

# Histograms, cumulative frequency and box plots

## Exam questions

### Higher tier

Please write clearly in block capitals.

Name

Class

Teacher

**Time allowed: 110 minutes**

### Materials

For this booklet you need a black pen, a pencil, a ruler, a rubber and a calculator for Section B.

### Instructions

- Use black ink or black ballpoint pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer all questions in the spaces provided.
- **Section A** (questions 1 to 10): you must not use a calculator.
- **Section B** (questions 11 to 23): you may use a calculator.
- Do all rough work in this booklet. Cross through any work you do not want marked.

### Information

- The marks for each question are shown in brackets.
- The maximum mark for this booklet is 100.

### Advice

- Read each question carefully.
- In all calculations, show clearly how you work out your answer.

### For teacher's use

| Q     | Mark | Q  | Mark |
|-------|------|----|------|
| 1     |      | 13 |      |
| 2     |      | 14 |      |
| 3     |      | 15 |      |
| 4     |      | 16 |      |
| 5     |      | 17 |      |
| 6     |      | 18 |      |
| 7     |      | 19 |      |
| 8     |      | 20 |      |
| 9     |      | 21 |      |
| 10    |      | 22 |      |
| 11    |      | 23 |      |
| 12    |      |    |      |
| TOTAL |      |    |      |

## Section A



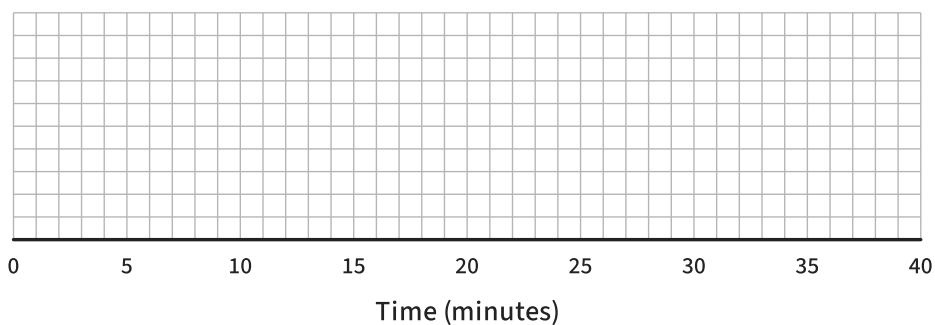
You must not use a calculator

Do not  
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the box

- 1** The table shows information about the times, in minutes, that some people waited to check in at an airport.

| Shortest time | Lower quartile | Median | Interquartile range | Range |
|---------------|----------------|--------|---------------------|-------|
| 4             | 11             | 15     | 9                   | 32    |

Draw a box plot to show this information.



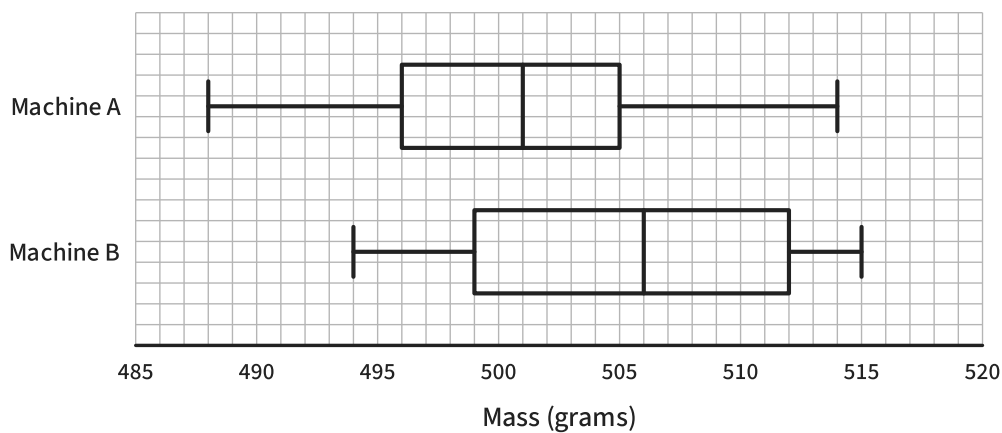
[3 marks]

2

Two machines fill bags of rice.

Each bag should contain 500 grams of rice.

The box plots show information about the masses of rice in some bags filled by each machine.



The company wants a machine that puts close to 500 grams in each bag and is consistent.

Which machine should the company use?

Give reasons for your answer.

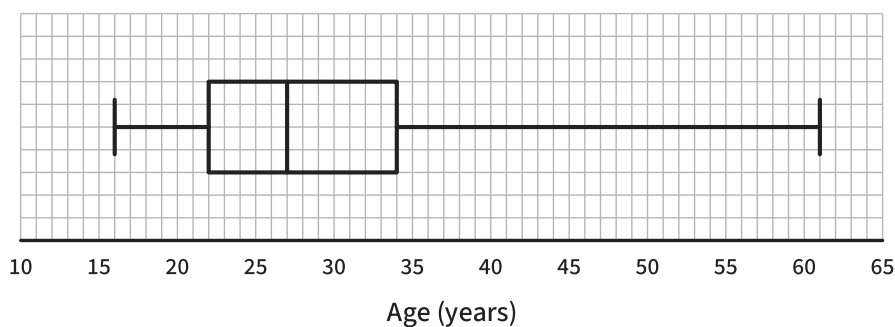
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[3 marks]

3

The box plot shows information about the ages of 240 people at a music festival.

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- (a) Write down the interquartile range of the ages.

Answer \_\_\_\_\_ years  
[1 mark]

- (b) Work out an estimate of the number of people at the festival who were older than 34

Answer \_\_\_\_\_  
[2 marks]

- (c) Kai says,  
*“More people were aged between 27 and 34 than between 22 and 27, because that part of the box is longer.”*  
 Is Kai correct?  
 Give a reason for your answer.

[1 mark]

4

The table shows information about the lengths,  $t$  minutes, of 80 calls to a helpline.

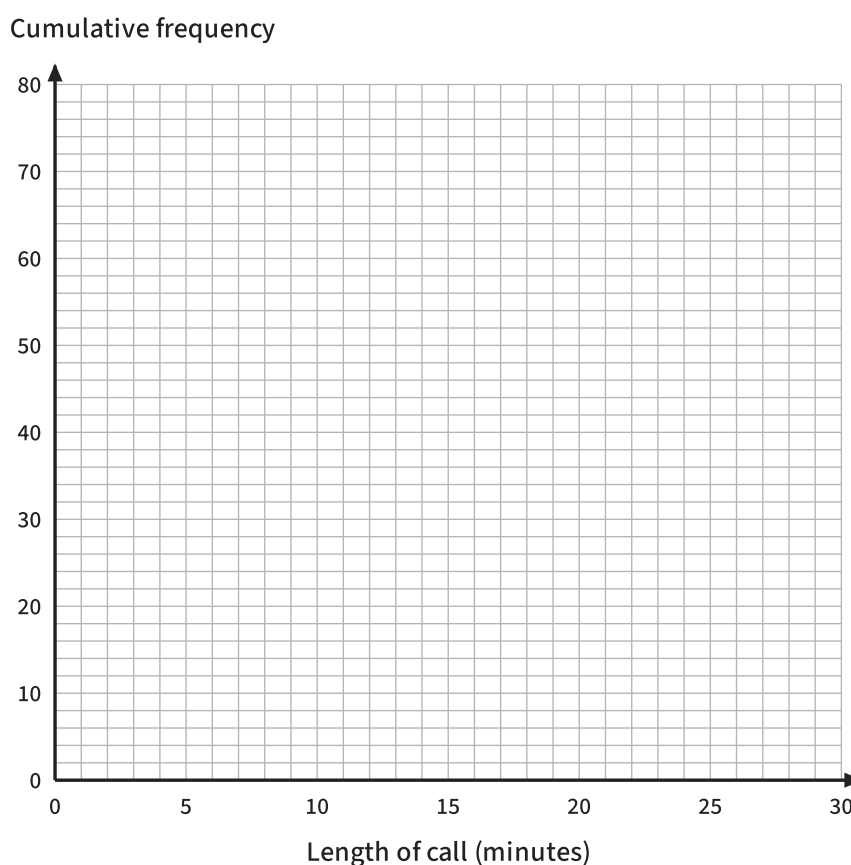
| Length ( $t$ minutes) | $0 < t \leq 5$ | $5 < t \leq 10$ | $10 < t \leq 15$ | $15 < t \leq 20$ | $20 < t \leq 25$ | $25 < t \leq 30$ |
|-----------------------|----------------|-----------------|------------------|------------------|------------------|------------------|
| Frequency             | 10             | 16              | 24               | 16               | 10               | 4                |
| Cumulative frequency  |                |                 |                  |                  |                  |                  |

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- (a) Complete the cumulative frequency row of the table.

[1 mark]

- (b) On the grid, draw a cumulative frequency graph for this information.



[2 marks]

- (c) Use your graph to estimate the median length of call.

Answer \_\_\_\_\_ minutes

[1 mark]

- (d) Use your graph to estimate the number of calls that were longer than 22 minutes.

Answer \_\_\_\_\_

[2 marks]

5

The stem and leaf diagram shows the scores of 19 golfers in one round.

|   |  |                         |
|---|--|-------------------------|
| 6 |  | 7 9                     |
| 7 |  | 0 1 1 2 3 4 4 5 6 6 7 9 |
| 8 |  | 0 1 2 4 8               |

Key: 6 | 7 means a score of 67

- (a) Work out the median score.

Answer \_\_\_\_\_

[1 mark]

- (b) Work out the interquartile range.

Answer \_\_\_\_\_

[2 marks]

- (c) One of the scores was written down wrongly.  
The score of 67 should have been 76  
Work out the correct median.

Answer \_\_\_\_\_

[1 mark]

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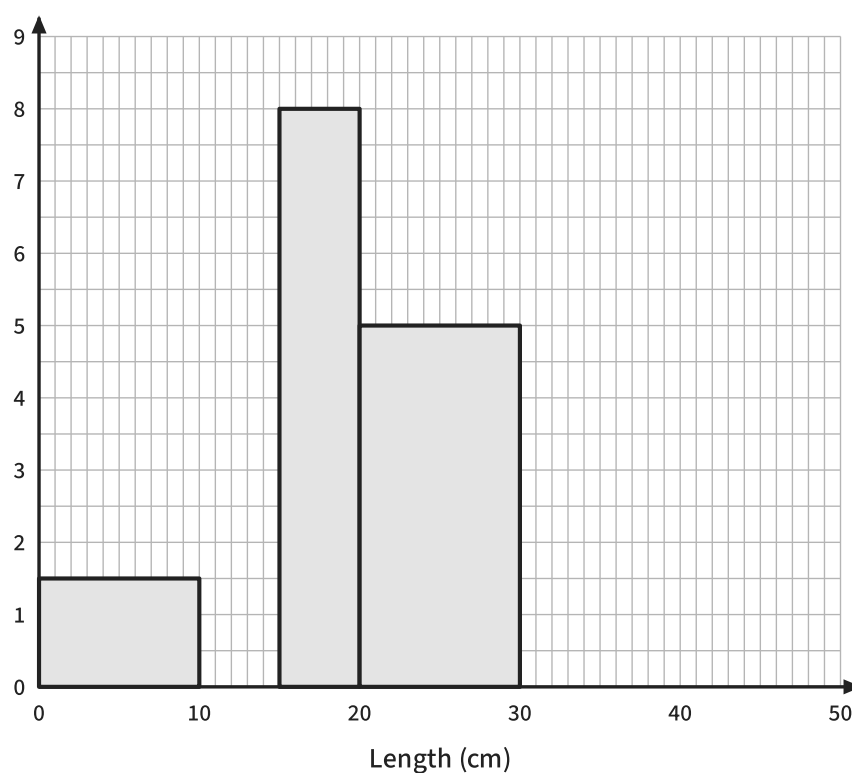
6

A survey measured the lengths,  $l$  cm, of some fish in a river.  
The table and the histogram show information about the lengths.

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| Length ( $l$ cm) | Frequency |
|------------------|-----------|
| $0 < l \leq 10$  |           |
| $10 < l \leq 15$ | 25        |
| $15 < l \leq 20$ |           |
| $20 < l \leq 30$ |           |
| $30 < l \leq 50$ | 20        |

Frequency density



(a) Use the histogram to complete the table.

[2 marks]

(b) Use the table to complete the histogram.

[2 marks]

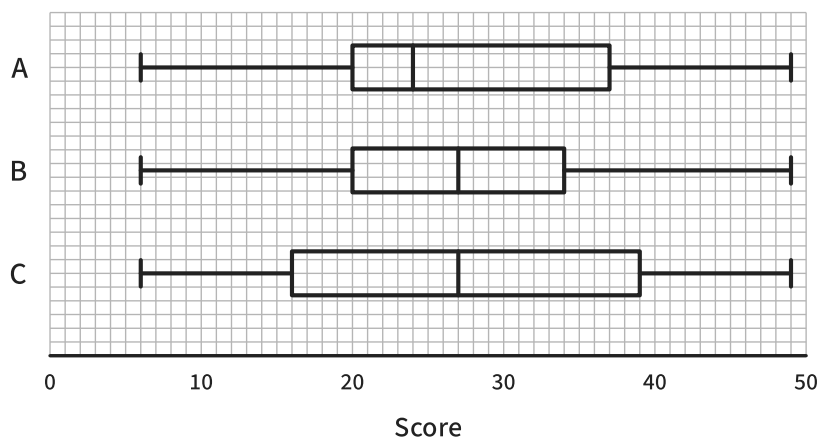
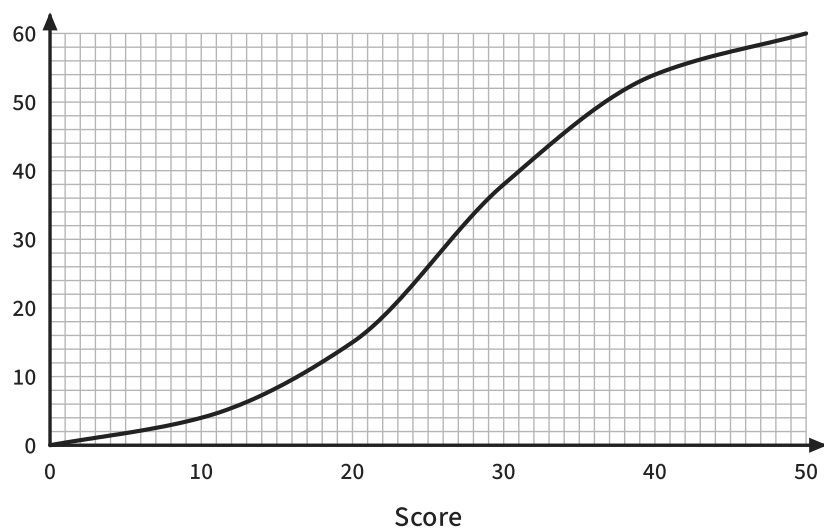
- 7 The cumulative frequency graph shows information about the scores of 60 people in a quiz.

The lowest score was 6 and the highest score was 49

Which box plot, A, B or C, shows the same data?

Give a reason for your answer.

Cumulative frequency



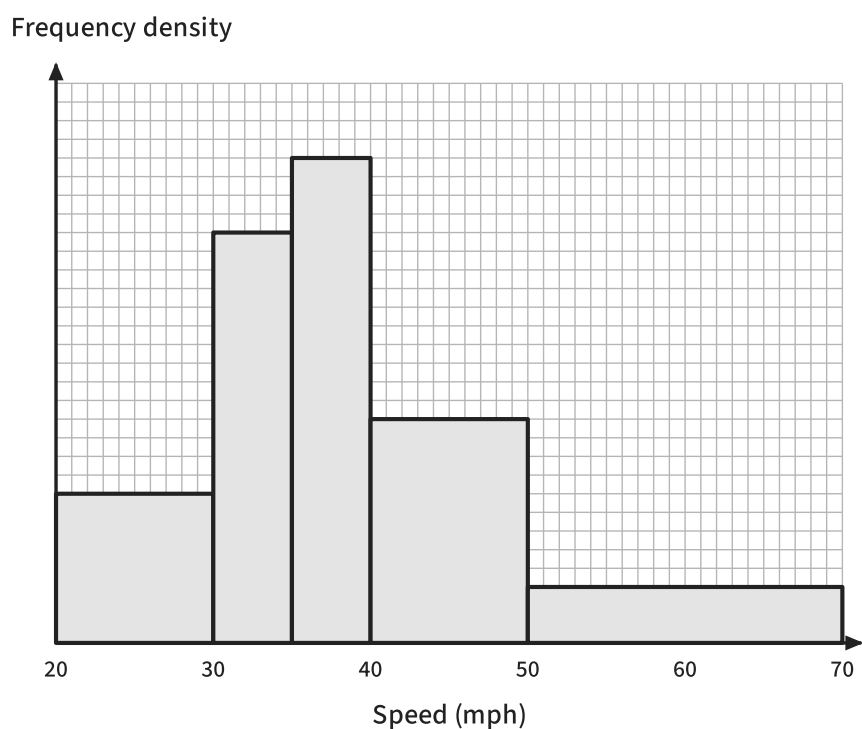
Answer \_\_\_\_\_

[2 marks]

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- 8 The histogram shows information about the speeds,  $s$  mph, of some cars on a road.  
There are 16 cars with speeds in the class  $20 < s \leq 30$

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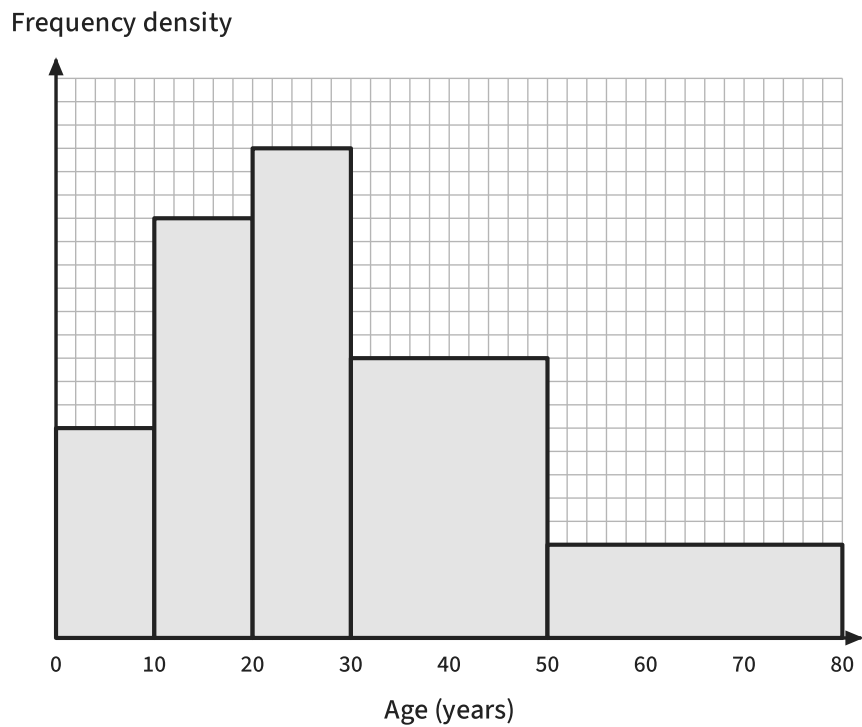


Work out the total number of cars.

Answer \_\_\_\_\_

[3 marks]

- 9 The histogram shows information about the ages,  $a$  years, of the people at a leisure centre one morning.
- There were 12 more people in the class  $20 < a \leq 30$  than in the class  $0 < a \leq 10$



Work out an estimate of the number of people at the leisure centre who were older than 45

Answer \_\_\_\_\_

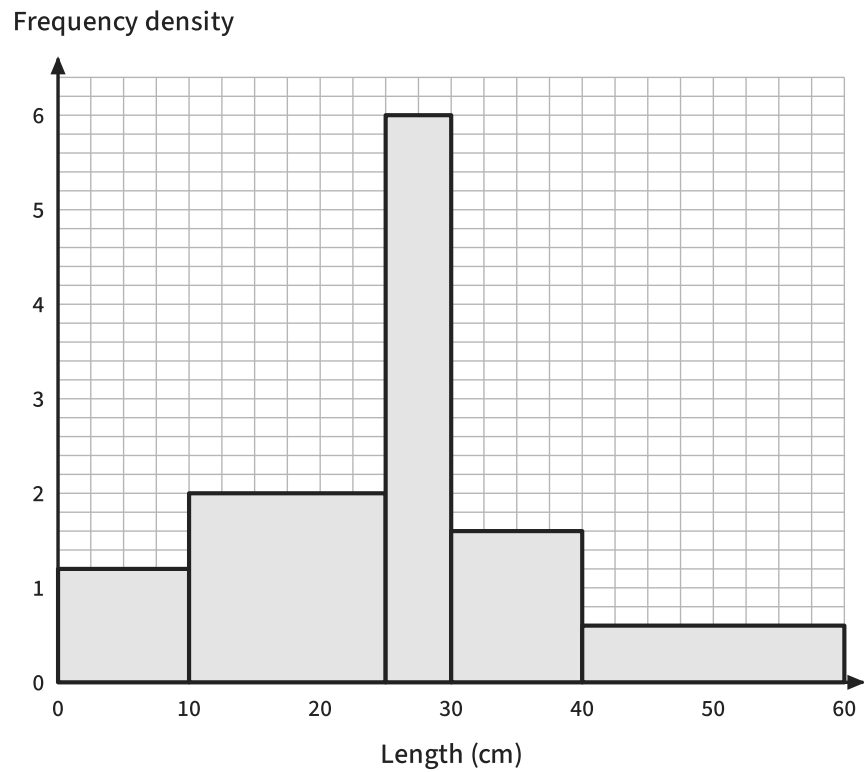
[5 marks]

10

The histogram shows information about the lengths of the fish caught in a lake in one week.

A fish is chosen at random.

The probability that its length is between 16 cm and  $k$  cm is 0.45



Work out an estimate of the value of  $k$ .

Answer \_\_\_\_\_

[4 marks]

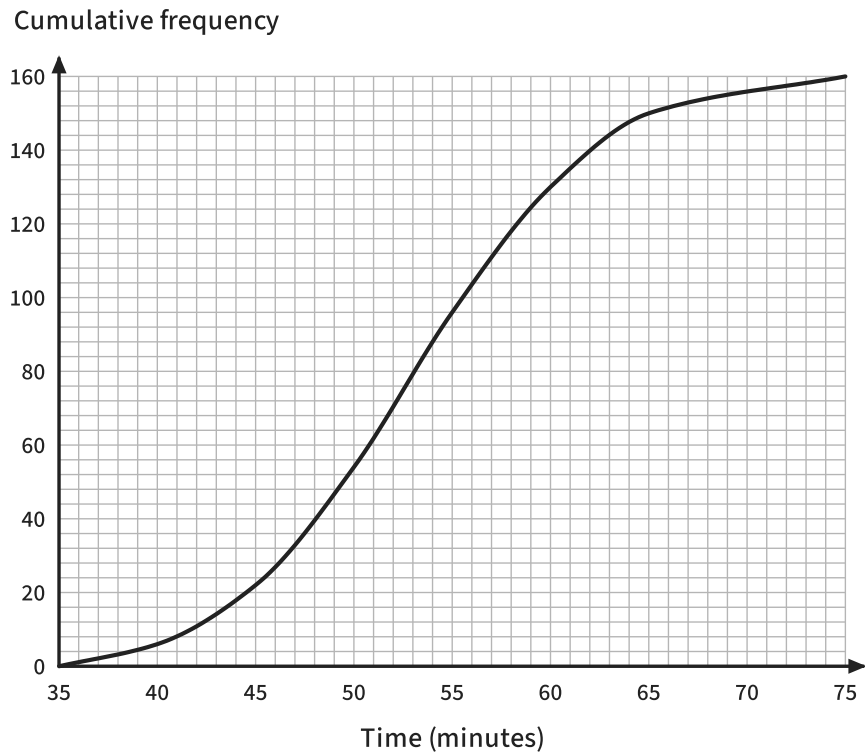
## Section B



You may use a calculator

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- 11** 160 runners took part in a 10 km race.  
The cumulative frequency graph shows information about their times.



- (a) Use the graph to estimate the median time.

Answer \_\_\_\_\_ minutes

[1 mark]

- (b) Use the graph to estimate the percentage of the runners who took less than 52 minutes.

Answer \_\_\_\_\_ %

[2 marks]

- (c) The fastest 20% of the runners get a medal.  
Use the graph to estimate the longest time that gets a medal.

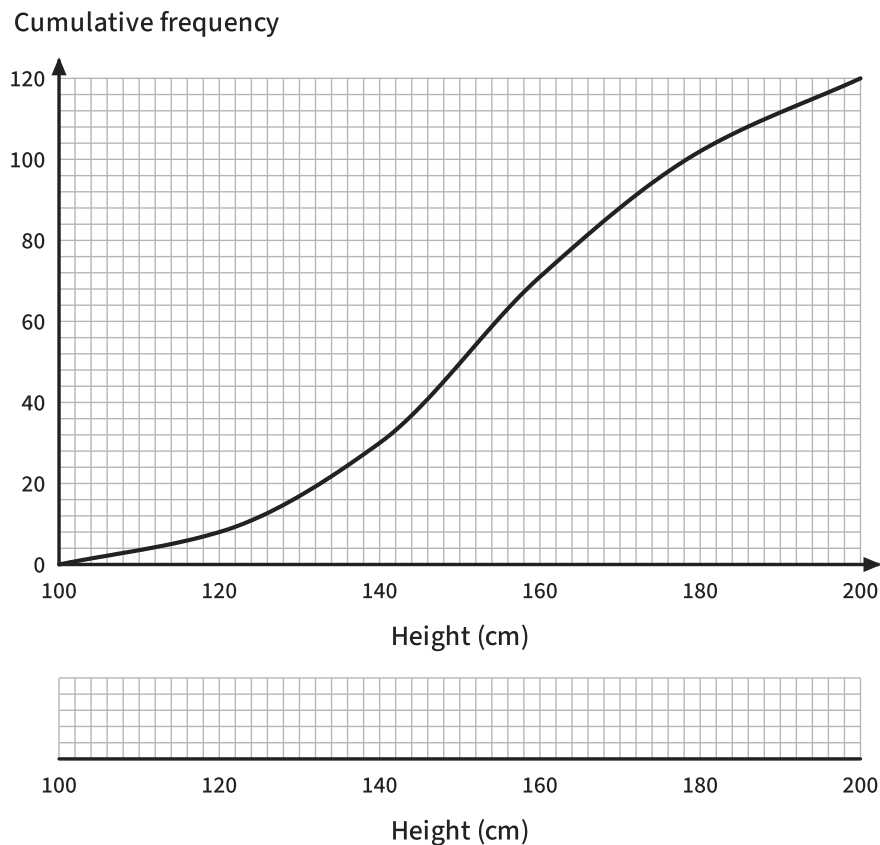
Answer \_\_\_\_\_ minutes

[2 marks]

12

The cumulative frequency graph shows information about the heights, in centimetres, of 120 sunflowers.

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- (a) Use the graph to estimate the interquartile range of the heights.

Answer \_\_\_\_\_ cm

[2 marks]

- (b) The shortest sunflower is 104 cm tall.  
The tallest sunflower is 197 cm tall.  
On the grid below the graph, draw a box plot for the heights.

[3 marks]

- (c) Sunflowers taller than 175 cm win a prize.  
Estimate the percentage of the sunflowers that win a prize.

Answer \_\_\_\_\_ %

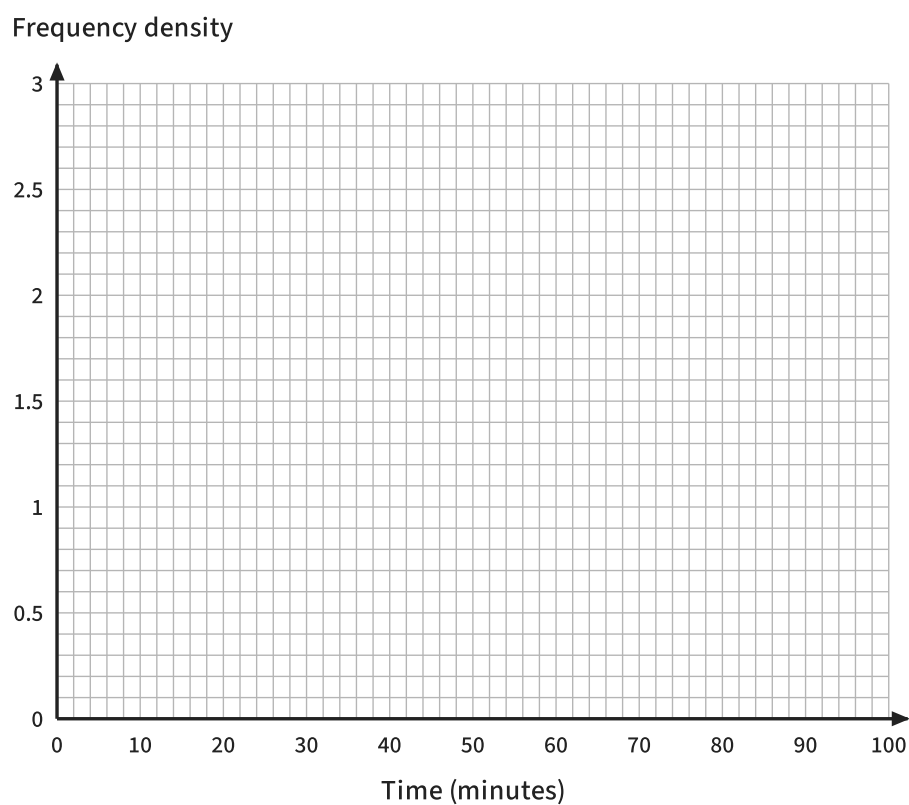
[2 marks]

13

The table shows information about the times,  $t$  minutes, that 102 visitors spent in a gallery.

| Time ( $t$ minutes) | Frequency |
|---------------------|-----------|
| $0 < t \leq 20$     | 12        |
| $20 < t \leq 30$    | 18        |
| $30 < t \leq 40$    | 26        |
| $40 < t \leq 60$    | 30        |
| $60 < t \leq 100$   | 16        |

(a) Draw a histogram for this information.



[3 marks]

(b) Ali says,

*“The class  $40 < t \leq 60$  has the most visitors, so it should have the tallest bar.”*

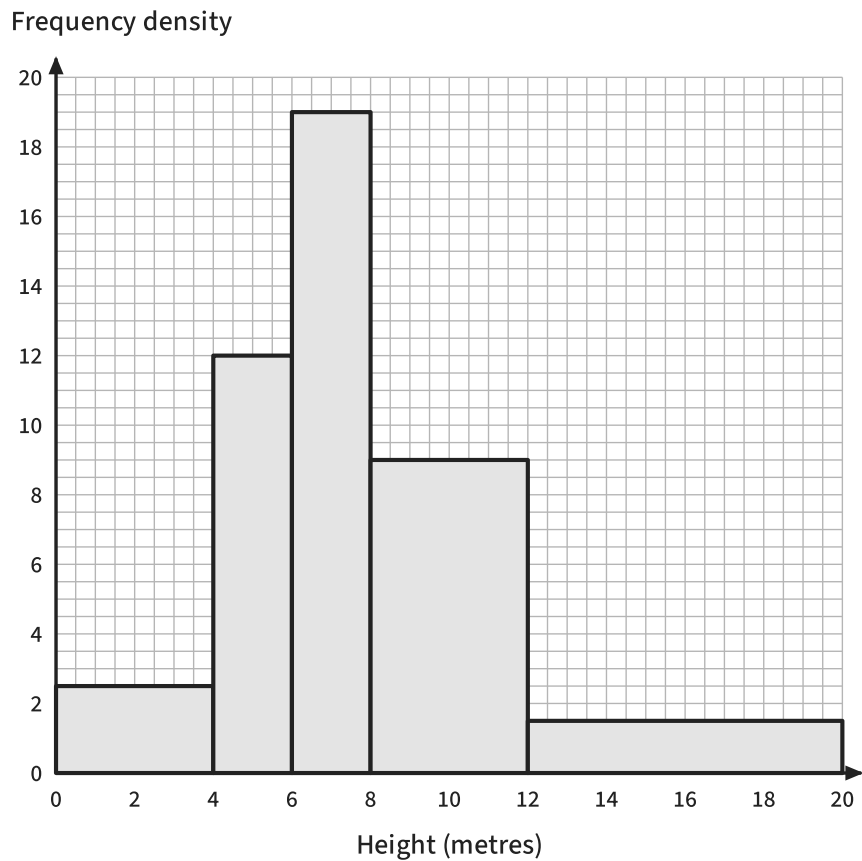
Explain why Ali is wrong.

[1 mark]

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- 14** The histogram shows information about the heights,  $h$  metres, of 120 trees in a wood.

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Work out an estimate of the number of trees with heights between 5 metres and 10 metres.

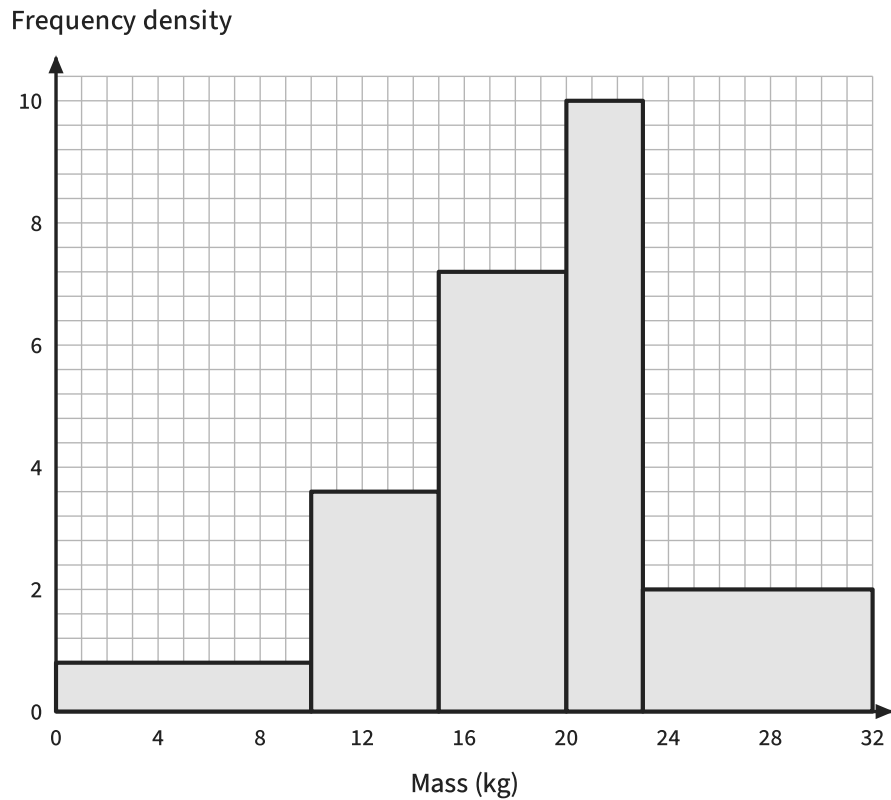
Answer \_\_\_\_\_

[3 marks]

15

The histogram shows information about the masses,  $m$  kg, of the suitcases checked in for one flight.

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- (a) Work out an estimate of the mean mass of the suitcases.

Answer \_\_\_\_\_ kg  
[4 marks]

- (b) The airline charges extra for a suitcase with a mass of more than 23 kg.  
What fraction of the suitcases were charged extra?

Answer \_\_\_\_\_  
[1 mark]

16

Company A has 436 employees.

Company B has 618 employees.

The box plots show information about the annual salaries of the employees.



Work out an estimate of the total number of employees at the two companies who earn more than £36 000 a year.

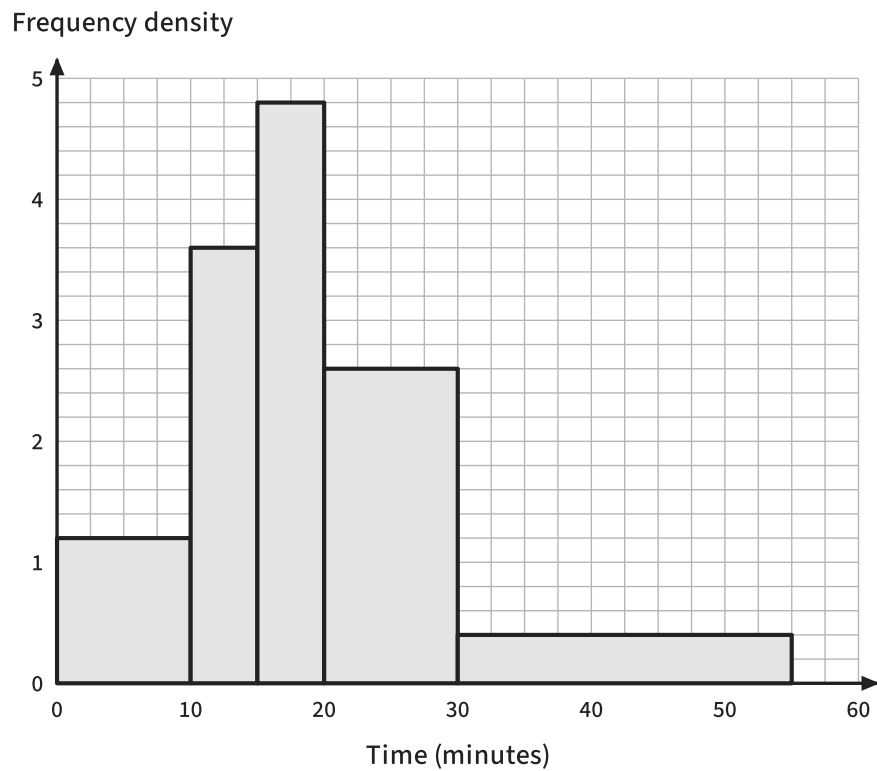
Answer \_\_\_\_\_

[4 marks]

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- 17** The histogram shows information about the times,  $t$  minutes, that 90 customers spent in a shop.

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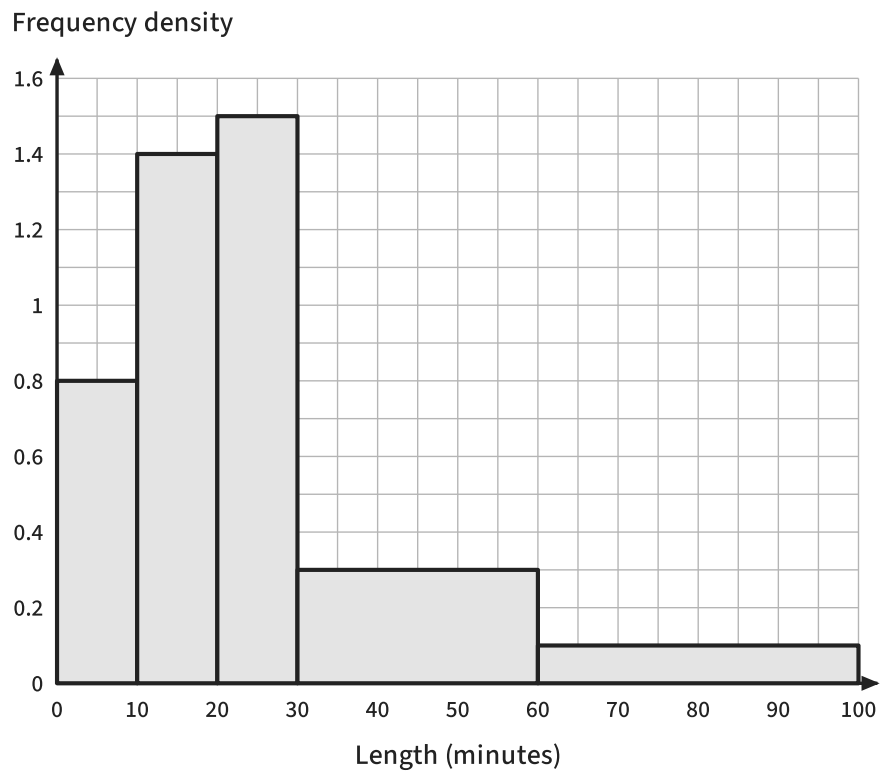


Work out an estimate of the median time.

Answer \_\_\_\_\_ minutes  
[4 marks]

- 18** The histogram shows information about the lengths, in minutes, of the 50 videos on a channel.

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Two of the videos are chosen at random.

Work out the probability that both videos are longer than 30 minutes.

Answer \_\_\_\_\_

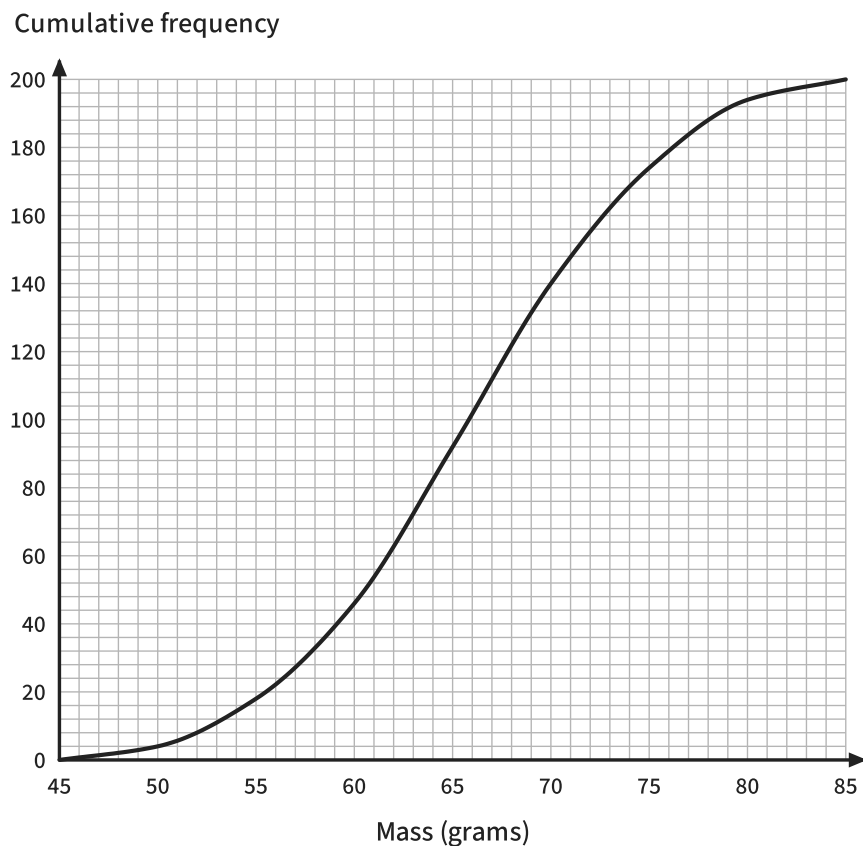
[4 marks]

19

The cumulative frequency graph shows information about the masses of 200 eggs laid on a farm.

An egg with a mass of more than 73 grams is *very large*.

An egg with a mass of more than 63 grams is *large* or *very large*.



- (a) Use the graph to estimate the number of very large eggs.

Answer \_\_\_\_\_

[2 marks]

- (b) Two eggs are chosen at random from the eggs with a mass of more than 63 grams. Estimate the probability that both eggs are very large.

Answer \_\_\_\_\_

[3 marks]

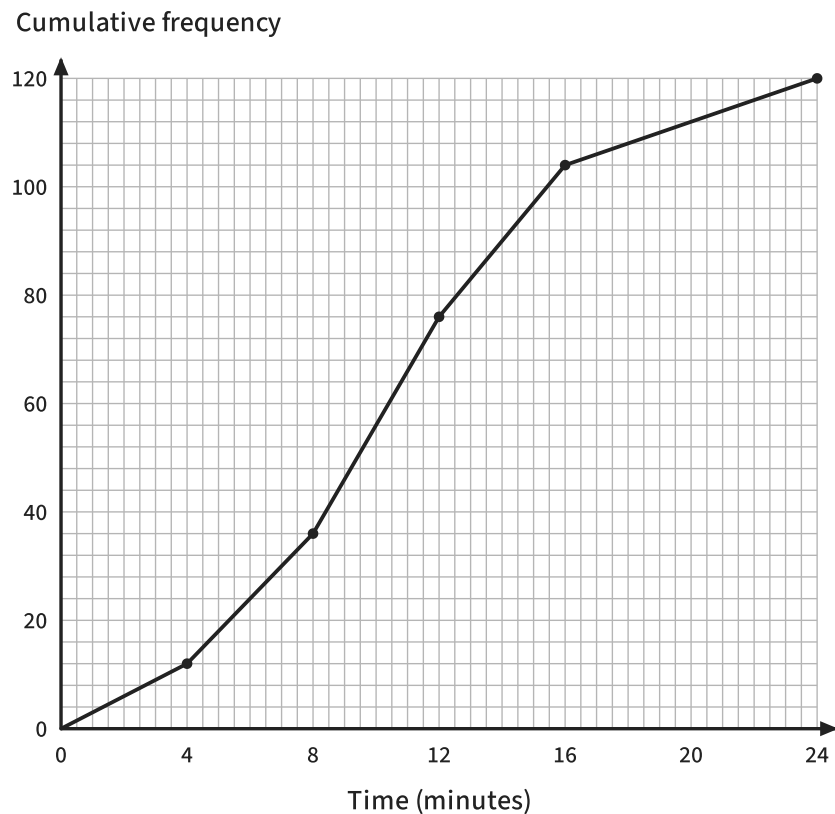
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**20**

120 people each filled in an online form.

The cumulative frequency graph shows information about the times they took.

The points are plotted at 4, 8, 12, 16 and 24 minutes.



- (a) Work out an estimate of the mean time.  
Give your answer to 1 decimal place.

Answer \_\_\_\_\_ minutes

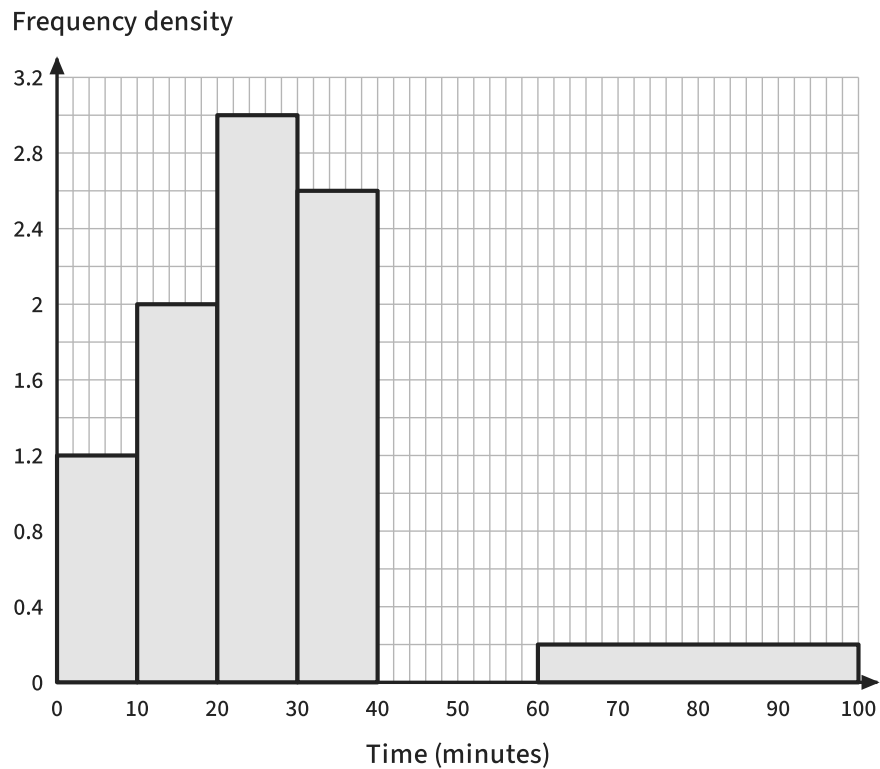
**[4 marks]**

- (b) Use the graph to estimate the median time.

Answer \_\_\_\_\_ minutes

**[1 mark]**

- 21** The histogram shows information about the times,  $t$  minutes, that some electric cars spent at a charging point.  
The bar for the class  $40 < t \leq 60$  has not been drawn.  
Using all of the data, an estimate of the median time is 28 minutes.



- (a)** Work out the number of cars in the class  $40 < t \leq 60$

Answer \_\_\_\_\_

**[4 marks]**

- (b)** Complete the histogram.

**[1 mark]**

22

The table shows information about the times,  $t$  minutes, that some visitors spent at an exhibition.

| Time ( $t$ minutes) | Frequency density |
|---------------------|-------------------|
| $0 < t \leq 20$     | 0.6               |
| $20 < t \leq 30$    | 2.4               |
| $30 < t \leq 40$    | 3                 |
| $40 < t \leq 60$    | 1.2               |
| $60 < t \leq k$     | 0.5               |

Using the table, an estimate of the mean time is 36.7 minutes.

Work out the value of  $k$ .

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Answer \_\_\_\_\_

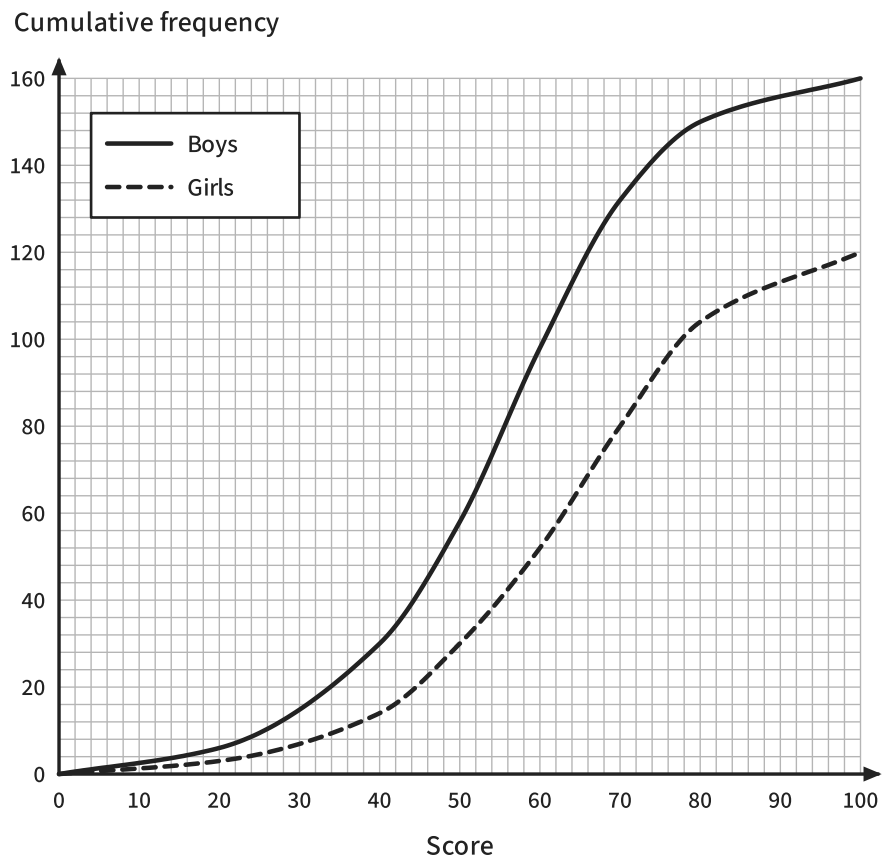
[5 marks]

23

160 boys and 120 girls took a test.

The cumulative frequency graphs show information about their scores.

Do not  
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- (a) The pass mark is set so that 70% of all the students pass.  
Use the graphs to estimate the pass mark.

Answer \_\_\_\_\_

[3 marks]

- (b) One of the students who passed is chosen at random.  
Estimate the probability that this student is a girl.

Answer \_\_\_\_\_

[3 marks]

END OF QUESTIONS