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 2

Tuesday 16 June 2020 Morning Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:
- a calculator
- 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 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	
2	
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5	
6	
7	
8	
9	
10	
11	
12	
TOTAL	

Do not write outside the box

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

1 Vanessa measures the height and mass of 12 children.

Circle the name given to the type of data she has collected.

[1 mark]

bivariate qualitative discrete categorical

1

2 A set of 16 data values, x, has,

$$\sum (x - \bar{x})^2 = 36$$

Circle the standard deviation of the data.

Use,

$$\text{standard deviation} = \sqrt{\frac{1}{N}\sum (x - \bar{x})^2}$$

[1 mark]

0.375 1.5 2.25 6

1

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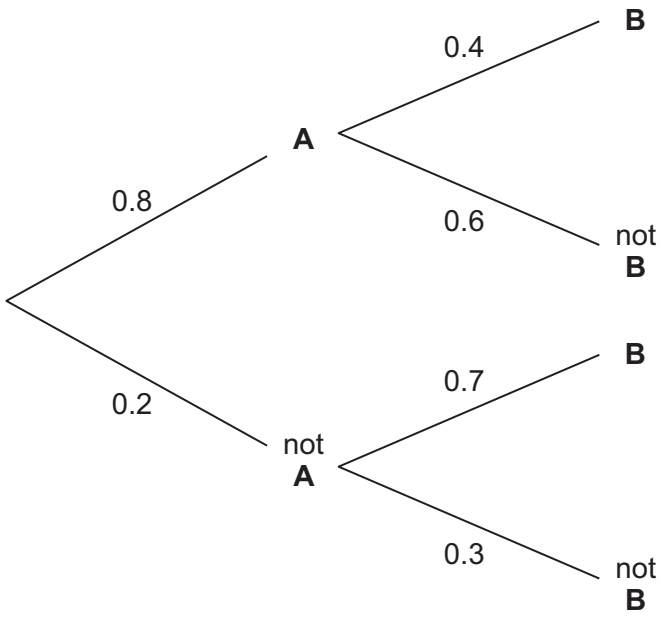
3 The tree diagram shows some probabilities relating to events A and B.



3 (a) Circle the probability of B **given** A.

[1 mark]

0.32 0.4 0.42 0.5

3 (b) Circle the probability of B **and** not A.

[1 mark]

0.9 0.7 0.14 0.06

2

Turn over for the next question

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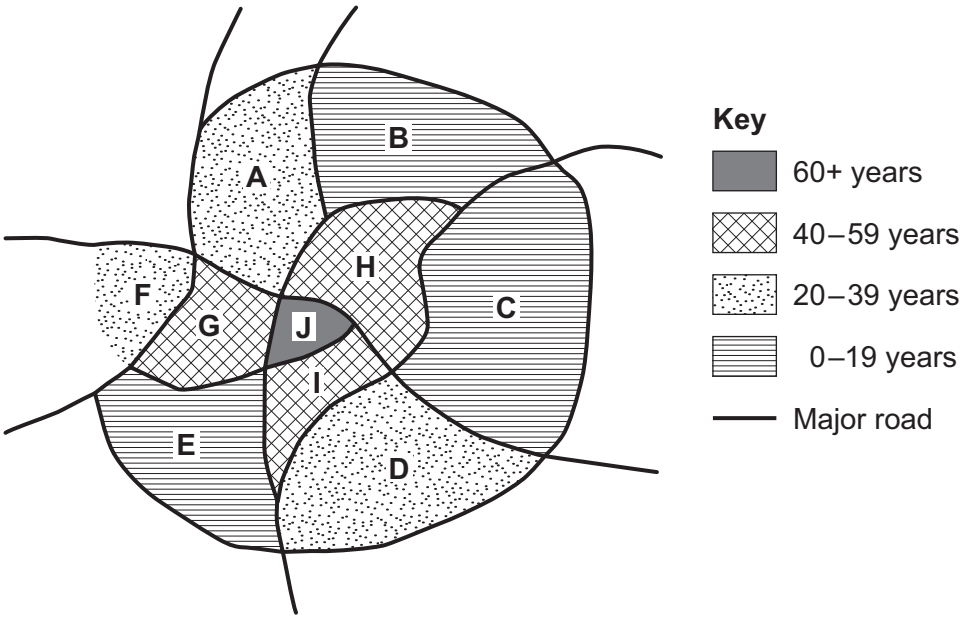
4 The diagram shows the map of a town.

The **modal** age of buildings in each region of the town is shown.



4 (a) Circle the modal age of the buildings in **region F** of this town.

[1 mark]

0–19 years 20–39 years 40–59 years 60+ years

4 (b) The oldest building in the town was built in 1847.

Ahmed says that this building is in region J.

Is Ahmed correct?

Tick (✓) a box.

Yes ☐ No ☐ Cannot tell ☐

Give a reason for your answer.

[1 mark]

_____

_____

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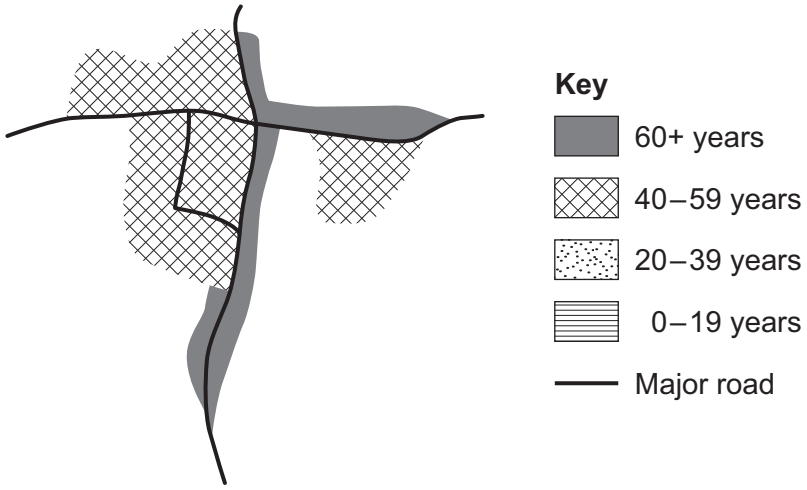
4 (c) The diagram below shows the **modal** age of buildings in a neighbouring village.



Compare the age of buildings in the village with the age of buildings in the town.

[1 mark]

_____

_____

_____

3

Turn over for the next question

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5 A town council is considering reducing the opening hours of the local library.

Grace and Alex want to find out how people living in the town feel about this.

5 (a) Grace decides to ask people as they leave a supermarket in the town at different times one week.

She collects data from,

30 males and 30 females aged 40 years and under

30 males and 30 females aged 41 years and over.

5 (a) (i) What is the name given to this type of sampling?

[1 mark]

Answer _____

5 (a) (ii) Give **two** different reasons why her sample may be unreliable.

[2 marks]

Reason 1 _____

_____

Reason 2 _____

_____

Do not write outside the box

The town has 8000 houses.

Alex decides to obtain a sample of 120 of these houses using random sampling.

5 (b) Explain how Alex can use a list of random numbers to select his sample.

[3 marks]

5 (c) Alex plans to interview one person face-to-face from each house he samples.

5 (c) (i) Write down **one** problem that he could have when he tries to carry out the interviews.

[1 mark]

5 (c) (ii) Write down **one** way that he could overcome the problem you wrote down in **part (c)(i)**.

[1 mark]

8

Turn over for the next question

6 The tables show the **mean** number of portions of fruit and vegetables eaten per day by children and adults of different ages and gender in England.

Children

	Age (years)				
	5–7	**8–10**	**11–13**	**14–15**	**All ages**
Females	3.3	3.2	3.5	3.2	**3.3**
Males	3.3	3.5	3.1	2.9	**3.2**
All children	3.3	3.4	3.3	3.0	**3.2**

Adults

	Age (years)							
	16–24	**25–34**	**35–44**	**45–54**	**55–64**	**65–74**	**75+**	**All ages**
Females	3.2	3.8	3.7	3.7	3.8	3.9	3.4	**3.7**
Males	2.6	3.4	3.6	3.4	3.5	3.9	3.6	**3.4**
All adults	2.9	3.6	3.7	3.6	3.7	3.9	3.5	**3.5**

Source: Adapted from *Health Survey for England*, 2015

6 (a) (i) Compare the amount of fruit and vegetables eaten by males **aged 14–15** with the amount eaten by females of the same age.

[1 mark]

_____

_____

6 (a) (ii) Write **two** comparisons of the amount of fruit and vegetables eaten by different ages of **adults**.

[2 marks]

Comparison 1 _____

_____

Comparison 2 _____

_____

Natalie wants to investigate how many portions of fruit and vegetables students in her year group at school eat.

The table shows the number of students of each gender in her year group.

Gender	Number
Males	99
Females	121

Natalie decides to interview a sample of 40 students.

She decides to **stratify** by gender.

6 (b) Explain why it is sensible for Natalie to stratify by gender.

[1 mark]

6 (c) Show that Natalie should select 18 male students from her year group.

[2 marks]

6 (d) Natalie's friend suggests she should interview students in her year group eating school dinners.

Explain why this could give biased results.

[1 mark]

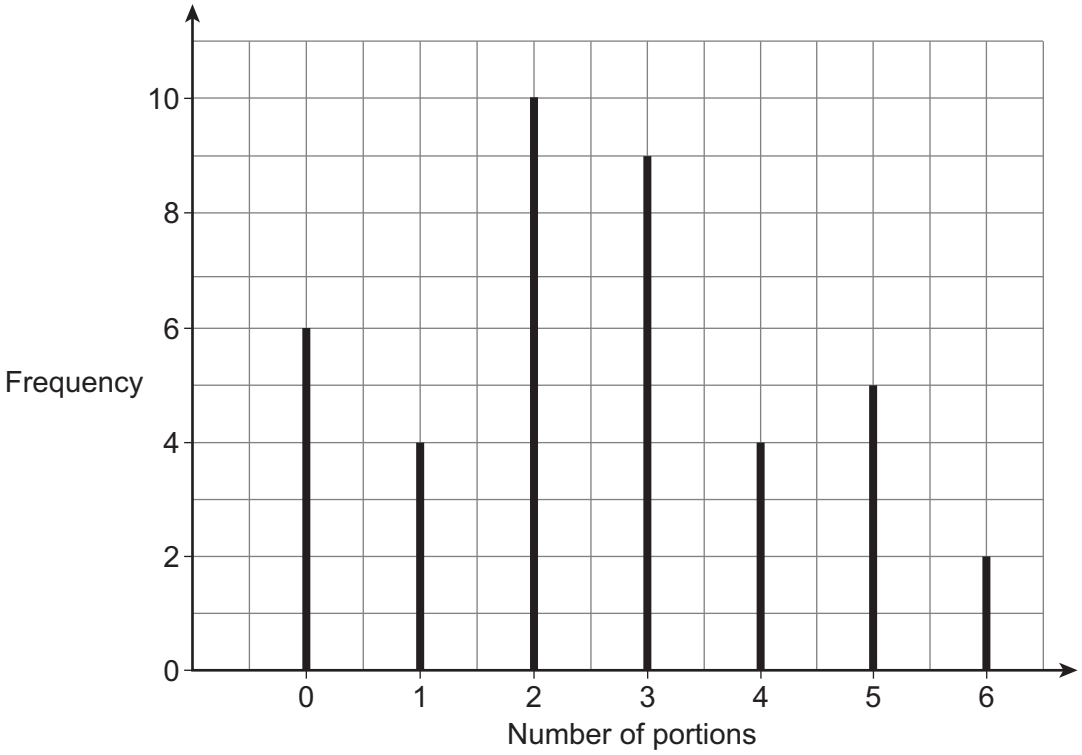
Question 6 continues on the next page

Natalie decides to select 18 male students and 22 female students at random from her year group.

She asks each student,

"How many portions of fruit and vegetables did you eat yesterday?"

The bar line graph shows the number of portions of fruit and vegetables eaten by the 40 students in her sample.



It is recommended that everyone should eat at least 5 portions of fruit and vegetables every day.

6 (e) Calculate an estimate of the percentage of students in Natalie's year group that ate at least 5 portions.

[2 marks]

Answer _____ %

Do not write outside the box

Students in Natalie's year are aged **14–15 years**.

6 (f) Compare the number of portions of fruit and vegetables eaten by students in Natalie's year with the corresponding figure for England.

You should,

- use the information from the bar line graph on page 10 and the information from the table on page 8
- calculate an appropriate average.

[5 marks]

6 (g) Suggest **two** things that Natalie could have done to make her comparison more reliable.

[2 marks]

Suggestion 1 _____

Suggestion 2 _____

16

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7 A small pottery factory has two designers, Lucy and William.

The factory makes three types of pottery: vases, jugs and teapots.

The table shows some information about the number of items of pottery made in 2018 by each designer.

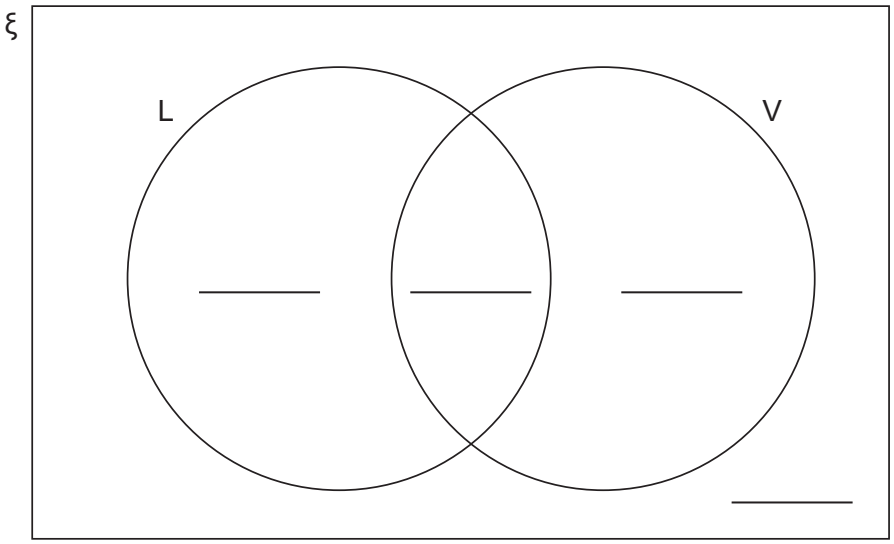
	Vases	**Jugs**	**Teapots**	**Total**
Lucy	325	115	40	**480**
William	250	145	95	**490**
				970

7 (a) Use the information in the table to complete the Venn diagram for these items.

ξ = 970 items of pottery made by Lucy and William

L = Number of items of pottery made by Lucy

V = Number of vases made



[3 marks]

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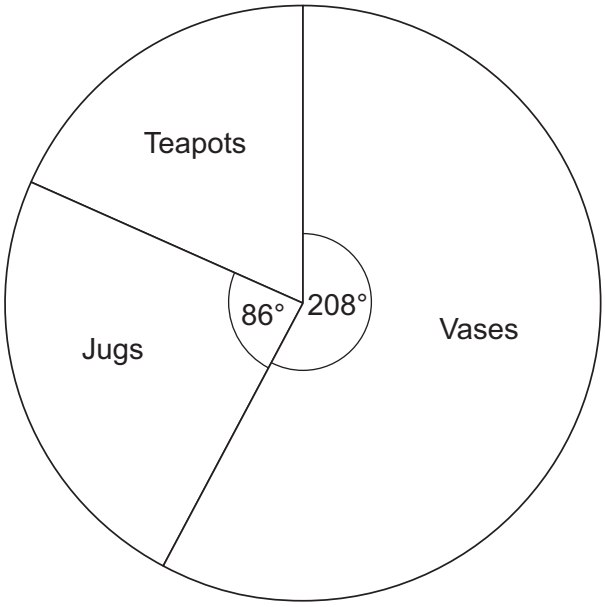
7 (b) The pie chart represents the items of pottery made by William in **2019**.



William made 312 Vases in 2019.

Did William make more **teapots** in 2019 than in 2018?

You **must** show your working.

[3 marks]

6

Turn over for the next question

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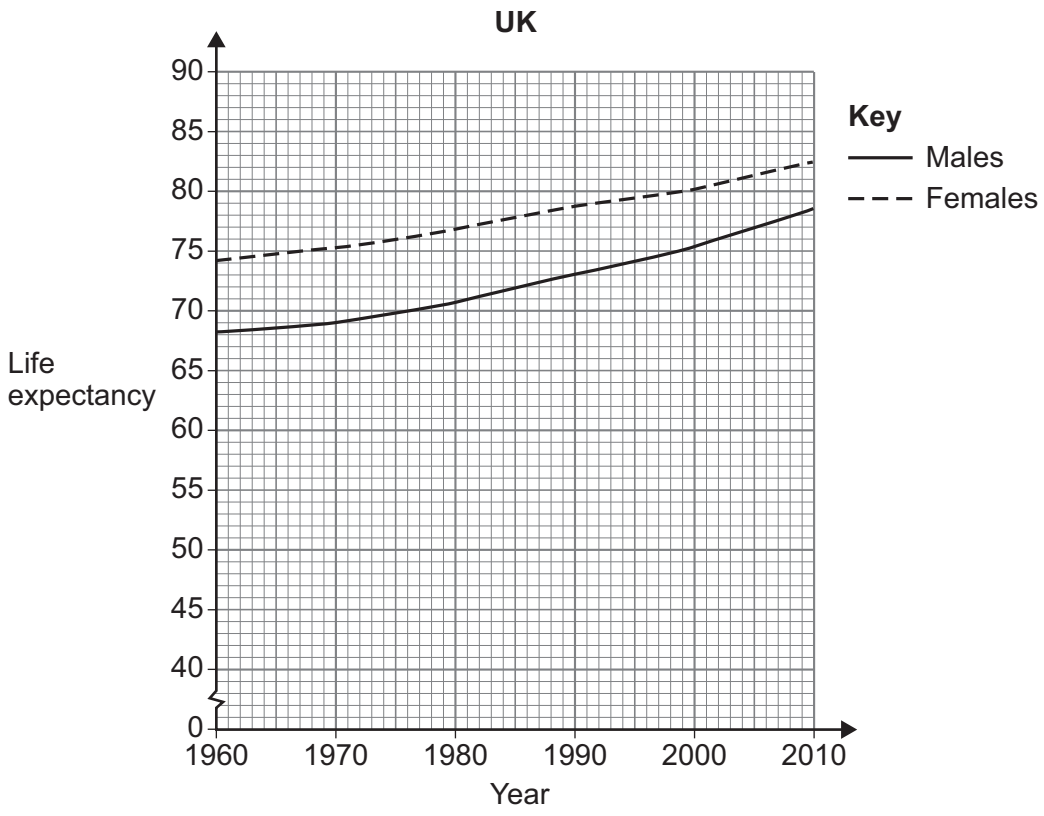
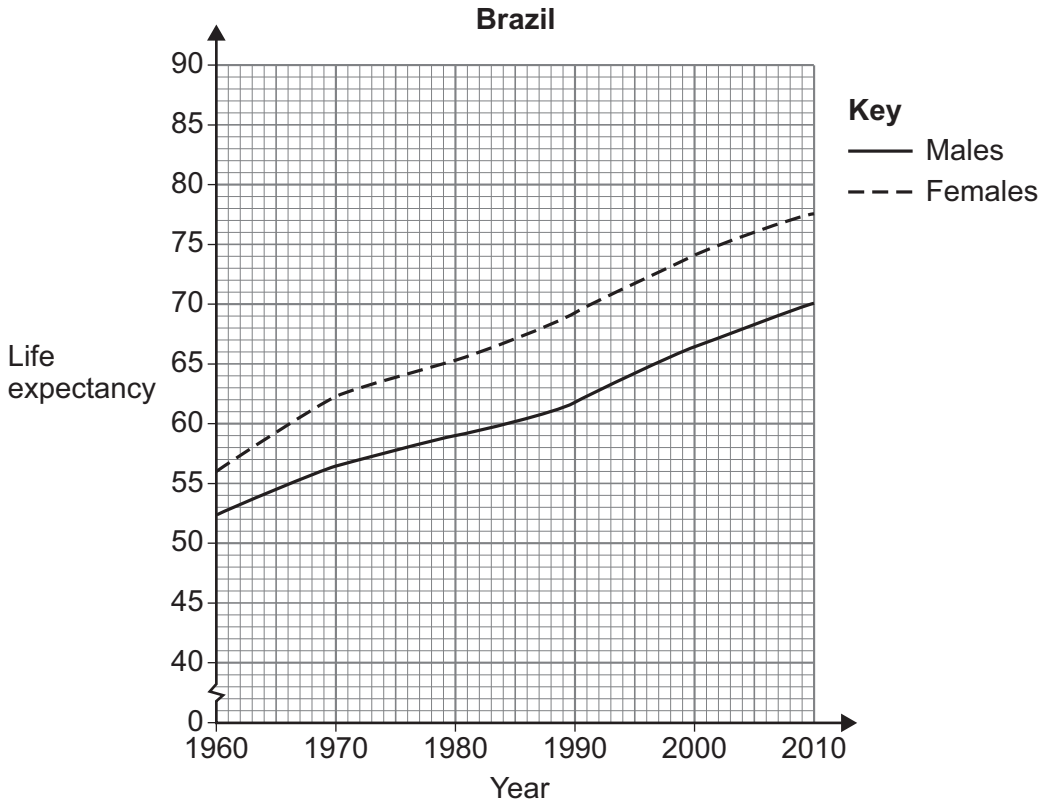
8 The line graphs show the life expectancy at birth of males and females in the UK and in Brazil.





Source: data.worldbank.org

Do not write outside the box

Compare life expectancy in the UK and Brazil.

Your answer should include,

- a comparison of life expectancy in the UK and Brazil
- differences between life expectancy of males and females
- a comparison of the trends in life expectancy over time.

[5 marks]

5

Turn over for the next question

Do not write outside the box

9 The table shows some of the index numbers for the average prices of houses in different countries of the UK in 2015, 2016 and 2017.

The base year is 2015.

The table also shows the weightings.

Country	2015	2016	2017	Weighting
England	100	100.4	105.7	84
Wales	100	101.7	105.2	4
Scotland	100	101.6	100.6	10
Northern Ireland	100	99.3	103.4	2

Source: adapted from ONS

9 (a) Explain why the weighting for England is greater than the weightings for the other countries of the UK.

[1 mark]

_____

_____

9 (b) The average price of a house in **Wales** in 2016 was £177 000

Calculate the average price of a house in Wales in **2017**.

[3 marks]

_____

_____

_____

Answer £ _____

Do not write outside the box

9 (c) Calculate a weighted index number for the price of houses in the whole of the UK in **2017**, using 2015 as the base year.

[3 marks]

Answer _____

9 (d) The table below shows the average price of a house in London in 2015 and 2017.

2015	£499 000
2017	£543 000

A newspaper claims that the average price of a house in London has increased by a greater percentage between 2015 and 2017 than houses in the UK as a whole.

Comment on the newspaper's claim.

You **must** show your working.

[2 marks]

9

Turn over for the next question

Do not write outside the box

10 Plaque is a sticky substance that forms on teeth.

Tim is a dentist.

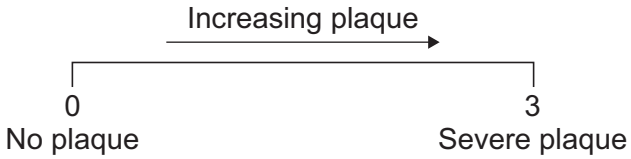
Tim wants to find out whether the amount of plaque on teeth is affected by the length of time a person cleans their teeth.

He plans an experiment.

Tim cleans the teeth of 10 of his patients by removing all their plaque.

He asks these 10 patients to record the length of time they spend cleaning their teeth each day for two months.

At the end of the two months, he calculates a plaque score for each patient's teeth using a 0 to 3 continuous scale.



10 (a) Write down the response variable.

[1 mark]

Answer _____

10 (b) Tim gives each patient a diary to complete so that they can record when and for how long they clean their teeth.

Why might this be a good idea?

[1 mark]

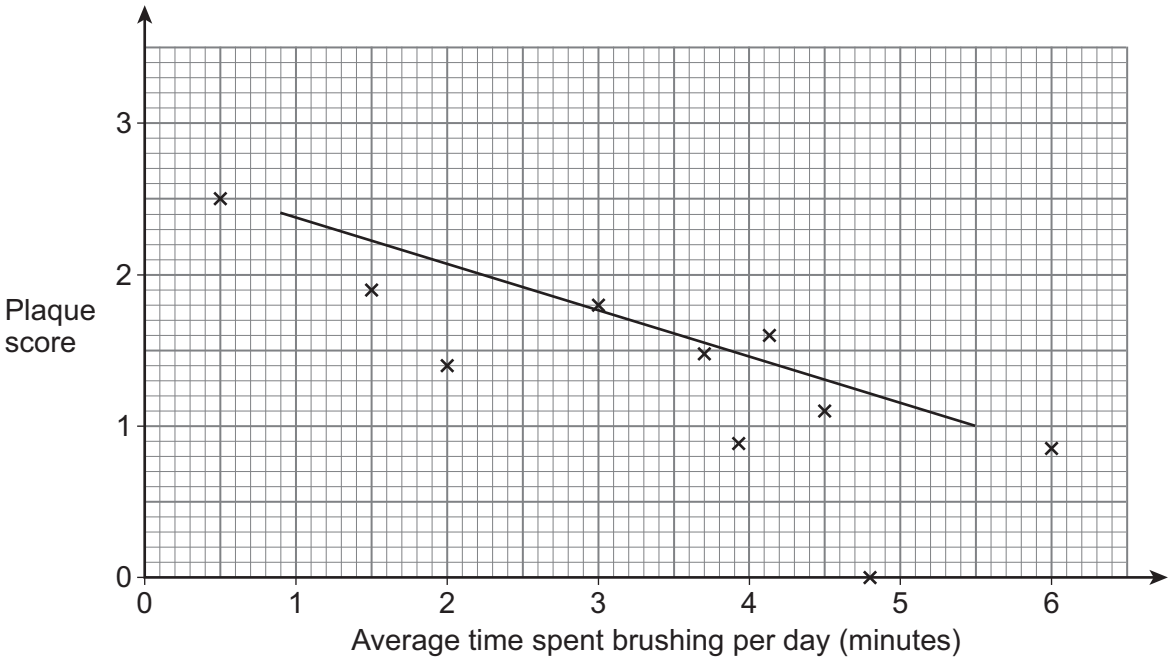
_____

_____

_____

Do not write outside the box

10 (c) He draws this scatter diagram to show the data he collects and adds a line of best fit.



Write down **two** different problems with Tim's line of best fit.

[2 marks]

Problem 1 _____

_____

Problem 2 _____

_____

Question 10 continues on the next page

Do not write outside the box

10 (d) Ellie, another dentist, does the same experiment with some of her patients.

She draws a line of best fit on her scatter diagram.

The equation of her line is $y = 2.7 - 0.43x$ where,

y is plaque score

x is average time spent brushing **per day** (minutes)

10 (d) (i) Ellie suggests that her patients should brush their teeth **twice** a day for an average of 2 minutes each time.

Estimate the plaque score for a patient who follows Ellie's advice.

[2 marks]

Answer _____

10 (d) (ii) Ellie collects her data from 12 patients.

She ranks her data and finds that $\sum d^2 = 520$

Calculate the value of Spearman's rank correlation coefficient.

Use $r_s = 1 - \frac{6\sum d^2}{n(n^2-1)}$

[2 marks]

Answer _____

Do not write outside the box

10 (e) Tim collects plaque data for some different patients.

He also asks them to record the average time they spend showering each day.

The Spearman's rank correlation coefficient for his data is −0.76

He concludes,

> "People can reduce their plaque score by spending more time in the shower every day."

Is Tim's conclusion valid?

Tick (✓) a box.

Yes ☐ No ☐

Give a reason for your answer.

[1 mark]

_____

_____

9

Turn over for the next question

Do not write outside the box

11 (a) In this question you will need to use,

$$\text{flu vaccination rate} = \frac{\text{number receiving vaccine}}{\text{number offered vaccine}} \times 1000$$

The table gives some information about the number of children receiving the flu vaccine in two NHS areas one winter.

NHS area	Number of children offered vaccine	Number of children receiving vaccine	Flu vaccination rate
Greater Manchester	188 500	113 100	
South East		171 800	

[Source: Public Health England]

The flu vaccination rates in Greater Manchester and the South East are equal.

Complete the table.

[3 marks]

Do not write outside the box

All young children are offered the MMR (measles, mumps and rubella) vaccine.

91% of young children in England receive the vaccine.

11 (b) A child minder in England cares for 4 young children.

11 (b) (i) Write down **one** assumption that must be made if the number of these children who receive the MMR vaccine follows a Binomial distribution with probability 0.91

[1 mark]

11 (b) (ii) Assuming this Binomial distribution is appropriate, calculate the probability that **at least** 3 of these 4 children receive the MMR vaccine.

[4 marks]

Answer _____

Question 11 continues on the next page

Do not write outside the box

11 (c) Lara randomly selects 250 young children attending nursery schools in a city.

230 of these children receive the MMR vaccine.

Lara says,

> "Children in this city are more likely to receive the MMR vaccine than children in the whole of England."

Explain why Lara may **not** be correct.

You **must** show your working.

[2 marks]

10

Do not write outside the box

12 A trout is a type of fish.

Gemma wants to estimate the number of trout living in a lake.

She captures 138 trout from the lake.

She marks these trout and then releases them back into the lake.

The following week she captures a second sample of 95 trout.

She finds that 23 trout from her second sample are marked.

12 (a) (i) Calculate an estimate of the number of trout in the lake.

[3 marks]

Answer _____

12 (a) (ii) Why does Gemma wait one week before she takes her second sample?

[1 mark]

Question 12 continues on the next page

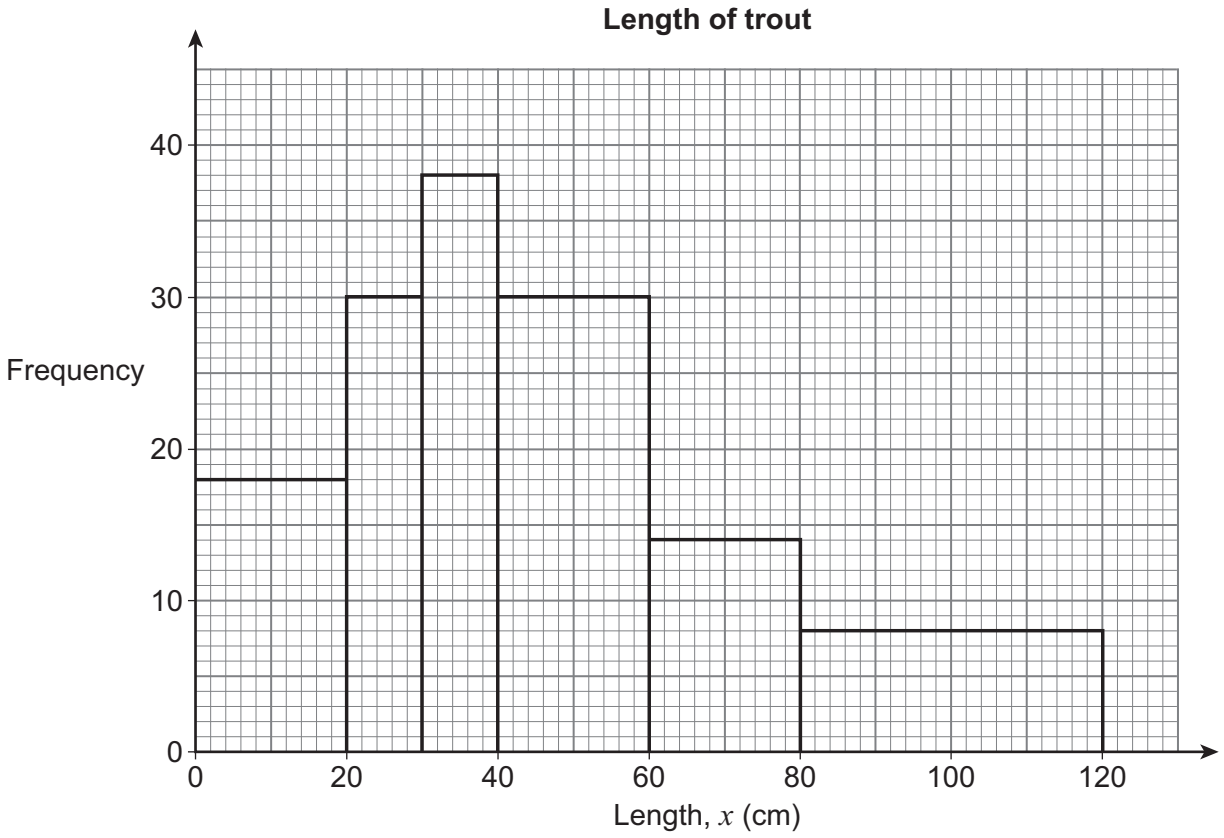
12 (b) Gemma measured the length of the 138 trout she captured in her first sample.

The table gives information about the length of these trout.

Length, x (cm)	Frequency
$0 < x \leqslant 20$	18
$20 < x \leqslant 30$	30
$30 < x \leqslant 40$	38
$40 < x \leqslant 60$	30
$60 < x \leqslant 80$	14
$80 < x \leqslant 120$	8

12 (b) (i) Gemma wants to show her information as a histogram.

She draws this diagram.



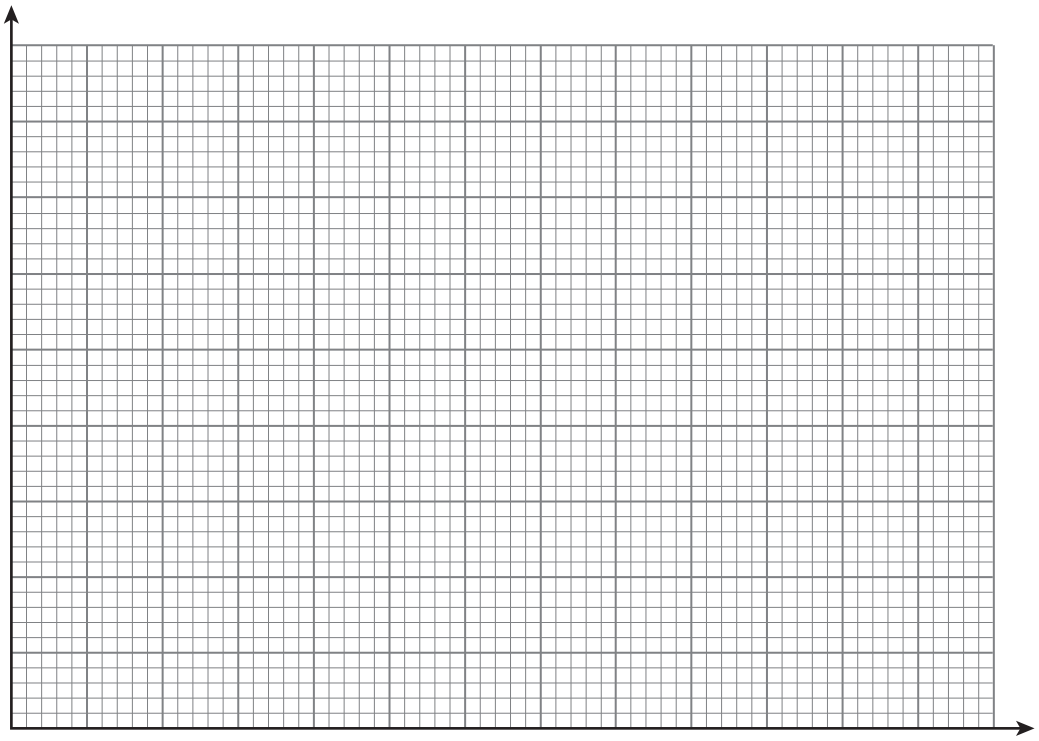
What mistake has Gemma made in drawing her histogram?

[1 mark]

Do not write outside the box

12 (b) (ii) Draw a correct histogram to show Gemma's information.

[4 marks]



12 (b) (iii) What type of skewness is shown in the histogram you drew in **part (b)(ii)**?

[1 mark]

Answer _____

10

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