

Please write clearly in block capitals.

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GCSE STATISTICS

H

Higher Tier Paper 1

Thursday 13 June 2019

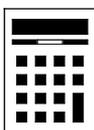
Afternoon

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 the 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.
- 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	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
TOTAL	



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

- 1** Amol wants to take a **systematic** sample of size 50 from the 1000 students in his school.
He numbers all the students from 0001 to 1000
He chooses the student numbered 0014 as his random starting point.
Circle the number corresponding to the next student who will be in his sample. **[1 mark]**

0015

0020

0034

0064

1

- 2** A library opens every Monday, Wednesday and Friday.
The librarian records the number of books borrowed each day for a period of 4 weeks.

Day	M	W	F	M	W	F	M	W	F	M	W	F
Books borrowed	47	33	39	51	34	42	52	32	45	56	39	46

What type of moving average would be suitable for these data?

Circle your answer.

[1 mark]

3-point

4-point

5-point

7-point

1



3 Pierre is investigating how the mileage of a second-hand car affects the car's value.

What type of variable is the make of a car in Pierre's investigation?

Circle your answer.

[1 mark]

response

extraneous

independent

dependent

1

4 A and B are events with

$$P(A) = 0.5$$

$$P(A \text{ and } B) = 0.3$$

Circle the value of $P(B | A)$.

[1 mark]

0.15

0.2

0.6

0.8

1

Turn over for the next question

Turn over ►



5 A college has a rule that no student should work more than 6 hours per week in a part-time job.

The college principal wants to find out how many students work for more than this.

He decides to carry out a census of all 3600 students in the college.

All students were asked to complete a questionnaire in one of their classes.

One of the questions on the questionnaire was

Do you usually work for more than 6 hours per week in a part-time job?

Only 75% of the students answered the question.

Of these students, 216 said that they did usually work for more than 6 hours per week in a part-time job.

5 (a) What percentage of the students answering the question usually worked for more than 6 hours per week in a part-time job?

[2 marks]

Answer _____ %

5 (b) Give **two** reasons why the percentage of students in the college who usually work more than 6 hours per week in a part-time job is likely to be greater than your answer to **part (a)**.

[2 marks]

Reason 1 _____

Reason 2 _____



- 6** A bird charity places nest boxes in three woodlands, Staple Woods, East Valley Woods and Stourness Woods.

The pictogram shows the number of nest boxes it places in each woodland.

Staple Woods	
East Valley Woods	
Stourness Woods	

Key:  represents _____ nest boxes

- 6 (a)** The charity places 24 more nest boxes in East Valley Woods than it places in Stourness Woods.

Show that  represents 15 nest boxes.

[2 marks]

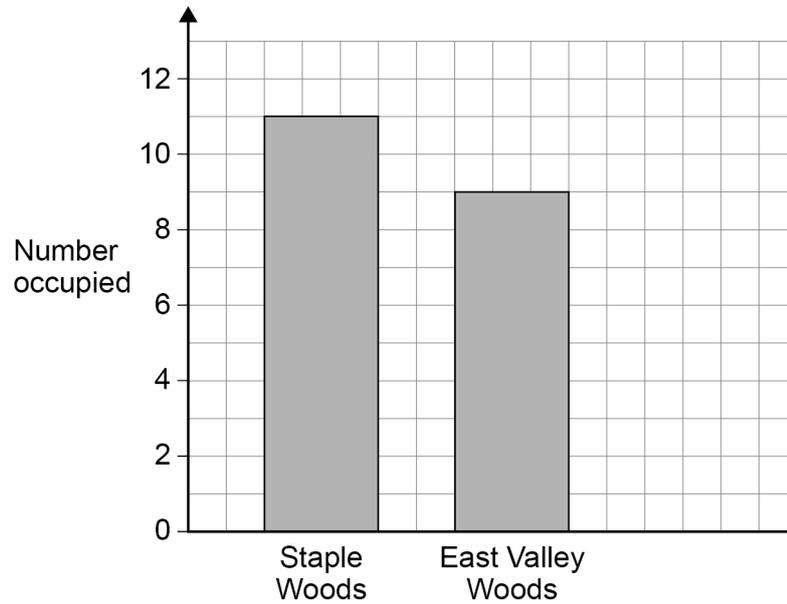
Question 6 continues on the next page

Turn over ►



At the end of the year, the charity checks the nest boxes to see if they have been occupied by birds.

The bar chart shows the number of occupied nest boxes in two of the woodlands.



- 6 (b)** Mandy claims that a greater proportion of the nest boxes in Staple Woods were occupied than the boxes in East Valley Woods.

Is she correct?

Tick (✓) one box.

Yes

No

You **must** show your working.

[3 marks]



6 (c) The charity finds that exactly 10% of all the nest boxes have been occupied.

Complete the bar chart on the page opposite to show the number of occupied nest boxes in Stourness Woods.

[3 marks]

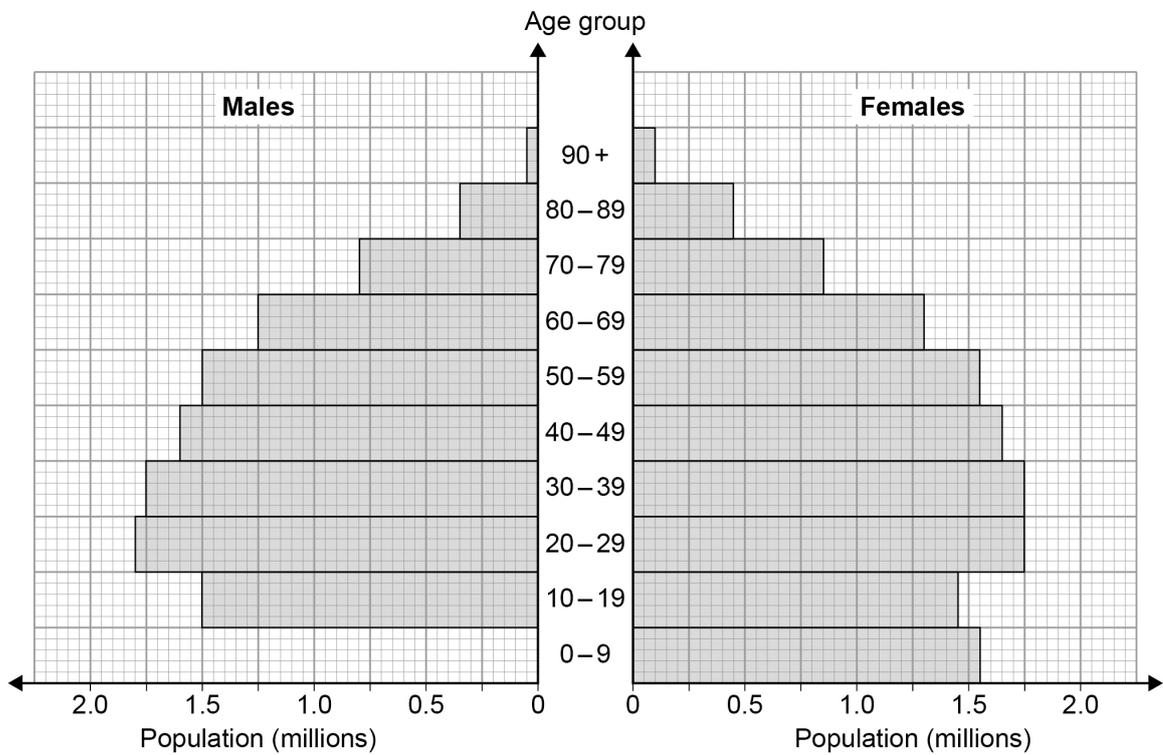
8

Turn over for the next question

Turn over ►



7 Information about the population of Australia in 2017 is shown in the population pyramid.



Source: Australian Bureau of Statistics

7 (a) In 2017, there were 1.6 million males aged 0 – 9 years.

Complete the population pyramid.

[1 mark]



7 (b) Carla is investigating the hypothesis,

The percentage of those aged 80 and over who are male is greater in 2017 than in 1997.

In 1997 there were,

- 330 000 females aged 80 and over
- 170 000 males aged 80 and over.

Investigate Carla's hypothesis.

You **must** show your working.

[4 marks]

5

Turn over for the next question

Turn over ►



- 8** Charlie wants to investigate how people do most of their travelling. She begins by asking 30 of her friends how they travel to school.

- 8 (a)** Write down a question that Charlie could ask.

[1 mark]

- 8 (b)** The frequency table shows Charlie's results.

Method of Travel	Frequency
Car	3
Bus	6
Walk	18
Cycle	2
Train	1

Charlie says,

“10% of these friends come to school by car, so 10% of all students come to school by car.”

Comment on **both parts** of Charlie's statement.

[2 marks]

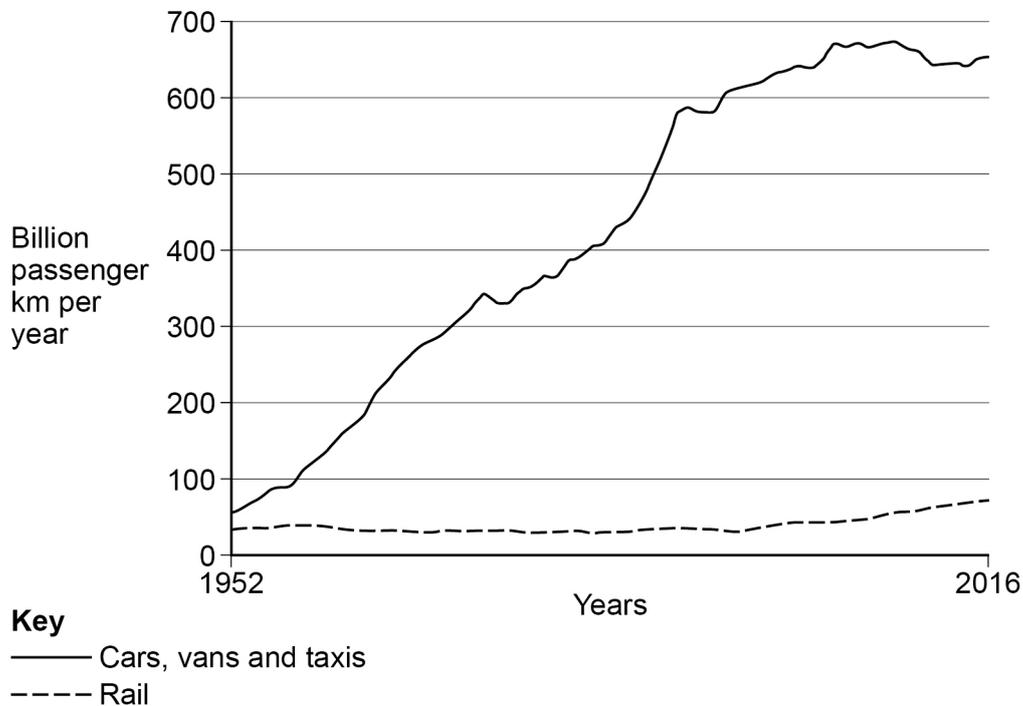
“10% of these friends come to school by car” _____

“10% of all students come to school by car” _____



8 (c) Charlie hears on the news that more people than ever are using cars to travel and roads are getting busier.

She sees this graph on a news website.



Source: adapted from Department for Transport

Comment, with a reason, whether or not the graph confirms that,

8 (c) (i) more people are using their cars to travel.

[1 mark]

8 (c) (ii) roads are getting busier.

[1 mark]

Question 8 continues on the next page

Turn over ►



8 (d) Using the graph on page 11, make **two** statements about **rail** travel over the years.

[2 marks]

8 (e) Charlie decides to look into rail travel in more depth.

She asks 12 of her friends how many times they have been on a train in the last year.

The results, in ascending order, are

0 0 0 0 0 1 1 2 4 6 7 387

Charlie says,

“The average number of times my friends have been on a train in the last year is 34”

8 (e) (i) Which measure of average did Charlie work out?

Show working to support your answer.

[2 marks]

Answer _____

8 (e) (ii) Comment on the use of this measure of average in this context.

[1 mark]



8 (e) (iii) Discuss the suitability of **two** other measures of average Charlie could use.

Suggest which would be the best measure of average to use.

[3 marks]

8 (f) Name **one** piece of primary data used in Charlie's investigation.

[1 mark]

8 (g) Name **one** piece of secondary data used in Charlie's investigation.

[1 mark]

8 (h) Give **one** way that Charlie could have improved the data collection at any point in her investigation.

[1 mark]

16

Turn over for the next question

Turn over ►



- 9** An online retailer wants to estimate the probability of an order being delivered by the following day.

The retailer tracks a sample of orders made each week during **February 2019**.

	Week 1	Week 2	Week 3	Week 4
Number of orders sampled	740	815	795	840
Number of these orders delivered by the following day	647	752	691	745

- 9 (a) (i)** Use the data to find the best possible estimate of the probability of an order being delivered by the following day.

[2 marks]

Answer _____

- 9 (a) (ii)** What could the retailer have done to get a more reliable estimate of this probability?

[1 mark]



9 (b) In **February 2018** the retailer delivered 5 out of every 6 orders by the following day.

Discuss whether the company was likely to have been more successful at delivering orders by the following day in **February 2019** or in **February 2018**.

Give a reason for your answer.

[1 mark]

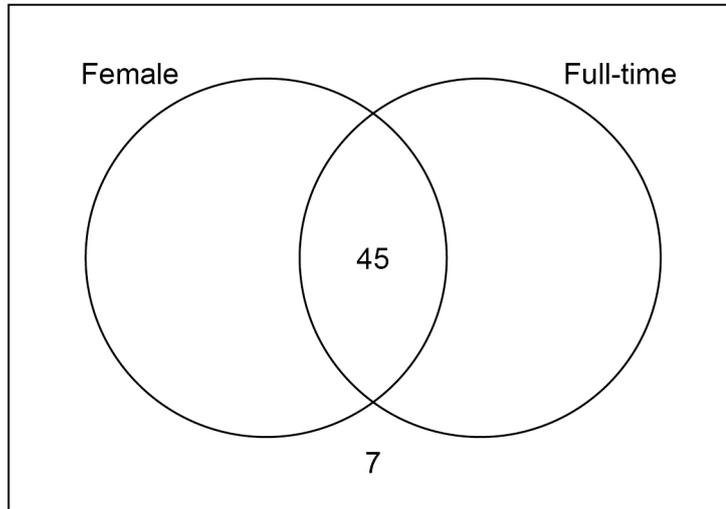
4

Turn over for the next question

Turn over ►



- 10** An IT company employs male and female workers who work either full-time or part-time. The Venn diagram shows some information about the number of workers.



- 10 (a)** The company employs a total of 160 workers.

$\frac{3}{4}$ of all workers are full-time.

Complete the Venn diagram.

[2 marks]



10 (b) The manager wants to ask a sample of workers how they feel about changes to the working day.

Declan suggests asking all workers that are at work one Friday morning.

Explain why this is likely to give an unrepresentative sample of all the company's workers.

[1 mark]

10 (c) Instead, the manager decides that the sample should be **stratified** by gender and type of employment (full-time or part-time).

Work out how many **full-time female** workers there should be in a sample of size 50

[2 marks]

Answer _____

5

Turn over for the next question

Turn over ►



- 11** The table shows some index numbers relating to the coal industry in the UK between 1910 and 1970 (base year = 1910).

Year	Index numbers	
	Amount of coal produced	Number of mining jobs
1910	100	100
1930	92.0	
1950	83.3	65.9
1970	54.9	27.4

Source: adapted from National Coal Mining Museum for England

- 11 (a)** The number of mining jobs decreased from 1 049 000 in 1910 to 914 000 in 1930.

Complete the table.

[2 marks]

- 11 (b) (i)** Work out the percentage decrease in the **amount of coal produced** in the UK between 1910 and 1970.

[1 mark]

Answer _____ %



- 11 (b) (ii)** Compare the percentage decrease in the amount of coal produced between 1910 and 1970 with the percentage decrease in the number of mining jobs.

[1 mark]

- 11 (c)** The UK produced 220 million tons of coal in 1950.
Calculate the amount of coal produced in the UK in 1910.

[2 marks]

Answer _____ million tons

6

Turn over for the next question

Turn over ►



- 12** The table shows the birth rate in different parts of the UK in **2006**.
The population of each part is also shown.

Part of UK	Population	Crude birth rate	Number of births
England and Wales	53 725 800	12.46	
Scotland	5 116 900	10.88	
Northern Ireland	1 741 600	13.36	
Total for UK			

Sources: Office for National Statistics, National Records for Scotland, NISRA

The population of the UK in **2016** was 65 648 000

The total number of births in the UK in 2016 was 774 835

Compare how the crude birth rate in the **UK as a whole** in 2016 differs from that in 2006.

You **must** show your working.

Complete the table to help you.

$$\text{Use } \text{crude birth rate} = \frac{\text{number of births}}{\text{total population}} \times 1000$$

[5 marks]



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5

Turn over for the next question

Turn over ►



- 13** Competitors in the Pairs Figure Skating competition in the Winter Olympics perform twice.
The competitors are awarded points each time.
The table shows the points awarded to the top 10 pairs in the 2018 Winter Olympics.

Names of competitors	Performance 1	Performance 2
Savchenko & Massot	76.59	159.31
Sui & Han	82.39	153.08
Duhamel & Radford	76.81	153.33
Tarasova & Morozov	81.68	143.25
James & Cipress	75.34	143.19
Marchei & Hotarek	74.50	142.09
Zabiiako & Enbert	74.34	138.53
Yu & Zhang	75.58	128.52
Seguin & Bilodeau	67.52	136.50
Della Monica & Guarise	74.00	128.74

Source: www.bbc.co.uk

- 13 (a)** Calculate the value of Spearman's Rank Correlation Coefficient between the points scored in the two performances.

Use $r_s = 1 - \frac{6 \sum d^2}{n(n^2 - 1)}$ and $\sum d^2 = 50$

[2 marks]

Answer _____



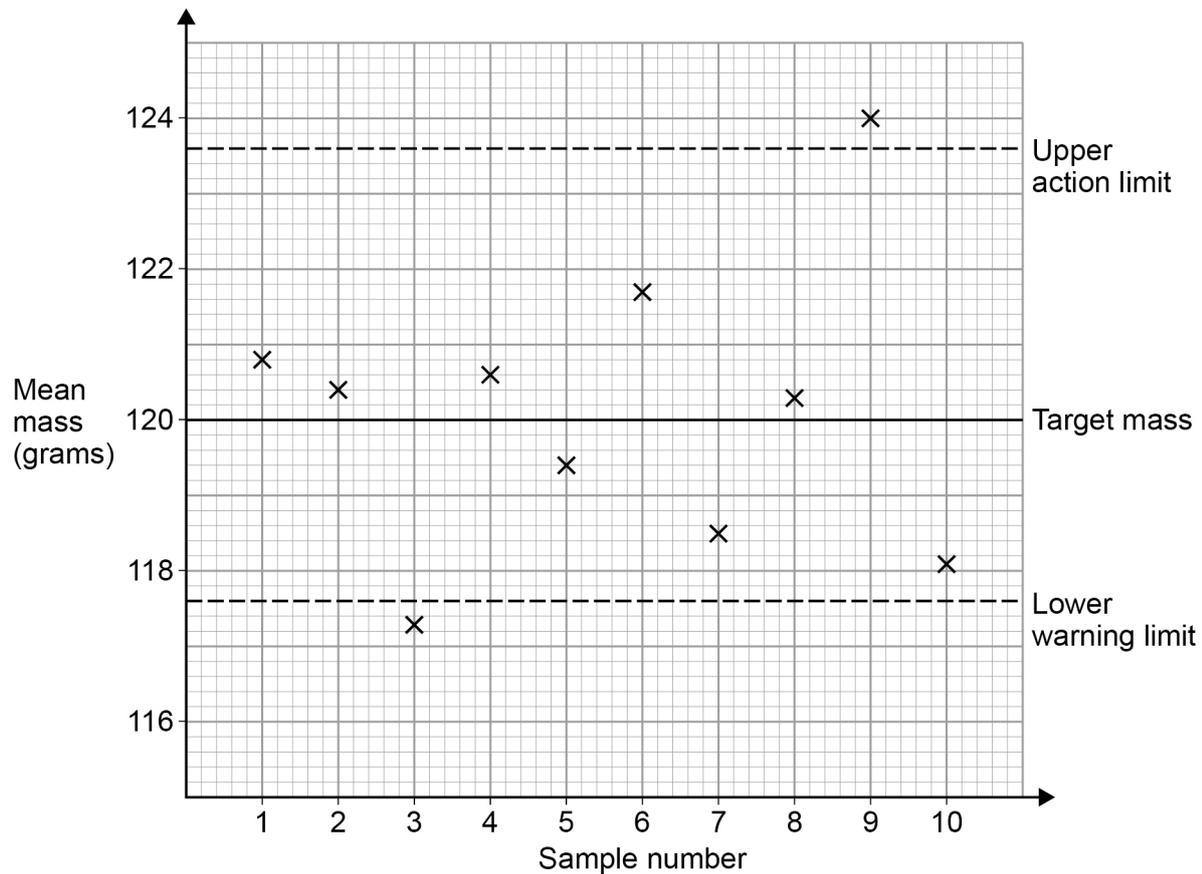
14

A machine fills packets with sweets.

The target mass for the bag of sweets is 120 grams.

Samples of packets are taken from the machine each day to check the machine is working correctly.

The sample means are shown on the control chart along with the upper action limit and the lower warning limit.



14 (a) The limit lines are symmetrical about the target mass.

Complete the chart by drawing in the lower action limit **and** the upper warning limit.

[2 marks]



- 14 (b)** After one of the samples had been taken the machine operator took an additional sample of sweets to check the machine was working correctly.

After which sample did this happen?

[1 mark]

Answer _____

- 14 (c)** Discuss the significance of the 9th sample mean.

What should happen to the machine after this sample was taken?

[2 marks]

5

Turn over for the next question

Turn over ►



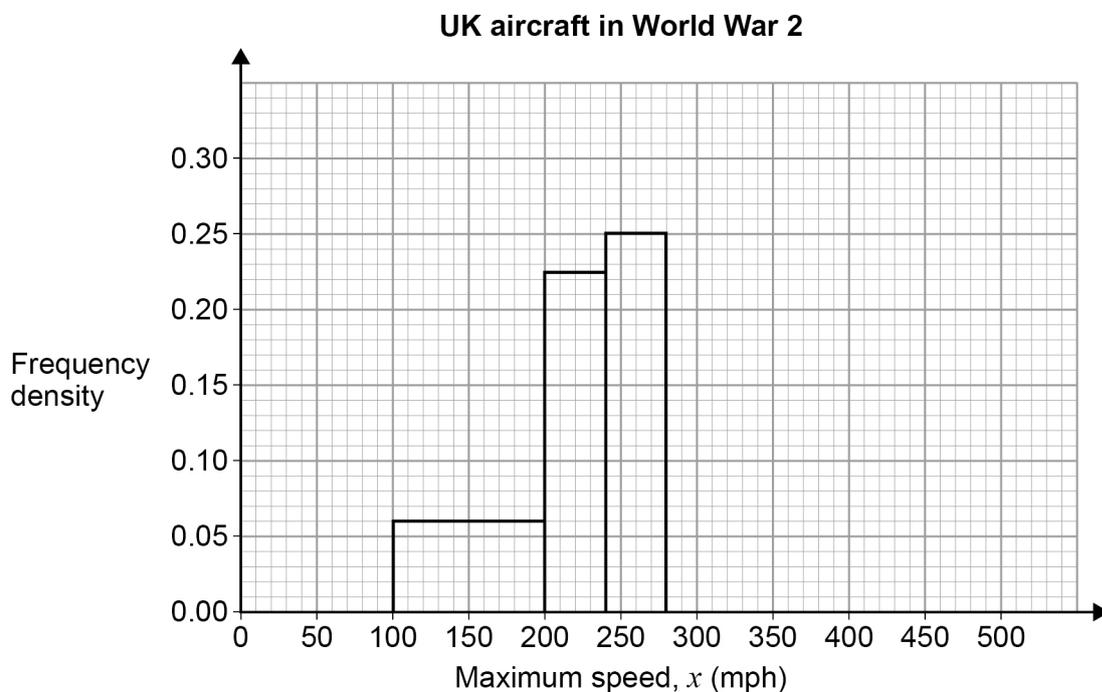
15 An air museum has aircraft that were used by the UK in the two World Wars.

15 (a) The table shows the maximum speed (mph) of the museum's aircraft from **World War 2**

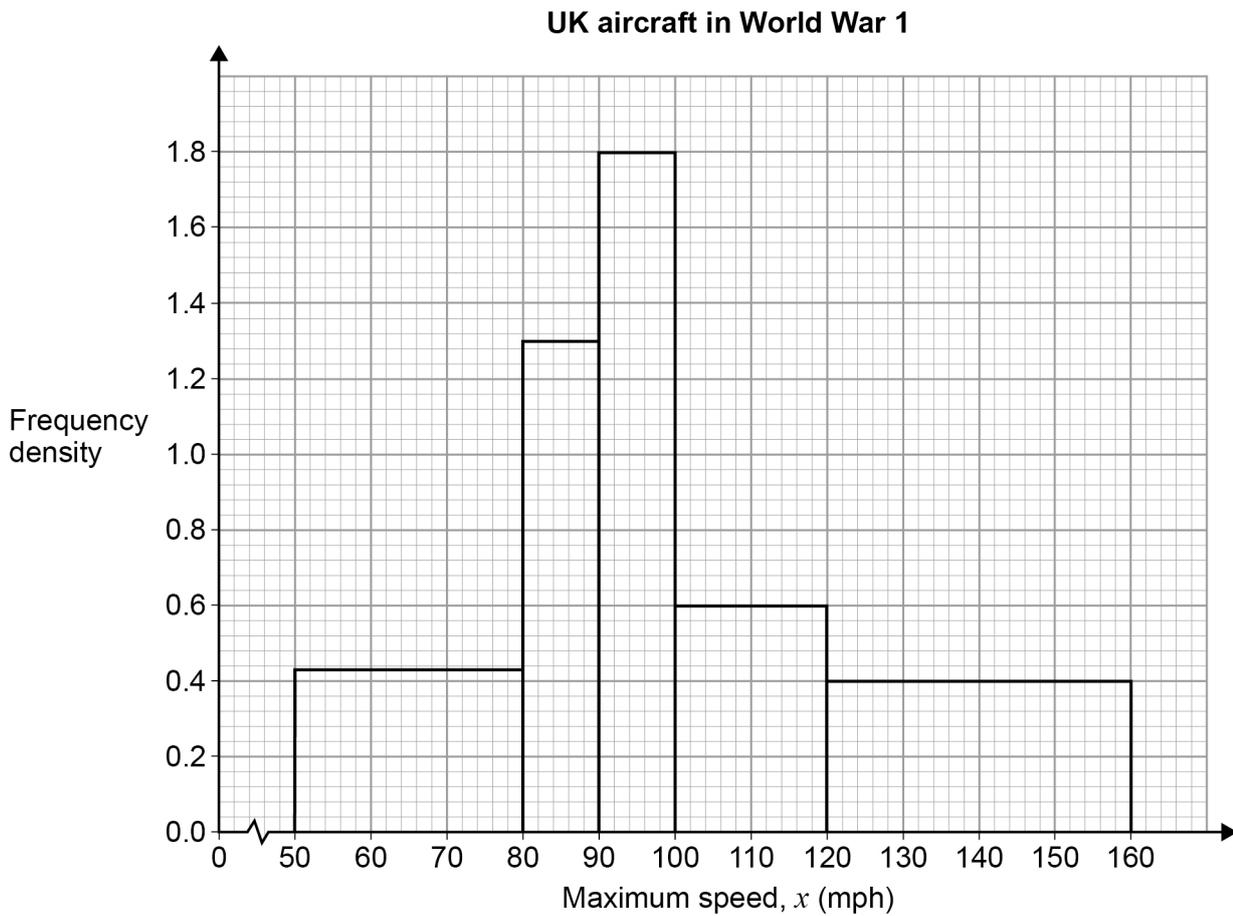
Maximum speed, x (mph)	Number of aircraft	
$100 \leq x < 200$	6	
$200 \leq x < 240$	9	
$240 \leq x < 280$	10	
$280 \leq x < 320$	6	
$320 \leq x < 400$	6	
$400 \leq x < 500$	3	

Complete the histogram to show the information.

[2 marks]



- 15 (b)** This histogram shows the maximum speed of the museum's 72 aircraft from **World War 1**



Estimate the number of these aircraft that had a maximum speed of between 90 mph and 115 mph.

[3 marks]

Answer _____

Question 15 continues on the next page

Turn over ►



15 (c) Ewan says that the fastest of the museum's aircraft from World War 1 is slower than all of the museum's aircraft from World War 2

Is Ewan correct?

Tick (✓) one box.

Yes

No

Cannot
tell

Give a reason for your answer.

[2 marks]

Reason _____

7



16 The tibia is the bone that connects the knee to the ankle bone.

The lengths of tibia bones in **modern-day** adult males have a normal distribution with mean 36.0 cm and standard deviation 2.8 cm.

16 (a) **Almost all** adult male tibia bones have lengths that are between a cm and b cm.

Calculate the values of a and b

[3 marks]

$a =$ _____

$b =$ _____

Question 16 continues on the next page

Turn over ►



16 (b) The lengths of tibia bones in **modern-day** adult **females** have a normal distribution with mean 33.8 cm and standard deviation 2.2 cm.

16 (b) (i) A tibia bone is discovered measuring 34.5 cm.

Alice says the bone is more likely to be from an adult female than an adult male.

Evaluate Alice's statement.

$$\text{Use standardised score} = \frac{\text{value} - \text{mean}}{\text{standard deviation}}$$

[3 marks]

16 (b) (ii) In fact, the bone in **part (b)(i)** was discovered on an old Roman site and is estimated as being about 1900 years old.

Is the conclusion made in **part (b)(i)** likely to be valid?

Explain your answer.

[1 mark]



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