

A Level · Edexcel · Maths

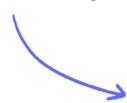
 3 hours  24 questions

2.2 Data Presentation

2.2.1 Data Presentation / 2.2.2 Box Plots & Cumulative Frequency / 2.2.3 Histograms

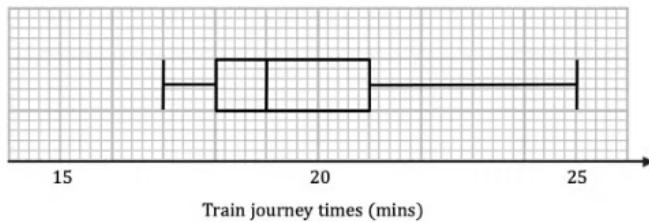
Easy (6 questions)	/35
Medium (6 questions)	/35
Hard (6 questions)	/41
Very Hard (6 questions)	/45
Total Marks	/156

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Easy Questions

- 1 (a)** The train journey times, in minutes, between March and Peterborough, are illustrated in the box and whisker diagram below.



Using the box and whisker diagram above to find

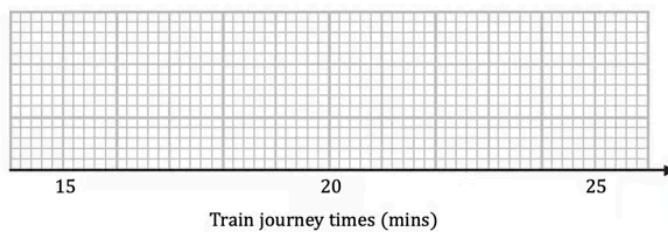
- (i) the median journey time
- (ii) the lower and upper quartiles
- (iii) the interquartile range.

(4 marks)

- (b)** The above times show those for a weekday. The table below summarises the times for the same journey on a Saturday.

	Journey Time
Fastest	16
Lower quartile	18
Median	19
Upper Quartile	20
Slowest	25

On the grid, draw a box plot for the information given in the table.

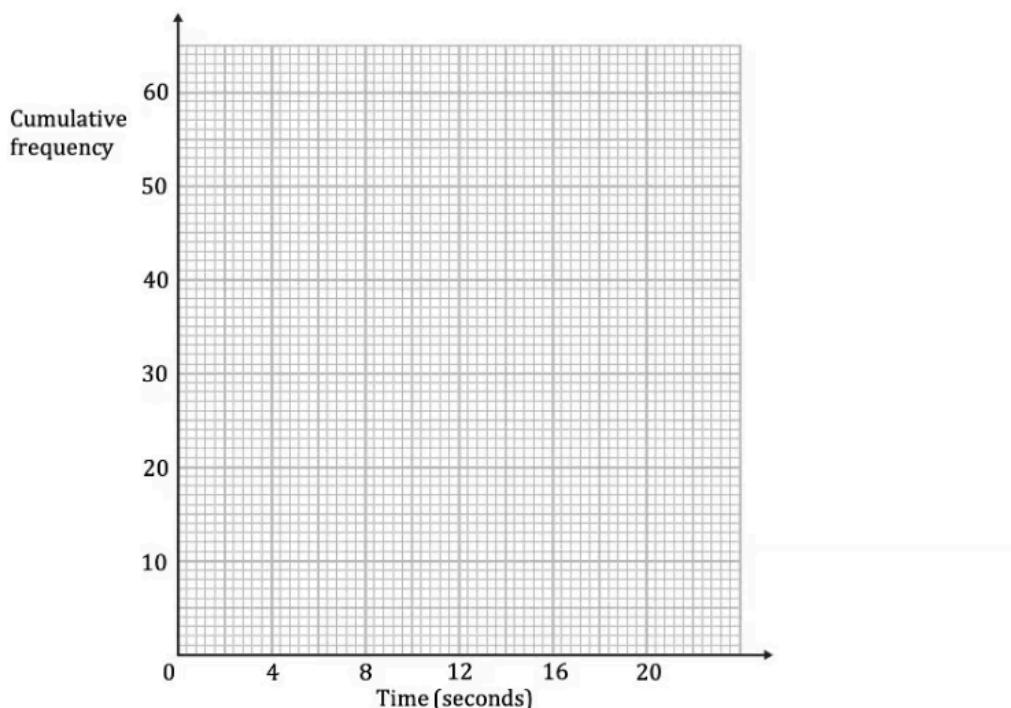


(3 marks)

- 2 (a) In the 2019 Red Bull Paper Wings World Finals, 55 contestants flew their paper aeroplanes in the Airtime Pre-Eliminations round. The flight times achieved by the contestants' paper aeroplanes are shown in the table below.

Time, t seconds	Frequency f
$0 \leq t < 4$	12
$4 \leq t < 8$	25
$8 \leq t < 12$	16
$12 \leq t < 16$	2

On the grid below, draw a cumulative frequency graph for the information in the table.



(3 marks)

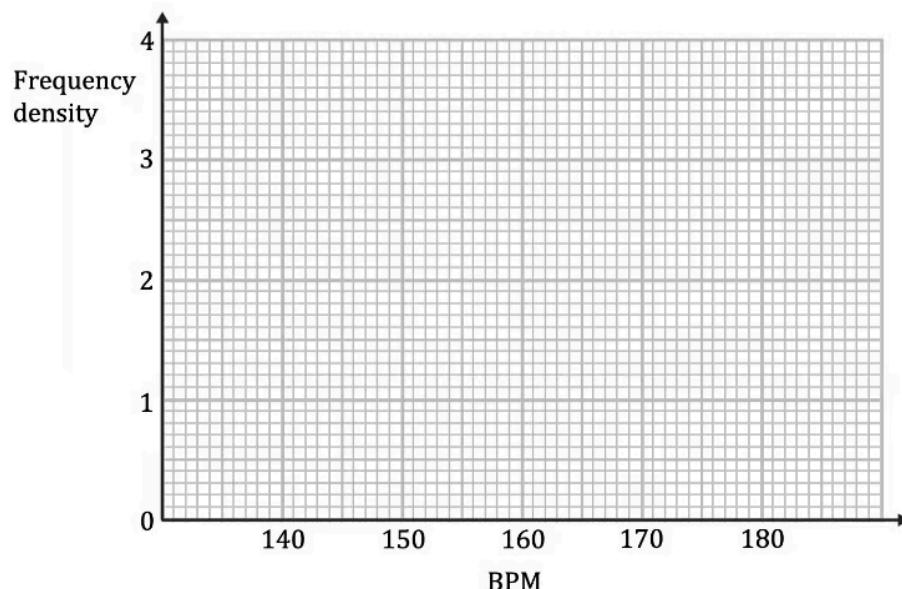
- (b) Use your graph to find an estimate of the median time.

(1 mark)

- 3 (a)** The beats per minute (bpm) of 60 randomly selected drum 'n' bass songs were recorded and the data is summarised in the table below.

b (bpm)	Frequency	Class width	Frequency density
$140 \leq b < 160$	10	$160 - 140 = 20$	$10 \div 20 = 0.5$
$160 \leq b < 170$	20	10	
$170 \leq b < 175$	20	5	
$175 \leq b < 180$	10	5	

- (i) Complete the column 'Frequency density' – the first one has been done for you.
- (ii) On the grid below, draw a histogram to represent these data.



(4 marks)

- (b)** Estimate how many of the 60 songs had less than 150 beats per minute.

(2 marks)

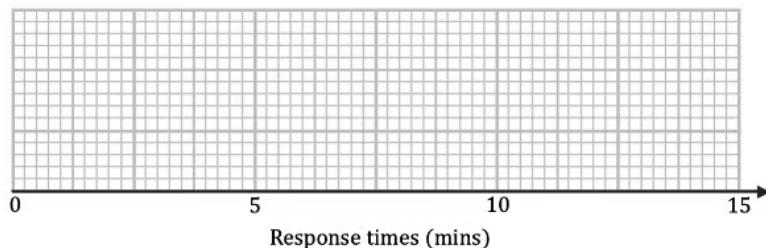
- 4 (a)** A local ambulance service is looking to cut down the times it takes to respond to 999 calls. The ambulance service manager recorded the response times, in minutes, on 15 occasions. These are given below.

4	8	12	9	7
14	6	5	8	7
9	10	7	3	6

- (i) Find the median of the response times.
(ii) Find the upper and lower quartiles, and the interquartile range.

(4 marks)

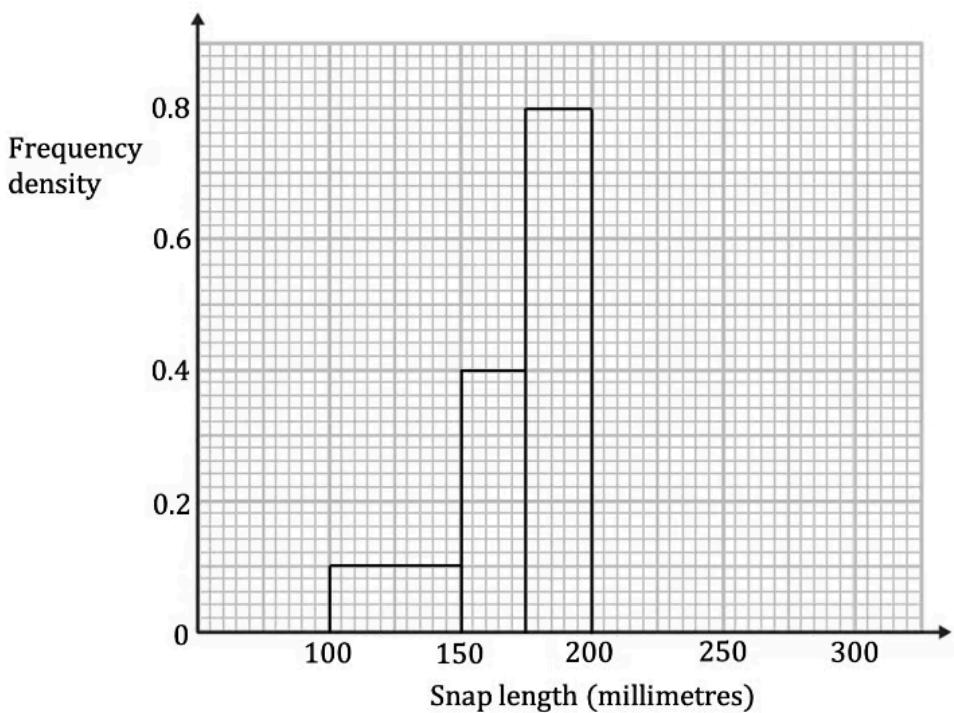
- (b)** On the grid, draw a box plot for the information given above.



(3 marks)

- 5** To quality control the elasticity of elastic bands, a company selects random elastic bands from the end of their production line and has a machine stretch them until they snap.

The length, measured in millimetres, of an elastic band at the moment it snaps is recorded. The incomplete histogram and frequency table below show the results.

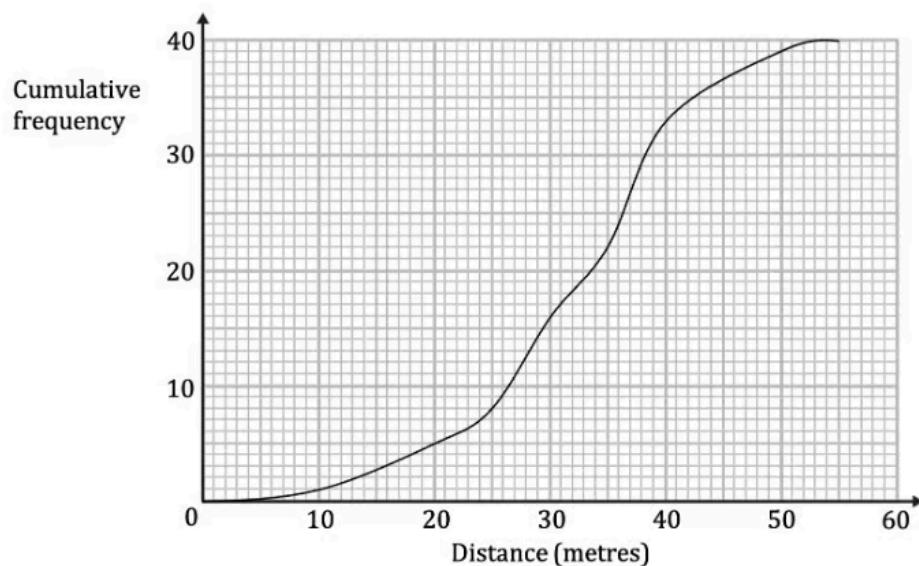


Snap length, l (mm)	Frequency	Class width	Frequency density
$100 \leq l < 150$	5	$150 - 100 = 50$	$5 \div 50 = 0.1$
$150 \leq l < 175$			$\div 25 = 0.4$
$175 \leq l < 200$			
$200 \leq l < 225$	15	$225 - 200 = 25$	
$225 \leq l < 275$	10		

Use the information to complete both the histogram and frequency table.

(5 marks)

- 6 (a)** In the 2019 Red Bull Paper Wings World Finals, 40 contestants flew their paper aeroplanes in the Distance Pre-Eliminations round. The distances achieved by the contestants' paper aeroplanes are shown in the cumulative frequency diagram below.



Use the cumulative frequency graph to estimate

- the median distance travelled by the contestants' paper aeroplanes
- the upper and lower quartiles
- the interquartile range.

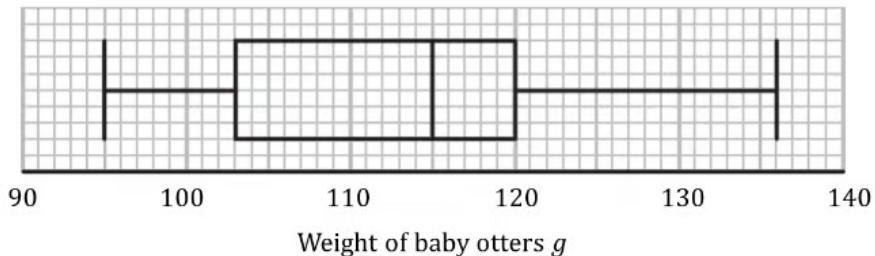
(4 marks)

- (b)** The top 9 contestants in the Pre-Eliminations round qualified for the Super Finals round. Estimate the minimum distance a contestants' paper aeroplane would've need to have flown in order for them to have qualified for the Super Finals.

(2 marks)

Medium Questions

- 1 (a)** Jeanette works for a conservation charity who rescue orphaned otters. Over many years she records the weight (g) of each otter when it first arrives. The data is illustrated in the following box and whisker diagram:



Using the box plot above:

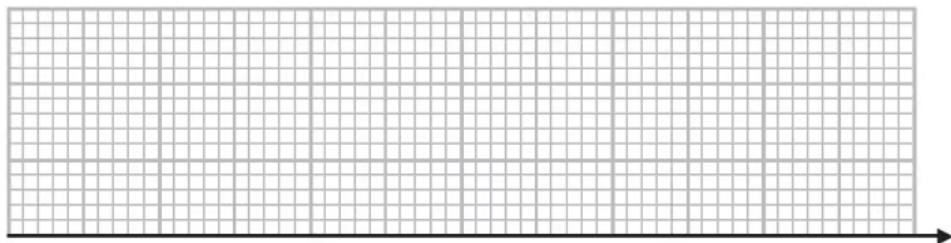
- Write down the median weight of the otters.
- Write down the lower quartile.
- Find the interquartile range.

(4 marks)

- (b)** Otters are then weighed weekly to track their growth. Summary data on the weights (g) of otters after one month is shown in the table below:

Weight g	
Smallest weight	125
Range	48
Median	152
Upper Quartile	164
Interquartile Range	33

On the grid, draw a box plot for the information given above.

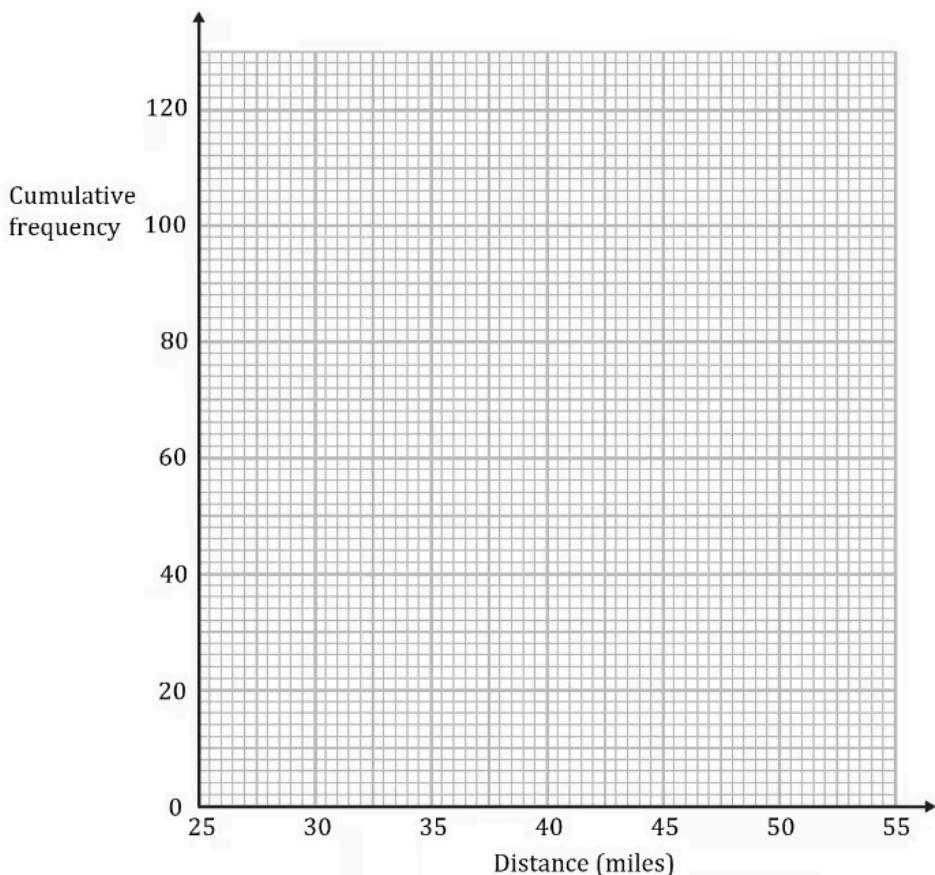


(3 marks)

- 2 (a) 120 competitors enter an elimination race for charity. Runners set off from the same start running as many laps of the course as possible. Their total distance is tracked and the competitor who runs the furthest over a 6-hour period is the winner. The distances runners achieved are recorded in the table below:

Distance d (miles)	Frequency f
$25 \leq d < 30$	8
$30 \leq d < 35$	10
$35 \leq d < 40$	32
$40 \leq d < 45$	54
$45 \leq d < 50$	10
$50 \leq d < 55$	6

On the grid below, draw a cumulative frequency graph for the information in the table.



(3 marks)

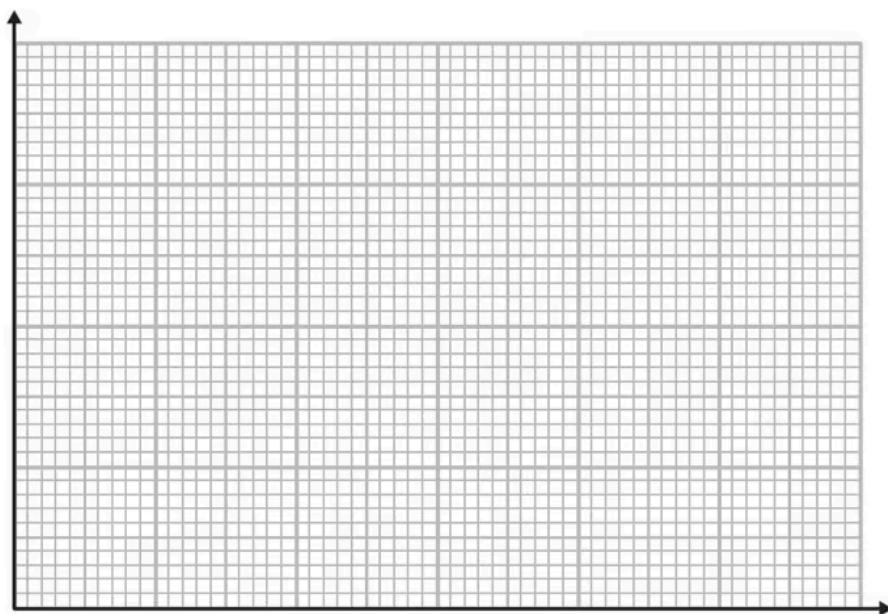
- (b)** Use your graph to find an estimate for the median and interquartile range.

(3 marks)

- 3 (a)** The total amount of time cleaners spent dealing with unplanned incidents in a supermarket was recorded each day. Data collected over 49 days is summarised in the table below.

Time t (minutes)	Frequency f
$0 \leq t < 90$	9
$90 \leq t < 120$	24
$120 \leq t < 200$	12
$200 \leq t < 250$	4

On the grid below, draw a histogram to represent this data.



(4 marks)

- (b)** Estimate how often cleaners spent longer than 3 hours dealing with incidents.

(3 marks)

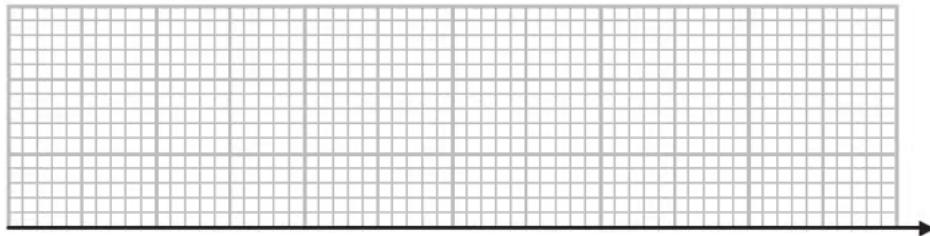
- 4 (a)** A taxi firm, JustDrive, records data on the amount of time, to the nearest minute, that customers had to wait before their taxis arrived. A random sample of 20 times is given below:

6	7	16	30	24
27	20	7	5	8
20	24	27	12	34
32	31	6	19	14

Find the median and interquartile range of the waiting times.

(3 marks)

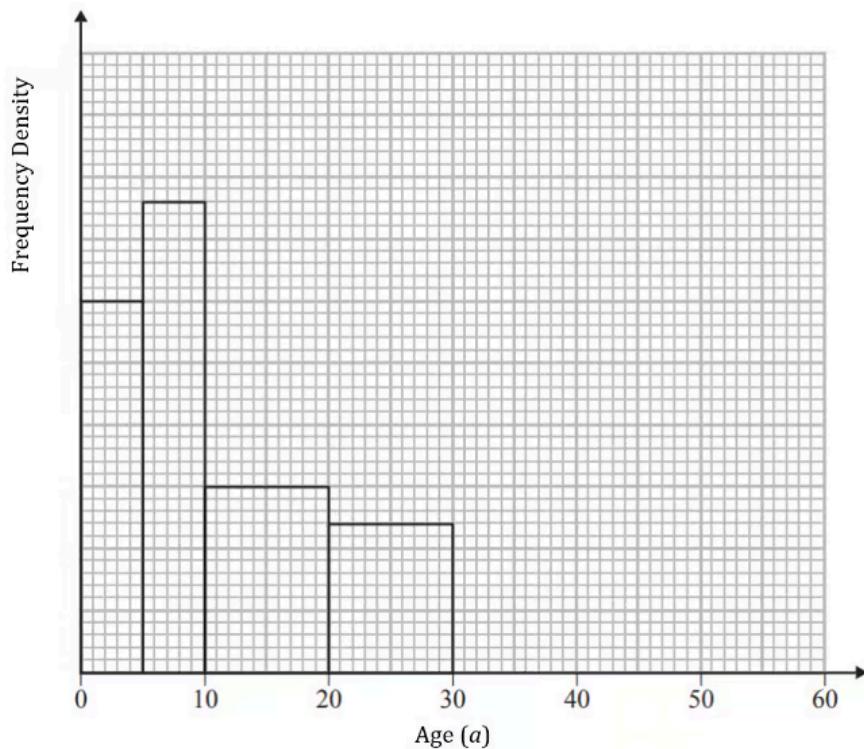
- (b)** On the grid, draw a box plot for the information given above.



(3 marks)

- 5** Filmworld cinemas collected data on the ages of visitors to their cinemas during a 24-hour period. The incomplete histogram and frequency table show some of the

information they collected:

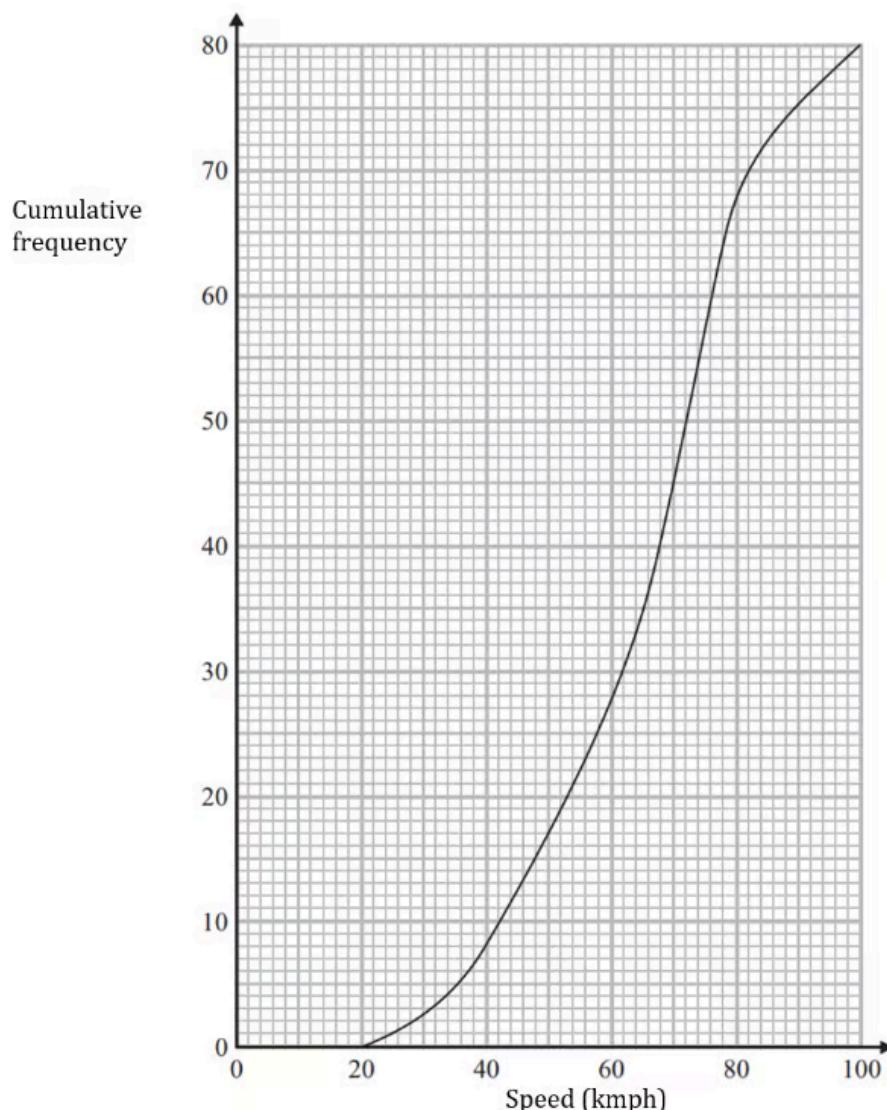


Age a (years)	Frequency f
$0 \leq a < 5$	15
$5 \leq a < 10$	
$10 \leq a < 20$	
$20 \leq a < 30$	12
$30 \leq a < 50$	18
$50 \leq a < 60$	7

Use the information to complete the histogram and fill out the missing data in the frequency table.

(4 marks)

- 6 (a) Police check the speed of vehicles travelling along a stretch of highway. The cumulative frequency curve below summarises the data for the speeds, in kmph, of 80 vehicles:



Use the graph to find an estimate for the median speed.

(2 marks)

(b) The speed limit for this section of road is 80 kmph.

Vehicles travelling above the speed limit are issued with a speeding ticket. Those travelling more than 10% over the speed limit are pulled over. Use the graph to estimate the percentage of vehicles that the police pull over.

(3 marks)

Hard Questions

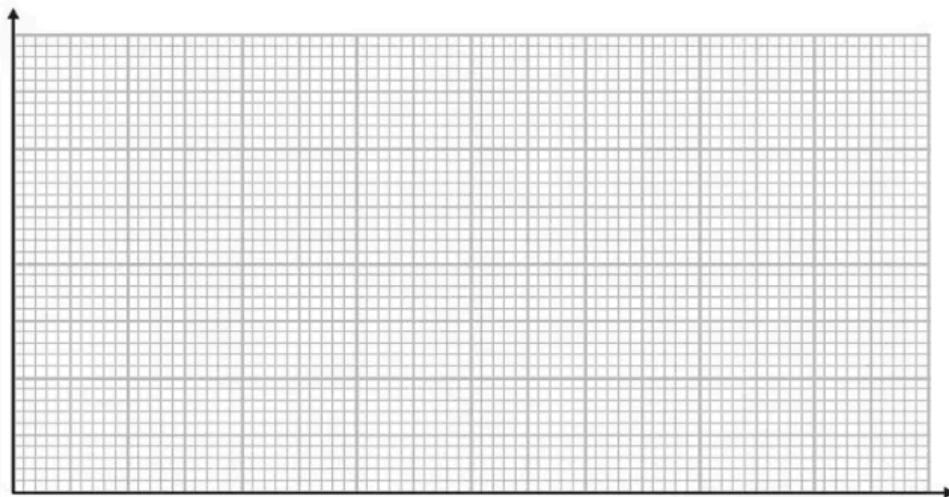
- 1 (a) The amounts of time engineers spent dealing with individual faults in a power plant were recorded to the nearest minute. Data on 30 different faults is summarised in the table below.

Time t (minutes)	Frequency f
90 - 129	6
130 - 169	8
170 - 199	12
200 - 249	4

Give a reason to support the use of a histogram to represent these data.

(1 mark)

- (b) On the grid below, draw a histogram to represent the data.

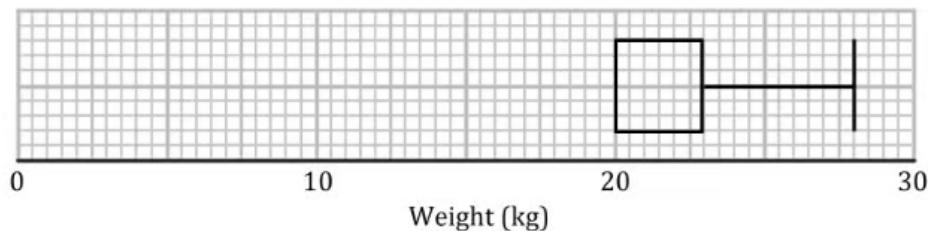


(4 marks)

- (c) Estimate the proportion of individual faults on which engineers spent longer than three hours.

(3 marks)

- 2 (a)** A teacher took 19 students on an international trip. The incomplete box plot below shows part of the summary of the weights, in kg, of the luggage brought by each student. Each student's luggage weighed a different value.



The median weight is 4 kg more than the lower quartile. The range of weights is three times the interquartile range of weights.

Use the information above to complete the box plot.

(3 marks)

- (b)** Calculate the proportion of luggage weights which were less than 20 kg.

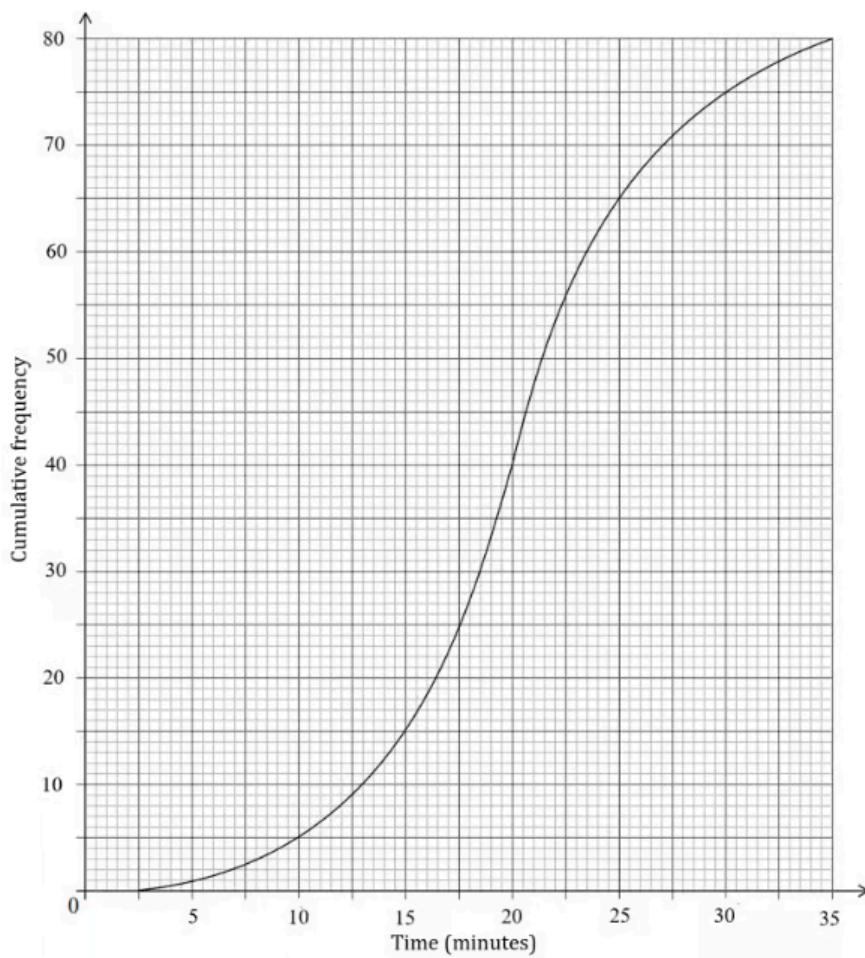
(2 marks)

- (c)** Students had to pay an additional fee if the weight of their luggage exceeded 23 kg.

Find the number of students who had to pay the additional fee.

(2 marks)

- 3 (a)** Remy is timing how long it takes each of his 80 rats to find the exit to a maze. Every two and a half minutes he records the number of rats which have found the exit which he then represents as a cumulative frequency curve.

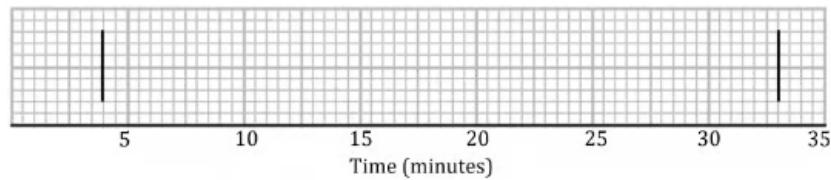


Based on the graph, write down an inequality for the time, t , taken by the fastest rat.

(2 marks)

- (b)** Remy's assistant also recorded the actual times taken by the fastest and slowest rats. She has used this information to begin constructing a box plot to represent the data.

Use the cumulative frequency curve to complete the box plot for the times.



(3 marks)

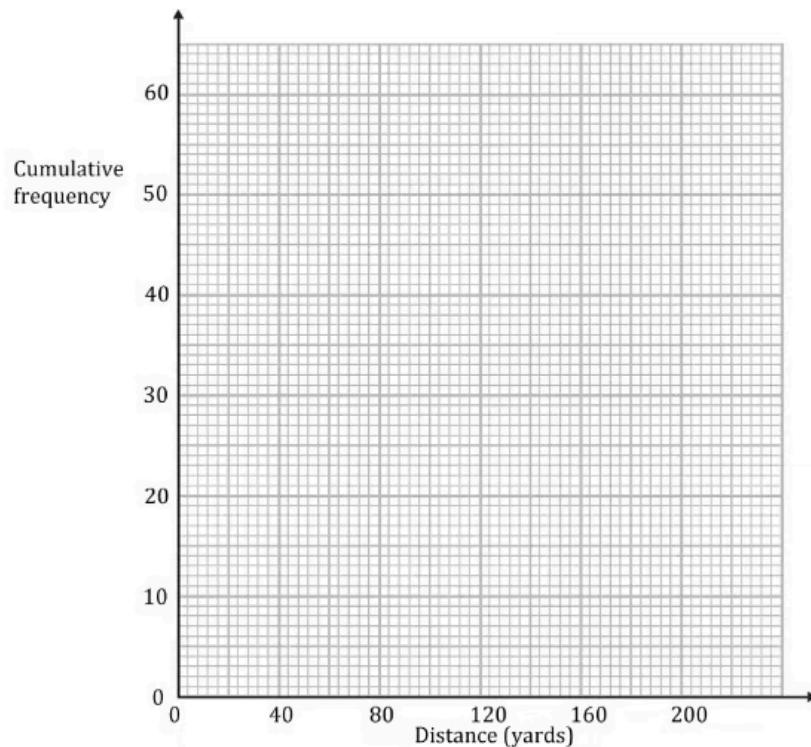
- 4 (a)** An annual cheese-rolling contest involves participants chasing a 4 kg round of cheese down a steep 200 yard long hillside. A group of 60 friends participated in the contest and the table below summarises the distances travelled by each before first falling over.

Distance d (yards)	Frequency f
$0 \leq d < 40$	23
$40 \leq d < 80$	11
$80 \leq d < 120$	9
$120 \leq d < 160$	7
$160 \leq d < 200$	6

How many of the 60 friends made it to the bottom without falling over?

(1 mark)

- (b)** Draw a cumulative frequency graph for the information in the table.

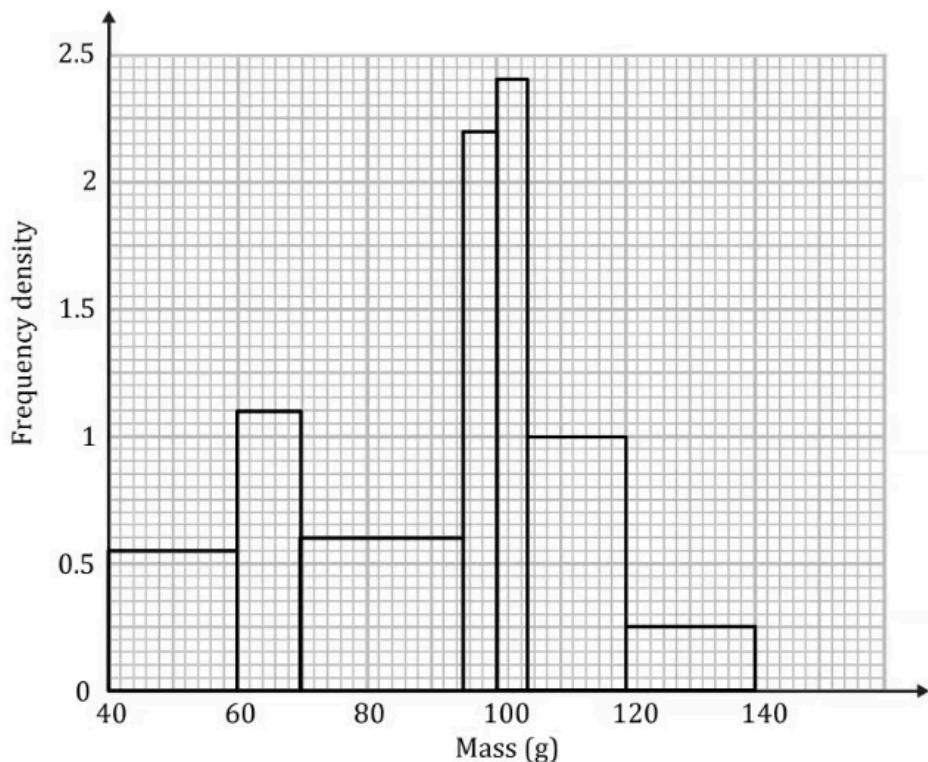


(3 marks)

- (c) The steepest part of the hill is between 100 and 140 yards away from the start. Using your graph, estimate how many people fell during this section of the hill.

(3 marks)

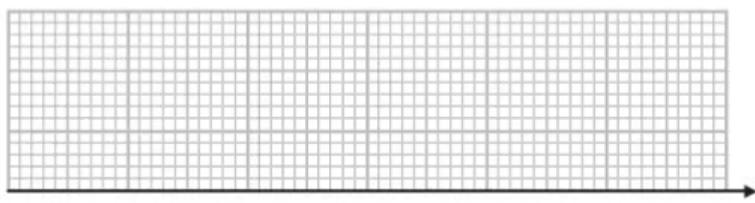
- 5 (a) The histogram below shows the masses, in grams, of 80 apples.



Find estimates for the median, lower quartile and upper quartile.

(5 marks)

- (b) Given that the lightest apple weighs 41 g and that the range of masses is 97 g, draw a box plot to show the distribution of the masses of the apples.



(2 marks)

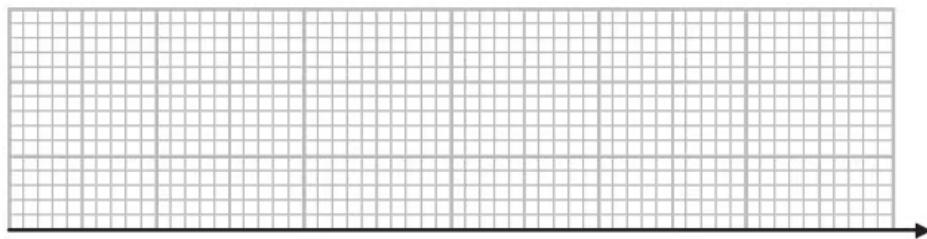
- 6 (a)** Wendy is using the large data set to learn about the daily mean windspeeds for Leeming in June 2015. She lists the data below:

4	4	4	5	5	5
5	6	6	6	6	7
7	7	7	7	8	8
8	9	9	9	10	10
10	11	11	16	17	17

Using your knowledge of the large data set, state the units for the values in the table.

(1 mark)

- (b)** On the grid below draw a box plot for the information above.



(4 marks)

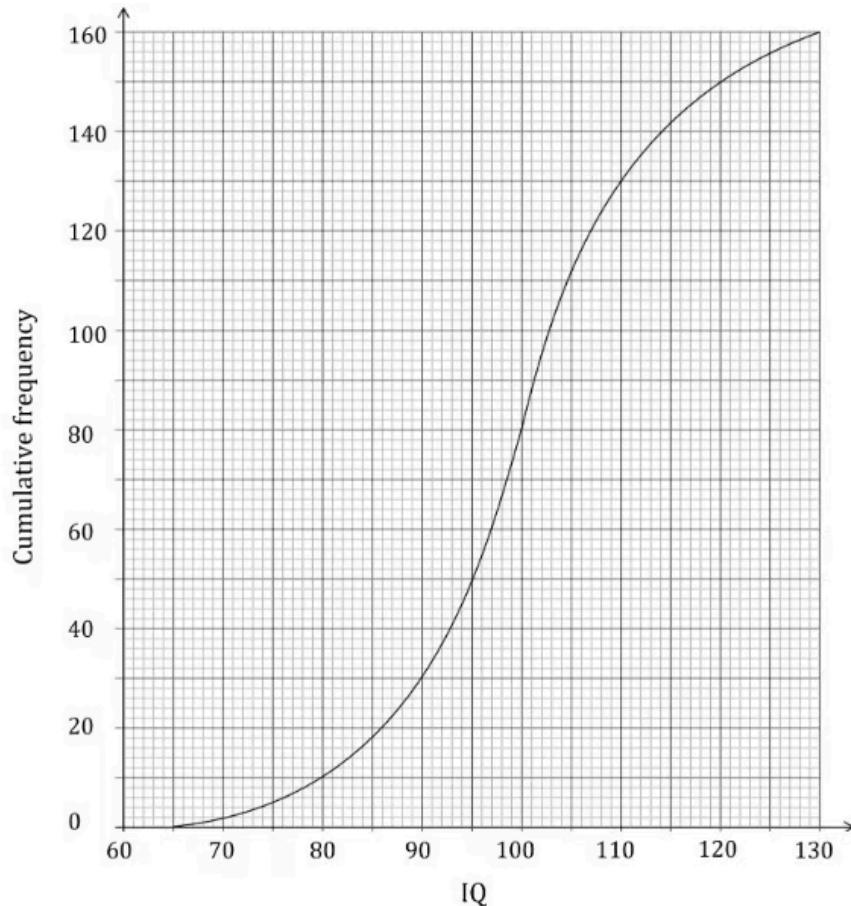
- (c)** Wendy discovers that the value 16 is incorrect. Wendy corrects the value and redraws the box plot.

Given that the box plot is unchanged, write down a range of values for the correct value x .

(2 marks)

Very Hard Questions

- 1 (a) The cumulative frequency graph below shows the IQs of 160 employees of a company.



Using the graph, estimate the number of employees whose IQ is within 5 of the median IQ.

(4 marks)

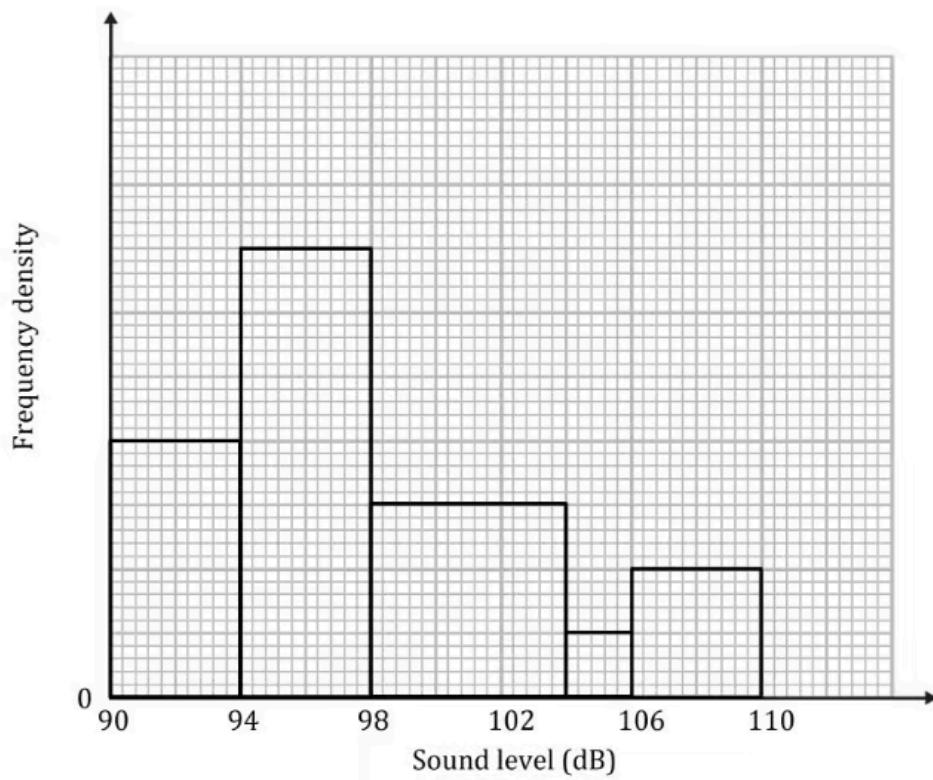
- (b) The employees who are within the top 10% of IQs are offered training for a management role. Estimate the lowest IQ of an employee who is offered the training.

(2 marks)

- (c) The employees who are within the bottom 5% of IQs must attend a meeting with the director of the company. Estimate the highest IQ of an employee who must attend a meeting with the director.

(2 marks)

- 2 (a) There are 180 dogs in a rescue shelter. The histogram below shows the highest sound level reached by each individual dog's bark, measured in decibels (dB).



Write down the underlying feature associated with each of the bars in a histogram.

(1 mark)

- (b) Estimate how many dogs had a bark which ranged between 99 dB and 107 dB.

(5 marks)

- 3 (a)** Mr Shapesphere, a history teacher, records the time, to the nearest minute, it takes him to mark each student's essay. The times were summarised in a grouped frequency table and an extract is shown below:

Time t (minutes)	Frequency f
0 - 10	7
11 – 30	16
31 – 35	4

A histogram was drawn to represent these data. The 11 – 30 group was represented by a bar of width 6 cm and height 4.5 cm.

Find the width and height of the 0 – 10 group.

(3 marks)

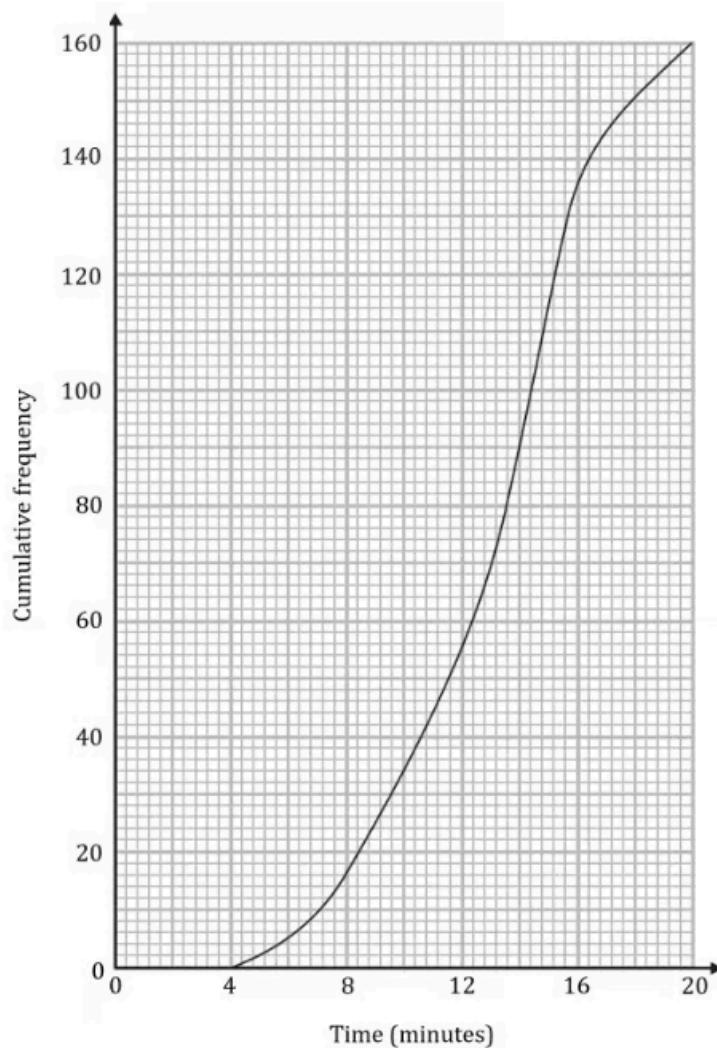
- (b)** The total area under the histogram was 60.75 cm^2 .

Find the number of essays which Mr Shapesphere recorded as taking longer than 35 minutes, to the nearest minute.

(3 marks)

- 4 (a) The grouped frequency table below contains information about the lengths of time of Susie's calls with her customers. The table was used to draw the cumulative frequency curve also shown below.

Time (t minutes)	$4 < t \leq 8$	$8 < t \leq 12$	$12 < t \leq 16$	$16 < t \leq 20$
Frequency	16	a	b	c



Use the graph to find the values of a , b and c .

(3 marks)

(b) Use the graph to calculate the interquartile range of times for Susie's calls.

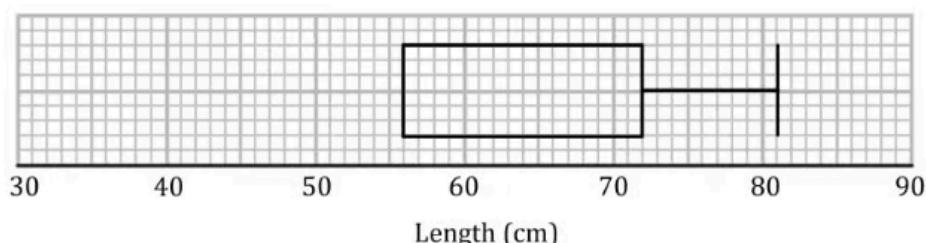
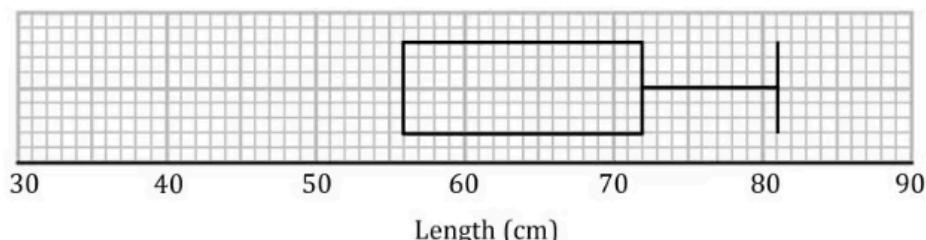
(3 marks)

(c) Use the graph to estimate the percentage of customers whose calls lasted longer than 10 minutes.

(2 marks)

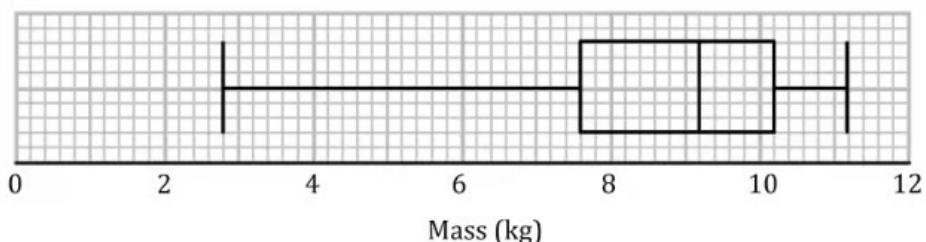
- 5 (a) Crystal is given an incomplete box plot showing the lengths of 99 unicorn horns. She also knows that the median length is the midpoint of the minimum and maximum lengths and that the range is 2.5 times as big as the interquartile range.

Complete the diagrams below to show that there are two possible distributions given the information above.



(5 marks)

- (b) The box plot below shows the masses of the 99 unicorn horns.



Crystal discovers that two masses were recorded incorrectly; 11 kg should have been 8 kg and 9 kg should have been 10 kg.

Explain why at most one value will need to be changed to fix the box plot.

(3 marks)

- (c)** Explain why it is possible that the box plot will remain unchanged when it is fixed.

(2 marks)

- 6 (a)** The table below shows the information for the daily maximum relative humidity, rounded to the nearest per cent, for Leuchars between June and August 2015.

Daily maximum relative humidity (x %)	Frequency f
80 - 89	7
90 - 95	21
96 - 98	21
99 - 100	43

Using your knowledge of the large data set, explain why roughly 70% of these days contained fog and/or mist.

(2 marks)

- (b)** The data from the table are to be presented on a statistical diagram.

For a histogram, the frequency density for the 96 – 98 class is 7. Find the frequency density for the 80 – 89 class.

(2 marks)

- (c)** For a cumulative frequency graph, state the coordinates of all the points that should be plotted.

(2 marks)

- (d)** Explain why an exact box plot cannot be drawn using only the information from the table.

(1 mark)