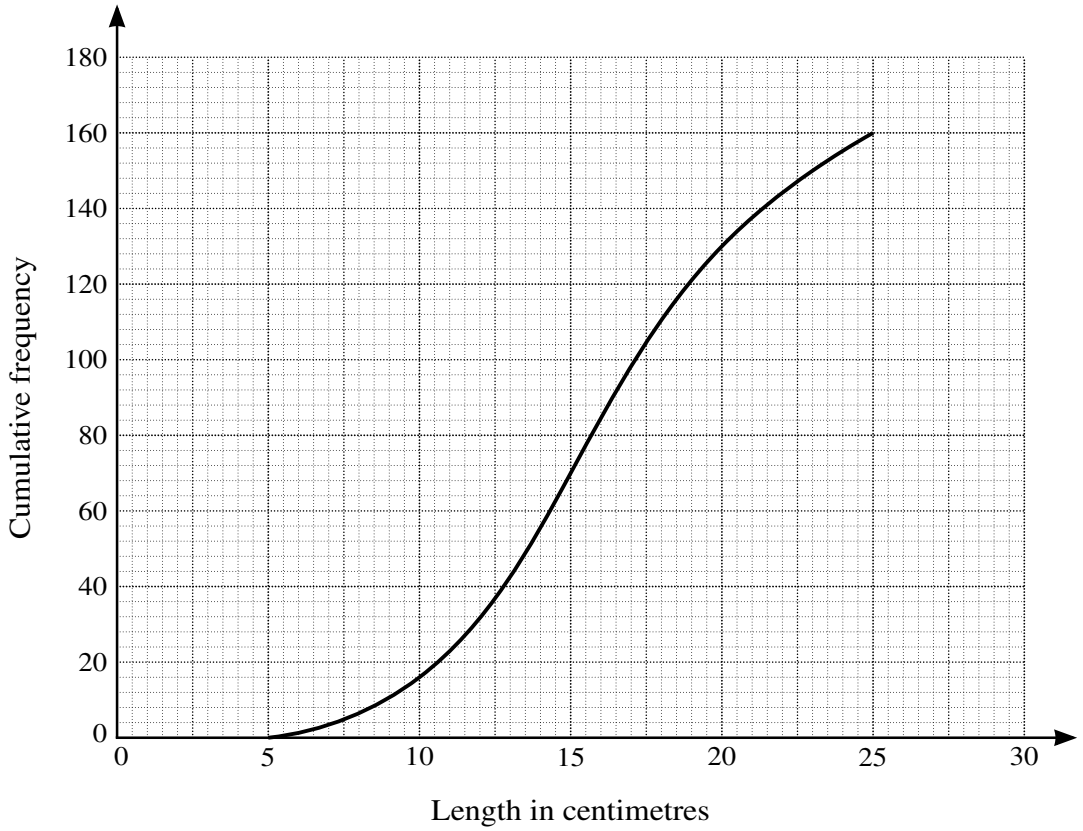
50 45 62 30 40 55 110 38 52 60 55 40

(i) Find the median and the interquartile range for the data. [3]

(ii) Give a disadvantage of using the mean as a measure of the central tendency in this case. [1]

19 **ON 2019/ P61/Q5**

Ransha measured the lengths, in centimetres, of 160 palm leaves. His results are illustrated in the cumulative frequency graph below.

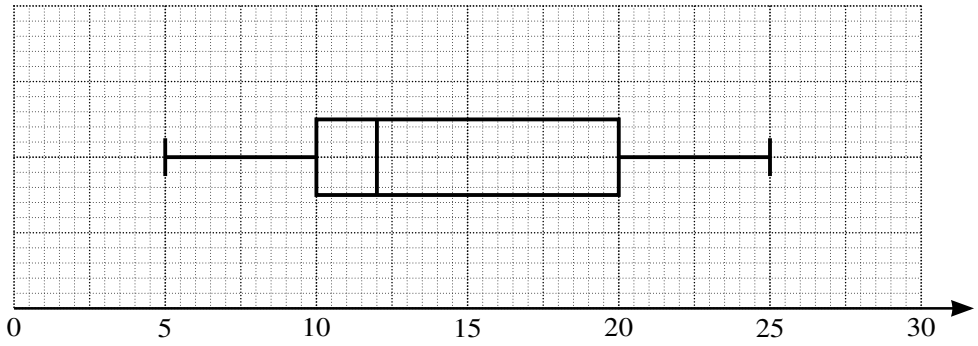


(i) Estimate how many leaves have a length between 14 and 24 centimetres. [1]

(ii) 10% of the leaves have a length of L centimetres or more. Estimate the value of L. [2]

(iii) Estimate the median and the interquartile range of the lengths. [3]

Sharim measured the lengths, in centimetres, of 160 palm leaves of a different type. He drew a box-and-whisker plot for the data, as shown on the grid below.



(iv) Compare the central tendency and the spread of the two sets of data. [2]

20 **ON 2019/ P61/Q3**

The mean and standard deviation of 20 values of x are 60 and 4 respectively.

(i) Find the values of Σx and Σx^2. [3]

Another 10 values of x are such that their sum is 550 and the sum of their squares is 40 500.

(ii) Find the mean and standard deviation of all these 30 values of x. [4]

21 **MJ 2019/ P63/Q7**

The times in minutes taken by 13 pupils at each of two schools in a cross-country race are recorded in the table below.

Thaters School	38	43	48	52	54	56	57	58	58	61	62	66	75
Whitefay Park School	45	47	53	56	56	61	64	66	69	73	75	78	83

(i) Draw a back-to-back stem-and-leaf diagram to illustrate these times with Thaters School on the left. [4]

(ii) Find the interquartile range of the times for pupils at Thaters School. [2]

The times taken by pupils at Whitefay Park School are denoted by x minutes.

(iii) Find the value of $\Sigma(x - 60)^2$. [2]

(iv) It is given that $\Sigma(x - 60) = 46$. Use this result, together with your answer to part **(iii)**, to find the variance of x. [2]

22 MJ 2019/ P62/Q6

(i) Give one advantage and one disadvantage of using a box-and-whisker plot to represent a set of data. [2]

(ii) The times in minutes taken to run a marathon were recorded for a group of 13 marathon runners and were found to be as follows.

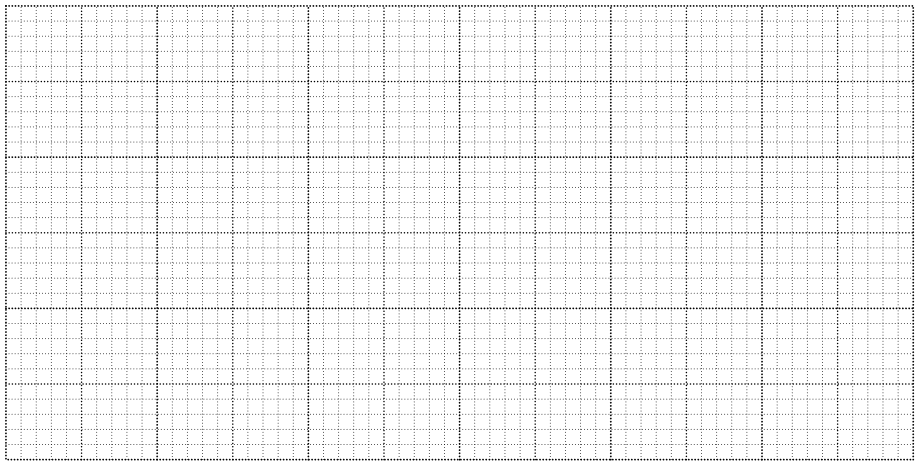
180 275 235 242 311 194 246 229 238 768 332 227 228

State which of the mean, mode or median is most suitable as a measure of central tendency for these times. Explain why the other measures are less suitable. [3]

(iii) Another group of 33 people ran the same marathon and their times in minutes were as follows.

190	203	215	246	249	253	255	254	258	260	261
263	267	269	274	276	280	288	283	287	294	300
307	318	327	331	336	345	351	353	360	368	375

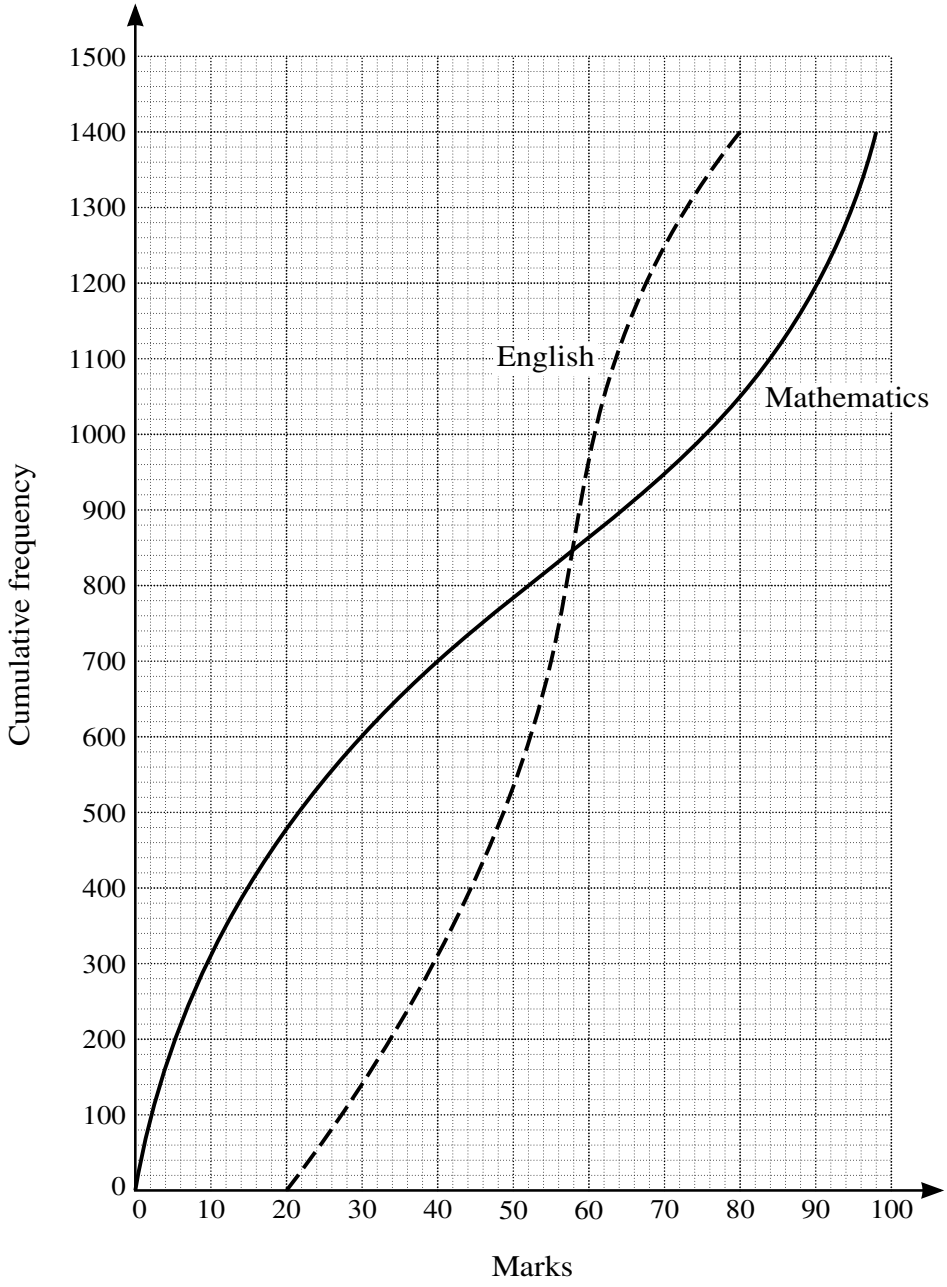
(a) On the grid below, draw a box-and-whisker plot to illustrate the times for these 33 people. [4]



(b) Find the interquartile range of these times. [1]

23 **MJ 2019/ P61/Q4**

The Mathematics and English A-level marks of 1400 pupils all taking the same examinations are shown in the cumulative frequency graphs below. Both examinations are marked out of 100.



Use suitable data from these graphs to compare the central tendency and spread of the marks in Mathematics and English. [6]

24 MJ 2019/ P61/Q1

The times, t seconds, taken to swim 100 m were recorded for a group of 9 swimmers and were found to be as follows.

95 126 117 135 120 125 114 119 136

(i) Find the values of $\Sigma(t - 120)$ and $\Sigma(t - 120)^2$. [2]

(ii) Using your values found in part **(i)**, calculate the variance of t. [2]

25 ON 2018/ P63/Q7

The heights, in cm, of the 11 members of the Anvils athletics team and the 11 members of the Brecons swimming team are shown below.

Anvils	173	158	180	196	175	165	170	169	181	184	172
Brecons	166	170	171	172	172	178	181	182	183	183	192

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

(ii) Find the median and the interquartile range for the heights of the Anvils. [3]

The heights of the 11 members of the Anvils are denoted by x cm. It is given that $\Sigma x = 1923$ and $\Sigma x^2 = 337\,221$. The Anvils are joined by 3 new members whose heights are 166 cm, 172 cm and 182 cm.

(iii) Find the standard deviation of the heights of all 14 members of the Anvils. [4]

26 ON 2018/ P62/Q5

The Quivers Archery club has 12 Junior members and 20 Senior members. For the Junior members, the mean age is 15.5 years and the standard deviation of the ages is 1.2 years. The ages of the Senior members are summarised by $\Sigma y = 910$ and $\Sigma y^2 = 42\,850$, where y is the age of a Senior member in years.

(i) Find the mean age of all 32 members of the club. [2]

(ii) Find the standard deviation of the ages of all 32 members of the club. [4]

27 ON 2081/ P62/Q2

The following back-to-back stem-and-leaf diagram shows the reaction times in seconds in an experiment involving two groups of people, A and B.

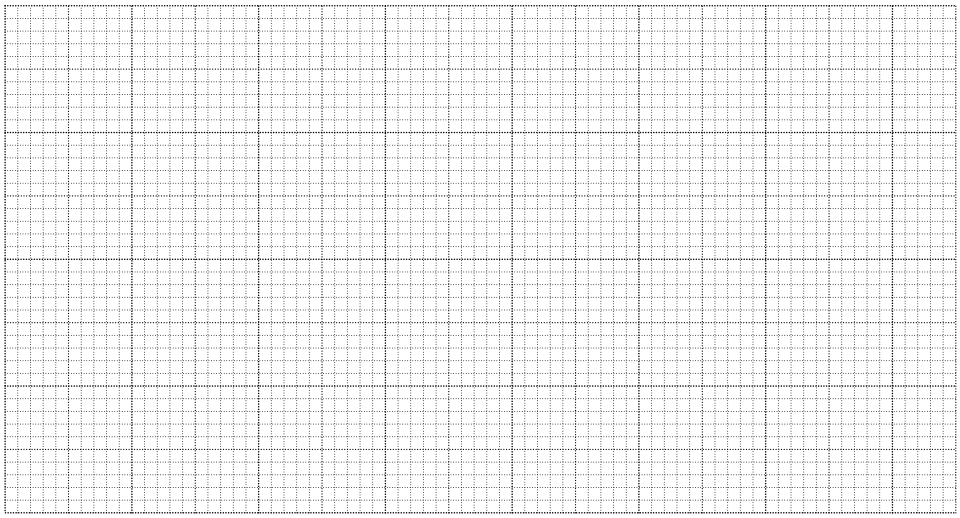
A			B	
(4)	4 2 0 0	20	5 6 7	(3)
(5)	9 8 5 0 0	21	1 2 2 3 7 7	(6)
(8)	9 8 7 5 3 2 2 2	22	1 3 5 6 6 8 9	(7)
(6)	8 7 6 5 2 1	23	4 5 7 8 8 9 9 9	(8)
(3)	8 6 3	24	2 4 5 6 7 8 8	(7)
(1)	0	25	0 2 7 8	(4)

Key: 5 | 22 | 6 means a reaction time of 0.225 seconds for A and 0.226 seconds for B

(i) Find the median and the interquartile range for group A. [3]

The median value for group B is 0.235 seconds, the lower quartile is 0.217 seconds and the upper quartile is 0.245 seconds.

(ii) Draw box-and-whisker plots for groups A and B on the grid. [3]



28 ON 2018/ P61/Q6

The daily rainfall, x mm, in a certain village is recorded on 250 consecutive days. The results are summarised in the following cumulative frequency table.

Rainfall, x mm	$x \leqslant 20$	$x \leqslant 30$	$x \leqslant 40$	$x \leqslant 50$	$x \leqslant 70$	$x \leqslant 100$
Cumulative frequency	52	94	142	172	222	250

(i) On the grid, draw a cumulative frequency graph to illustrate the data. [2]