AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE
STATISTICS

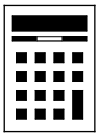
H

Higher Tier Paper 1

Monday 12 June 2023 Afternoon Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:
- a calculator
- a copy of the Data Sheet
- mathematical instruments.



Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross out any work you do not want to be marked.

Information
- The marks for the questions are shown in brackets.
- The maximum mark for this paper is 80.
- You may ask for more answer paper and graph paper. These must be tagged securely to this answer booklet.

For Examiner's Use	
Question	Mark
1–4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
TOTAL	

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Answer **all** questions in the spaces provided.

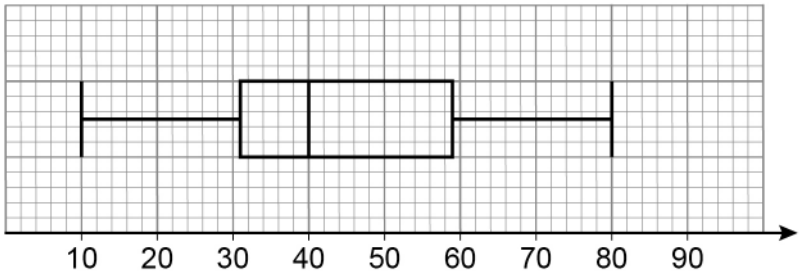
1 Which term best describes data that are **not** numerical?

Circle your answer.

[1 mark]

continuous discrete qualitative quantitative

2



What is the value of the median score shown in this box plot?

Circle your answer.

[1 mark]

28 31 40 59

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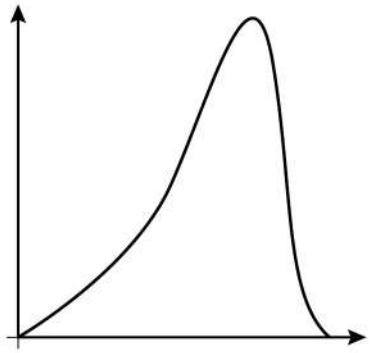
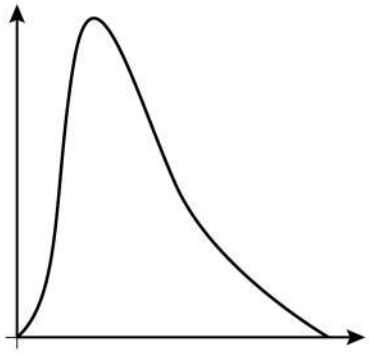
3 Here are four distributions.

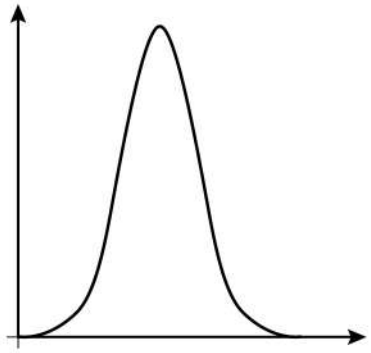
Distribution A



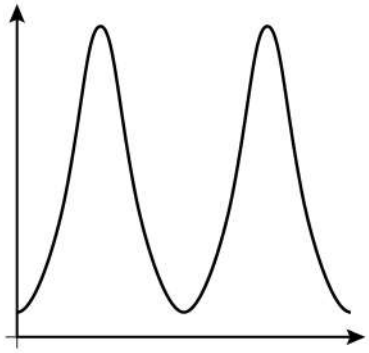
Distribution B



Distribution C



Distribution D



Which distribution shows negative skew?

Circle your answer.

[1 mark]

A B C D

4 *A* and *B* are independent events.

Circle the statement that is **false**.

[1 mark]

$P(A \mid B) = P(A)$

$P(A \mid \text{not } B) = P(\text{not } B)$

$P(A \text{ and } B) = P(A) \times P(B)$

$P(A \text{ and not } B) = P(A) \times P(\text{not } B)$

4

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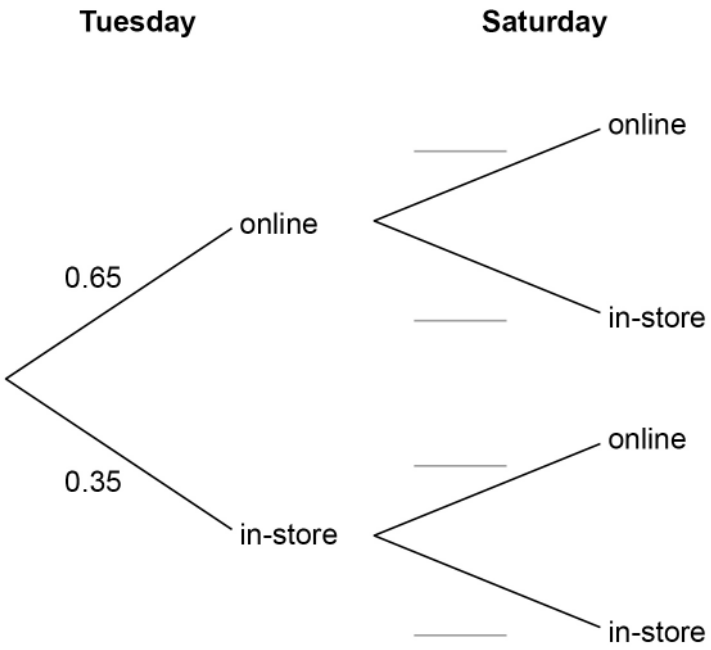
5 Ryan shops for groceries every Tuesday and Saturday.

He only shops either online or in-store.

The tree diagram shows some of the probabilities.



If Ryan shops online on Tuesday, the probability he shops **online** on Saturday is 0.2

If Ryan shops in-store on Tuesday, the probability he shops **online** on Saturday is 0.4

5 (a) Complete the tree diagram to show the probabilities for Saturday.

[2 marks]

5 (b) Work out the probability that Ryan will shop for groceries online **at least once** next week.

[3 marks]

Answer _____

5

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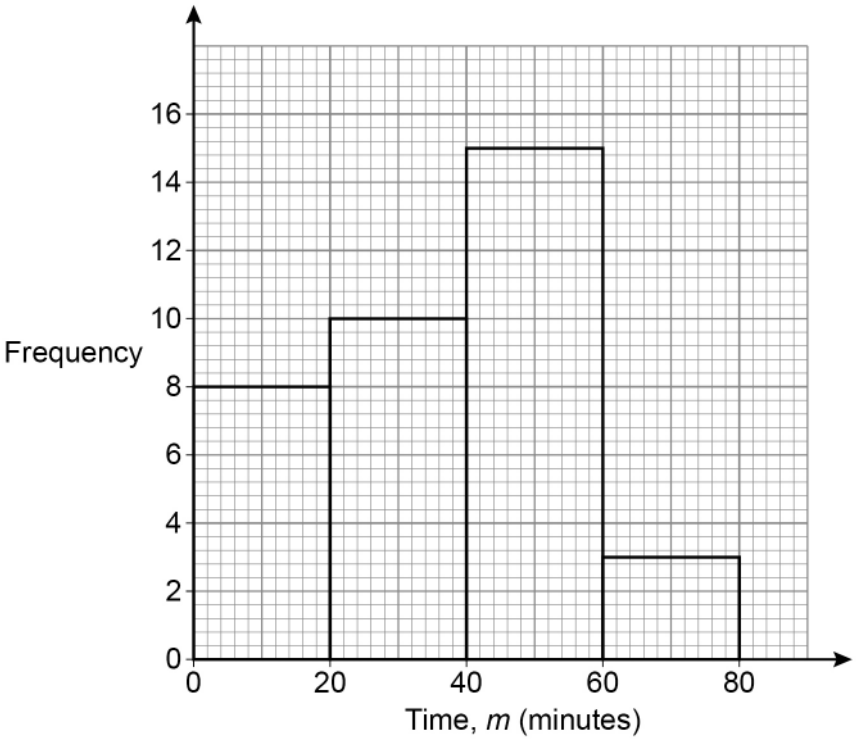
6 Erika records the time, m, in minutes, that it takes her to complete each piece of homework set during a term.

Her results are represented in the diagram.



By calculating an estimate of the mean, work out whether Erika takes, on average, between 30 and 40 minutes to complete each piece of homework.

You may use the table below to help you.

[5 marks]

5

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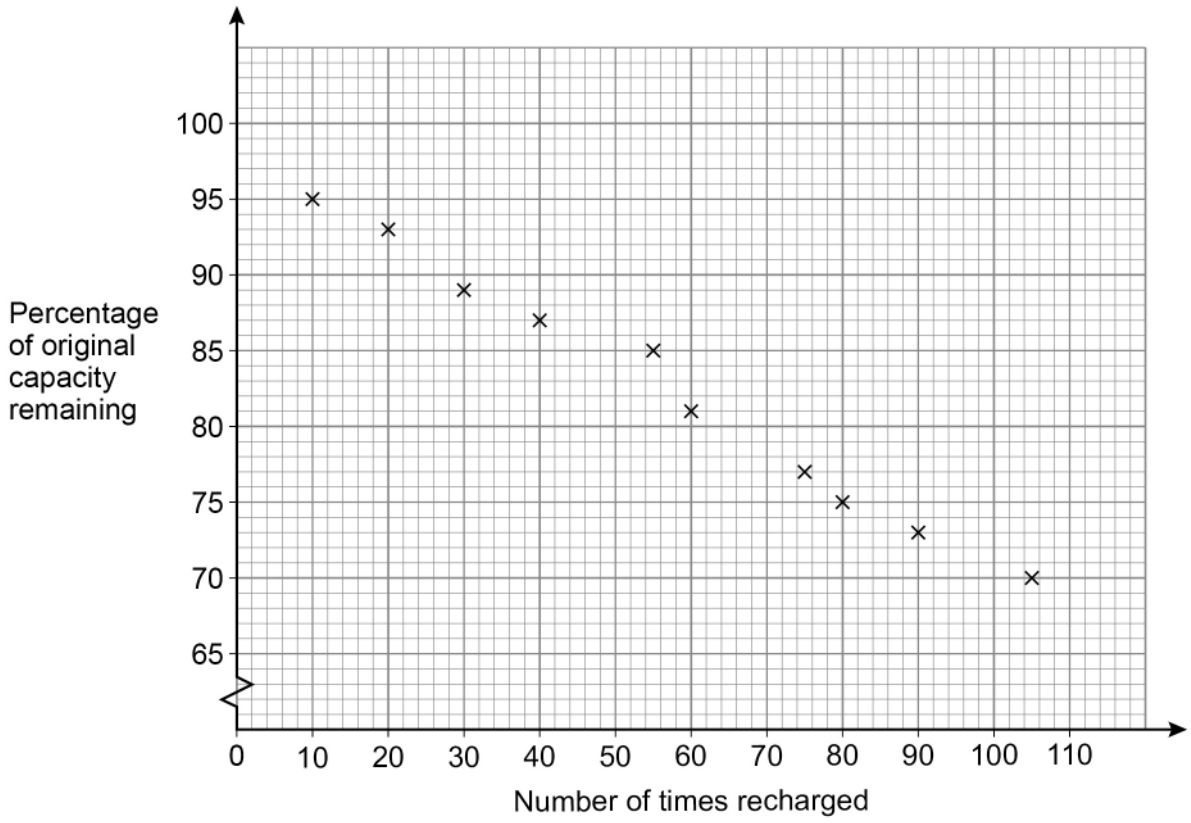
7 Raj is investigating rechargeable batteries.

Battery capacity is a measure of how much power can be stored in a battery.

Rechargeable batteries lose some of their capacity each time they are recharged.

The scatter graph shows information for 10 different rechargeable batteries.



7 (a) The coordinates for the double mean point for these data are $(a, 82.5)$

Work out the value of a.

[2 marks]

Answer _____

7 (b) Using your answer to **part (a)** draw a line of best fit on the scatter graph.

[2 marks]

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7 (c) Raj uses the scatter graph to predict the percentage of original capacity remaining in a battery after it has been recharged 70 times.

Will his prediction be accurate?

Tick (✓) a box.

Yes ☐ No ☐ Cannot tell ☐

Give a reason for your answer.

[2 marks]

6

Turn over for the next question

Do not write outside the box

8 Chris thinks that weeds are spreading on a football field.

He samples the number of weeds per square metre in different places on the field.

He chooses 5 places along one side of the field.

8 (a) Write down **two** ways Chris could make his sample more representative.

[2 marks]

1 _____

_____

2 _____

_____

8 (b) After collecting his first sample Chris treats the field to remove the weeds.

The next day, he collects a second sample to see if the treatment has had an effect.

Chris counts the weeds in several places, chosen at random.

Write down **one** way Chris can improve how he collects his second sample.

[1 mark]

_____

_____

3

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9 Susan wants to randomly select one person out of a group of 12

She selects the person by,

- assigning each person a number from 1 to 12
- rolling two fair, six-sided dice and adding the scores to give a total
- selecting the person whose number matches this total.

Write down **one** problem with this method.

[1 mark]

1

Turn over for the next question

Do not write outside the box

10 Elizabeth investigates house prices in London.

Her hypothesis is,

"The closer to the centre of London, the lower the average house price."

The choropleth map shows average house prices for different regions in London in July 2020.

Source: adapted from gov.uk

10 (a) Explain why this diagram is appropriate to test Elizabeth's hypothesis.

[1 mark]

10 (b) Does the diagram support Elizabeth's hypothesis?

Tick (✓) a box.

Yes ☐ No ☐

Give a reason for your answer.

[1 mark]

Do not write outside the box

10 (c) The average used in the choropleth map is the median house price.

Give **one** reason why the median house price might be a better average to use than the modal house price for these data.

[1 mark]

3

Turn over for the next question

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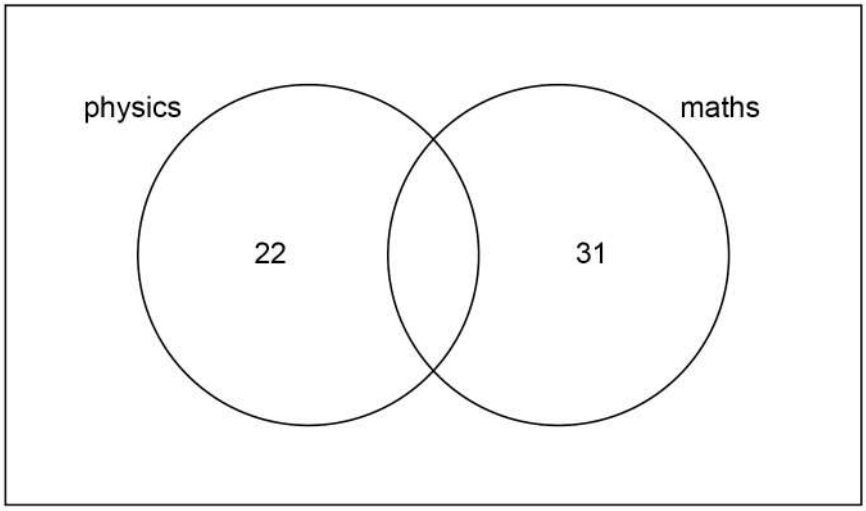
11 A group of 70 students are asked if they study physics or maths.

The Venn diagram shows some of the information.



11 (a) 38 of the 70 students study maths.

Complete the Venn diagram.

[2 marks]

11 (b) Tom says,

"The proportion of physics students who also study maths
is **greater** than
the proportion of students in the whole group who study maths."

By comparing these two proportions show that Tom is **not** correct.

[3 marks]

Do not write outside the box

11 (c) Tom wants to ask a sample of the 70 students about their lessons.

He uses a sample of size 20, stratified by subject.

Work out how many students there should be in the sample who study maths but **not** physics.

[2 marks]

Answer _____

7

Turn over for the next question

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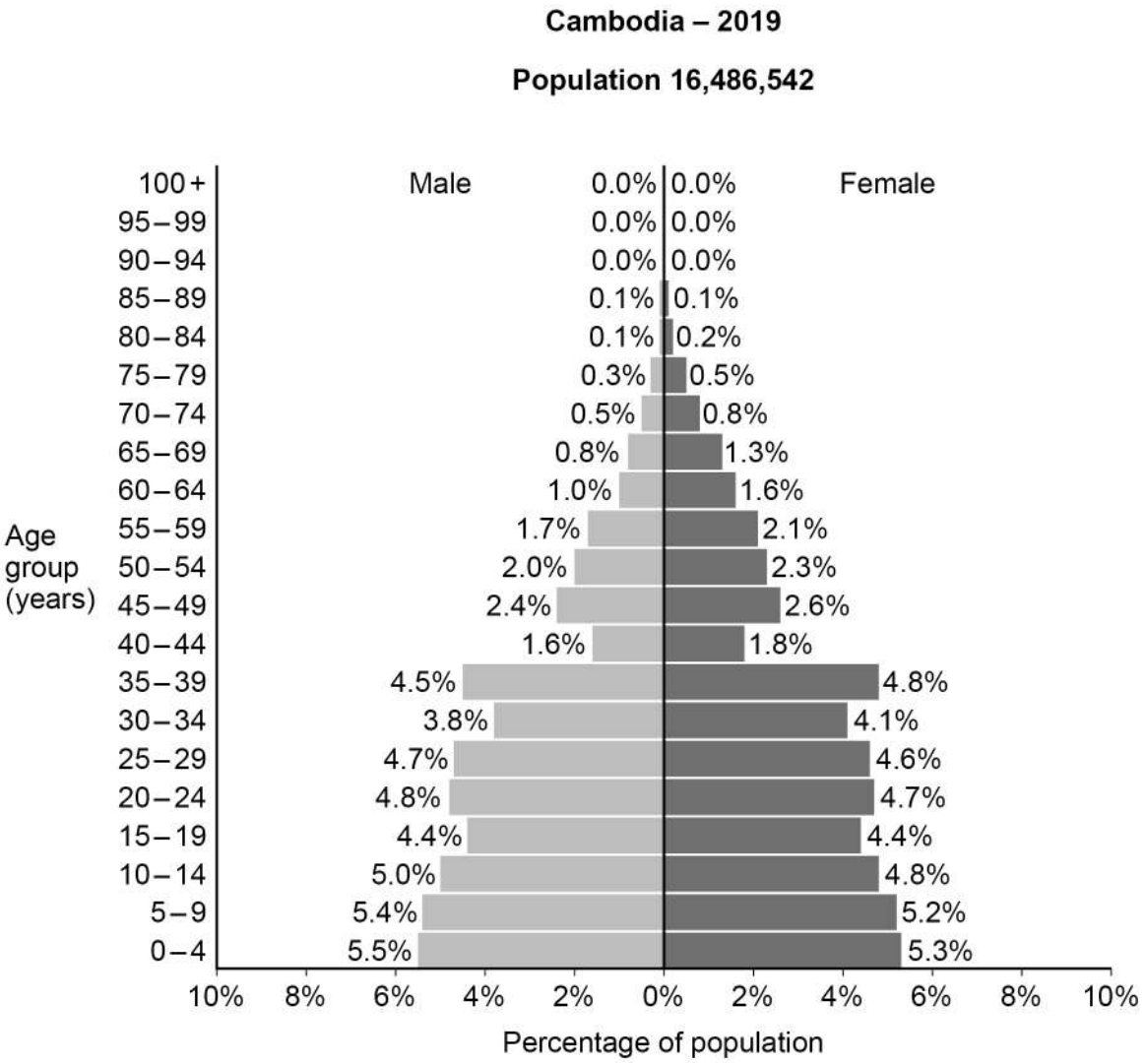
12 The population pyramid shows information about the population of Cambodia in 2019.



Source: adapted from populationpyramid.net

12 (a) Calculate the number of **males** aged between 5 and 19 years in Cambodia in 2019.

[3 marks]

Answer _____

Do not write outside the box

12 (b) During the 1970s, Cambodia suffered from war and famine.

How has this affected the shape of the population pyramid?

[1 mark]

4

Turn over for the next question

Do not write outside the box

13 Bruce wants to compare election results for two parts of Plymouth in the 2019 general election.

The table shows the number of votes for each party.

Party	Sutton and Devonport	Moor View
Conservative	20 704	26 831
Labour	25 461	13 934
Liberal Democrats	2545	2301
Other	4466	1173
Total votes	**53 176**	**44 239**

Source: plymouth.gov.uk

Bruce draws two pie charts to compare the two parts of Plymouth.

13 (a) Explain why he should use **comparative** pie charts to represent the data fairly.

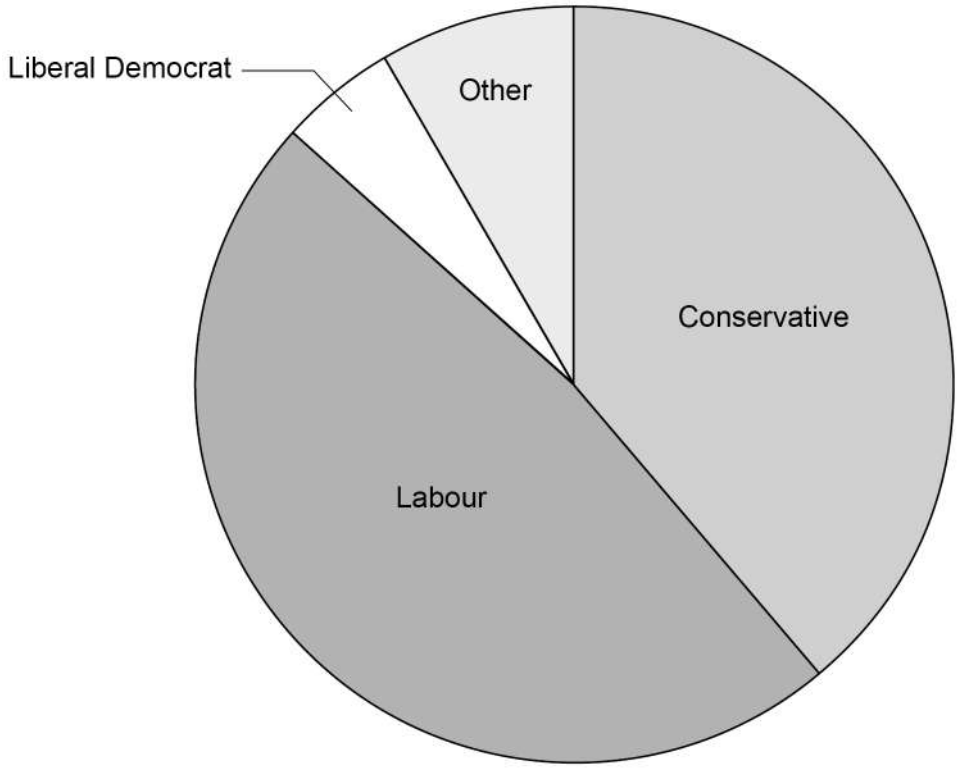
[1 mark]

Do not write outside the box

13 (b) Bruce draws this pie chart for Sutton and Devonport.

The radius is 5 cm.

Sutton and Devonport



13 (b) (i) Show that the radius for the Moor View pie chart should be 4.6 cm to one decimal place.

[2 marks]

Question 13 continues on the next page

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Here is the table again.

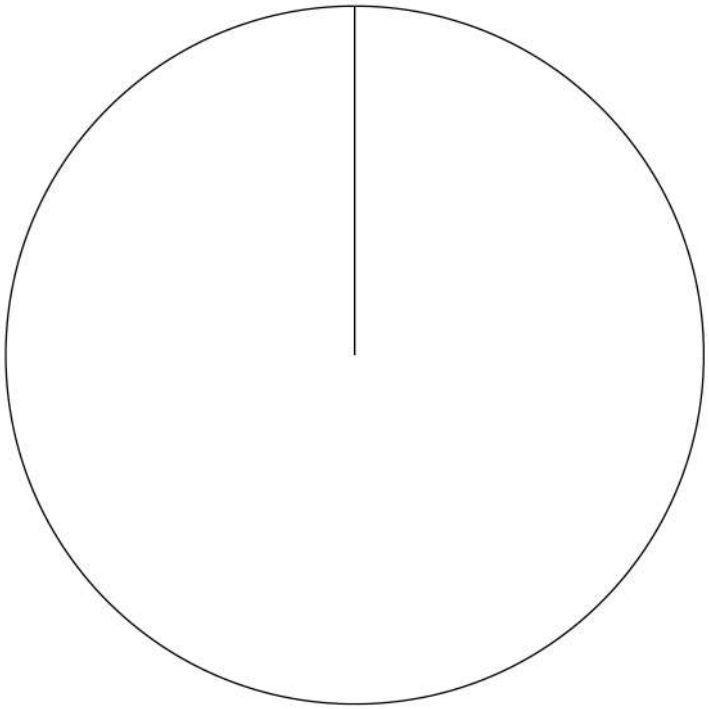
Party	Sutton and Devonport	Moor View
Conservative	20 704	26 831
Labour	25 461	13 934
Liberal Democrats	2545	2301
Other	4466	1173
Total votes	**53 176**	**44 239**

Source: plymouth.gov.uk

13 (b) (ii) Complete the pie chart below to show the results for **Moor View**.

[3 marks]

Moor View



13 (b) (iii) Using the two pie charts, compare the proportion of people who voted for the **Liberal Democrats** in Moor View and Sutton and Devonport.

[1 mark]

_____

_____

7

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14 Abeba calculates the percentage growth of her business for 2015 to 2019.

Year	Percentage growth	Multiplier
2015	5	1.05
2016	7	1.07
2017	1	1.01
2018	2	1.02
2019	9	1.09

14 (a) Calculate the geometric mean of the five **multipliers**.

[2 marks]

Answer _____

14 (b) Use your answer to **part (a)** to write down the average percentage growth of Abeba's business for 2015 to 2019.

[1 mark]

Answer _____ %

3

Turn over for the next question

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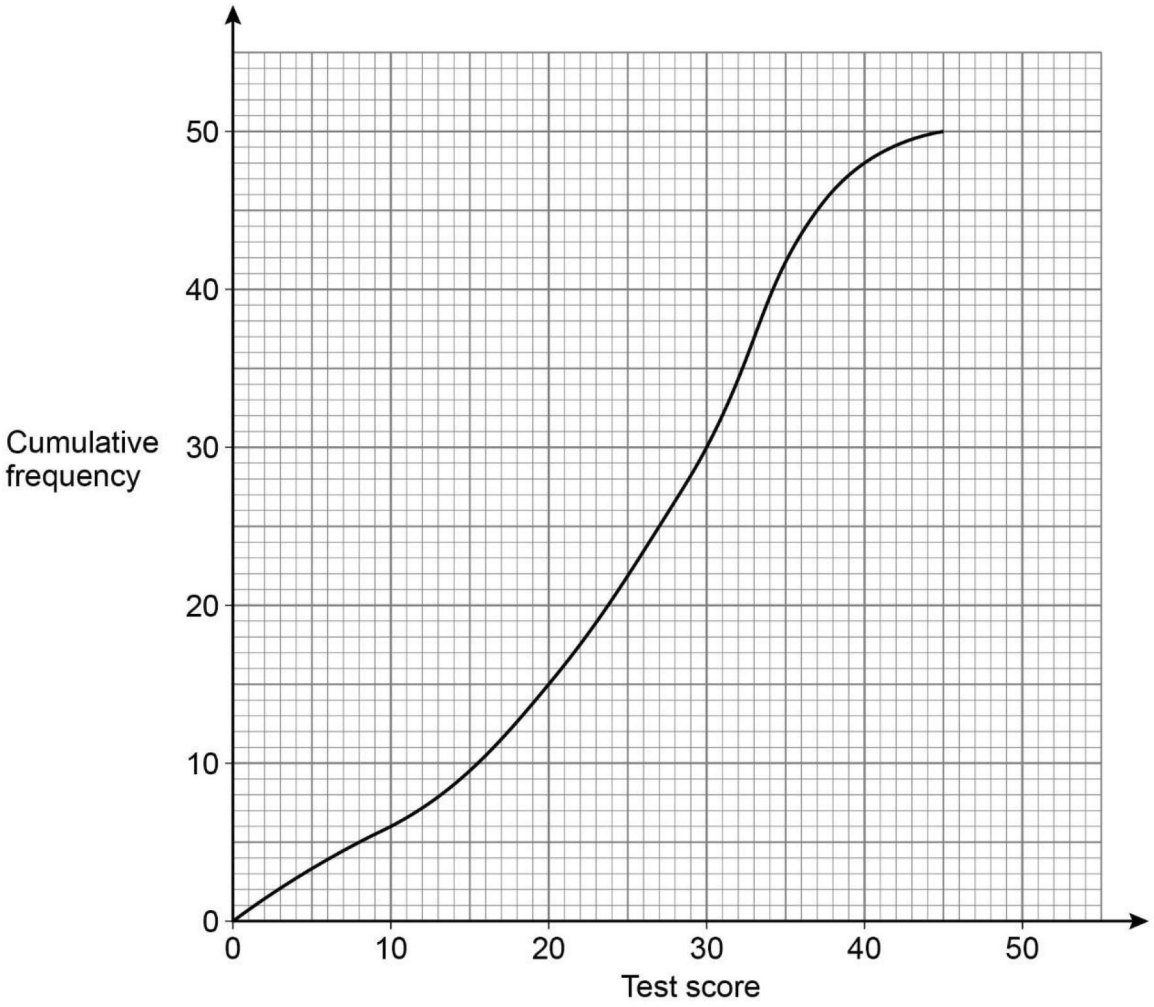
15 Students at Crockwood School and Britstone School take the same test.

The cumulative frequency graph shows the results for **Crockwood School**.



15 (a) Write down the median test score for Crockwood School.

[1 mark]

Answer _____

Do not write outside the box

15 (b) Using the graph, complete the table to find the interdecile range for Crockwood School.

[2 marks]

1st decile	
9th decile	
Interdecile range	

15 (c) Students at Britstone School had a median score of 31 and an interdecile range of 25

A teacher says that a good performing school will have test scores which are both high and consistent.

Using the values from **part (a)** and **part (b)**, compare statistically the performance of both schools and determine which school the teacher will say has performed better.

[3 marks]

6

Turn over for the next question

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16 In a computer game, players can find boxes that each contain a random item.

The probability of a box containing a diamond is 0.01

Brooke opens **five** boxes that she has found.

16 (a) Give **two** reasons why the number of diamonds in her five boxes can be modelled by a binomial distribution.

[2 marks]

Reason 1 _____

_____

Reason 2 _____

_____

16 (b) (i) Show that the probability of Brooke getting **zero** diamonds in her five boxes is 0.951 to three significant figures.

[2 marks]

_____

_____

_____

16 (b) (ii) Brooke states that the probability of her getting **exactly one** diamond is,

$$1 - 0.951 = 0.049$$

Explain why Brooke is **wrong**.

[1 mark]

_____

_____

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16 (c) Boxes can also contain emeralds.

The game designer claims that the probability of getting an emerald is 0.05

To check this, Brooke asks players online to record how often they get an emerald.

Players tell her that 14 out of 750 boxes contained emeralds.

Does this result support the game designer's claim?

Show working to support your answer.

[2 marks]

7

17 The masses of bags of sweets are normally distributed with a mean of 200 g and a standard deviation of 7 g

One bag is selected at random.

Calculate the probability that the mass of this bag is between 207 g and 214 g

[3 marks]

3

Answer _____

Turn over for the next question

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18 You will need the **data sheet** to answer this question.

Catherine is investigating the number of births in Kazakhstan and Mongolia.

She uses data from the United Nations website.

18 (a) These data are secondary data.

18 (a) (i) Write down one **advantage** of using secondary data.

[1 mark]

18 (a) (ii) Write down one **disadvantage** of using secondary data.

[1 mark]

18 (b) The **data sheet** shows a time series graph of the data for Kazakhstan.

18 (b) (i) Use the data sheet to calculate the mean seasonal variation for the number of births in Kazakhstan in Quarter 1 (Q1).

You may use the table to help you.

[3 marks]

	Number of births	Value from trend line	Seasonal variation
Q1 2017	91 660		
Q1 2018	92 730		
Q1 2019	93 410		

Answer _____

Do not write outside the box

18 (b) (ii) Using your answer to **part (b)(i)** and the data sheet, estimate the number of births in Kazakhstan in Q1 of 2020.

[2 marks]

Answer _____

18 (b) (iii) Give a reason why the value found in **part (b)(ii)** may **not** be accurate.

[1 mark]

Question 18 continues on the next page

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18 (c) This table shows the number of births (to the nearest hundred) in **Mongolia** during 2017, 2018 and 2019 and some 4-point moving averages.

Year	Quarter	Number of births (nearest hundred)	Moving average (nearest hundred)
2017	1	16 600	
	2	18 900	18 600
	3	19 200	19 100
	4	19 600	19 300
2018	1	18 700	19 400
	2	19 600	19 400
	3	19 700	
	4	19 600	19 400
2019	1	18 400	19 600
	2	20 000	19 600
	3	20 200	
	4	19 700	

Source: data.un.org

18 (c) (i) Complete the table by calculating the remaining 4-point moving average.

Round your answer to the nearest hundred.

[2 marks]

18 (c) (ii) Explain why 4-point moving averages are appropriate for these data.

[1 mark]

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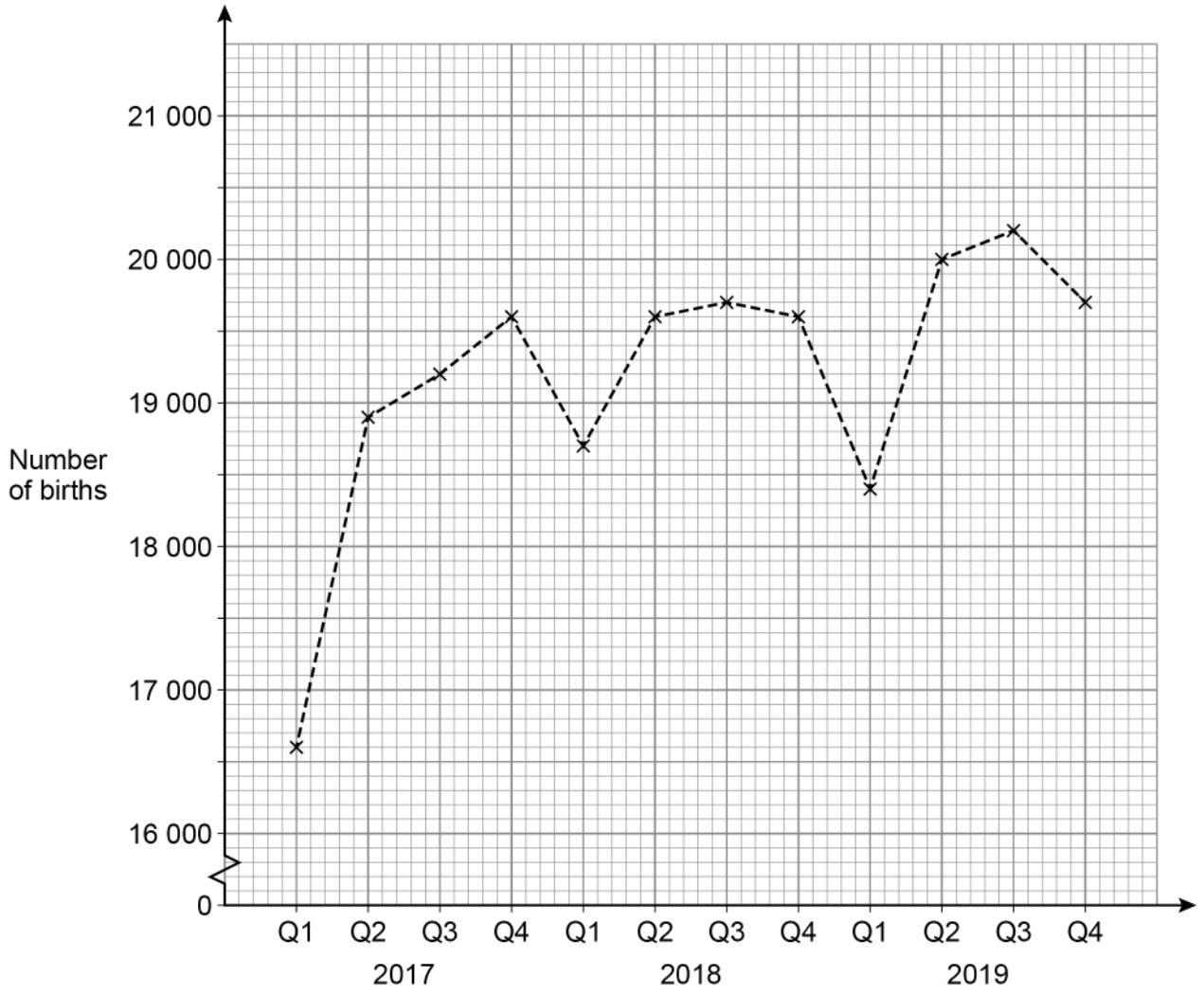
18 (d) The time series graph below shows the data for Mongolia.

Plot the 4-point moving averages from the table in **part (c)** and draw the trend line.

[3 marks]



18 (e) (i) Give one **similarity** in the trend in the numbers of births in Kazakhstan and Mongolia between 2017 and 2019.

[1 mark]

Question 18 continues on the next page

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18 (e) (ii) Give one **difference** between the seasonal pattern of numbers of births in Kazakhstan and Mongolia between 2017 and 2019.

[1 mark]

16

END OF QUESTIONS

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