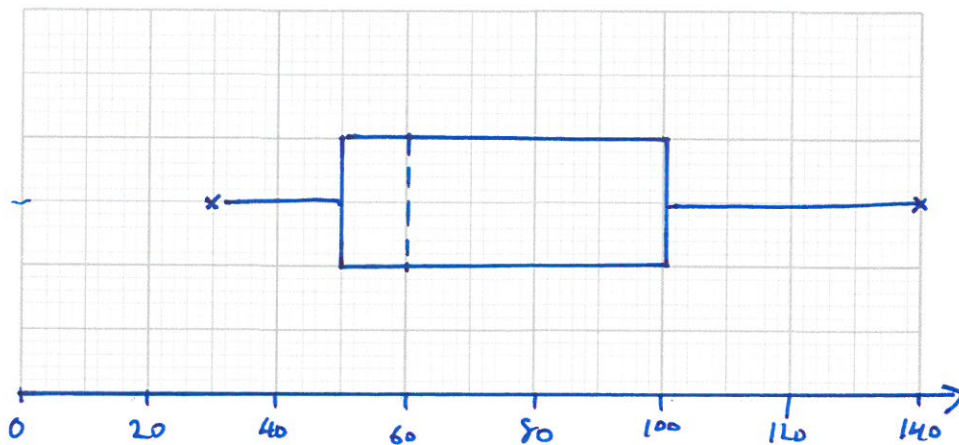


Box & Whisker PPQs

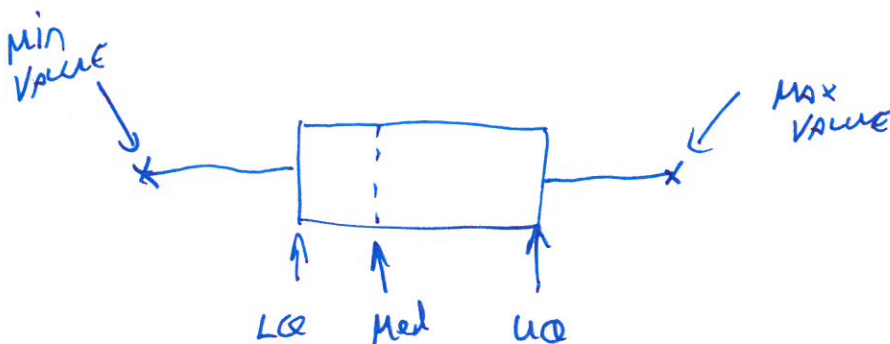
1. Iona needs to give a presentation to her work team. Her boss has asked her to include a box-and-whisker plot in her presentation. Iona works in a sales team, selling new telephone systems to large companies. She had been given some sales data by her boss, as shown below.

Cheapest system sold	£30
Most expensive system sold	£140
Median price of systems sold	£60
Lower quartile price of a system	£50
Upper quartile price of a system	£100

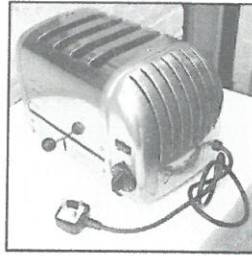
On the graph paper below, draw a box-and-whisker plot using the data that Iona has been given.



[4]



2.



The table gives the grouped frequency distribution for the lengths of the electrical cords of 80 toasters.

Length, to the nearest cm	49-53	54-58	59-63	64-68
Number of toasters	6	38	32	4

(a) Complete the following cumulative frequency table.

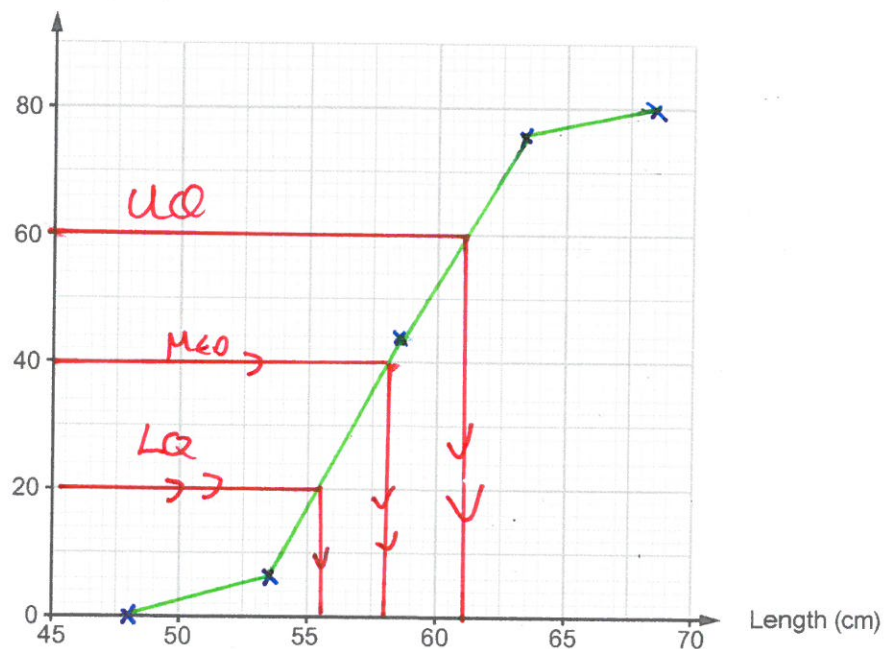
[1]

Length (cm)	<48.5	<53.5	<58.5	<63.5	<68.5
Cumulative frequency	0	6	44	76	80

(b) On the graph paper below, draw a cumulative frequency diagram to show this information.

[2]

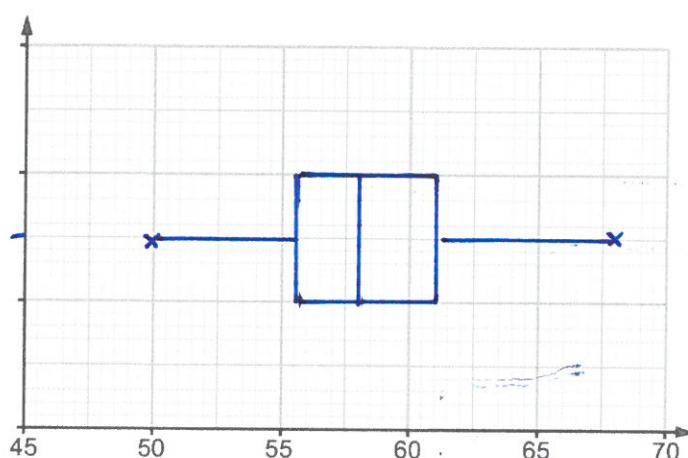
Cumulative frequency



- (c) Use your cumulative frequency diagram to find an estimate for the median, the lower quartile, the upper quartile and the interquartile range of the lengths of the electrical cords in centimetres. [4]

Median	58
Lower quartile	55.5
Upper quartile	61
Interquartile range	5.5

- (d) The length of the shortest electrical cord is 50 cm.
The length of the longest electrical cord is 68 cm.
Draw a box and whisker diagram to illustrate the lengths of the electrical cords. [3]



3.

The table gives a grouped frequency distribution of the arm lengths of 100 women each measured correct to the nearest centimetre.

Arm length, a cm	156 to 158	159 to 161	162 to 164	165 to 167	168 to 170
Number of women	5	15	35	40	5

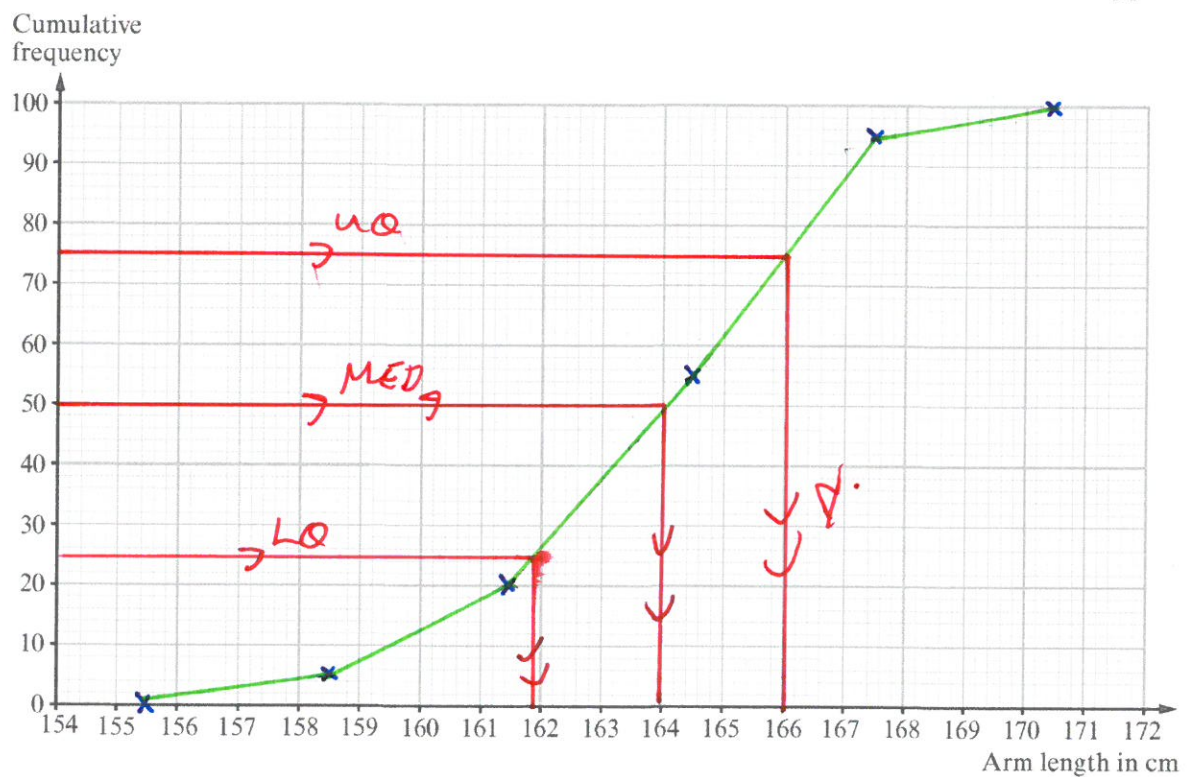
(a) Complete the following cumulative frequency table.

Arm length, a cm	$a < 155.5$	$a < 158.5$	$a < 161.5$	$a < 164.5$	$a < 167.5$	$a < 170.5$
Cumulative frequency	0	5	20	55	95	100

[1]

(b) On the graph paper below, draw a cumulative frequency diagram to show this information.

[2]



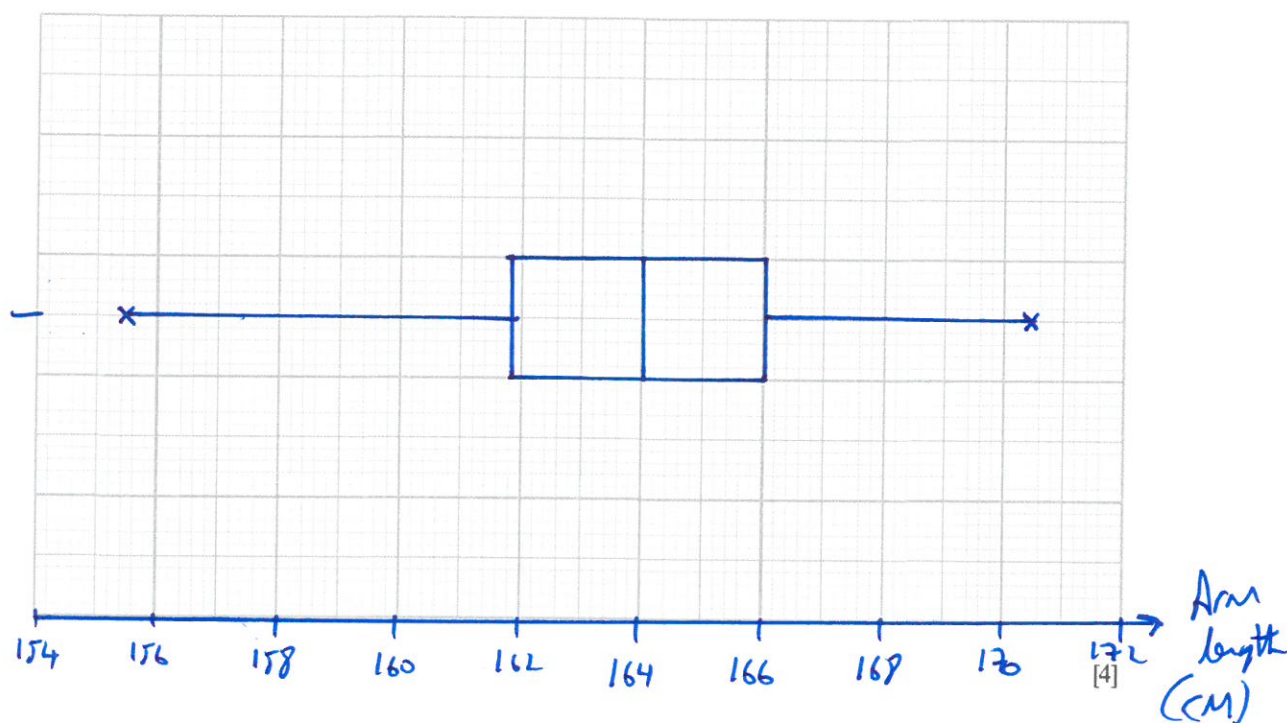
- (c) Use your cumulative frequency diagram to estimate the median and the interquartile range.

$$LQ = 161.8 \quad UQ = 166$$

Median 164 Interquartile range 4.2

[3]

- (d) Use the graph paper below to draw a box-and-whisker diagram to show these results.



4.

A company is considering changes to its price list for delivering parcels in a local area. The company is considering a charge based on the distance between the warehouse and the destination of the parcel. The table gives the grouped frequency distribution for the distances, measured to the nearest km, for 60 parcels.

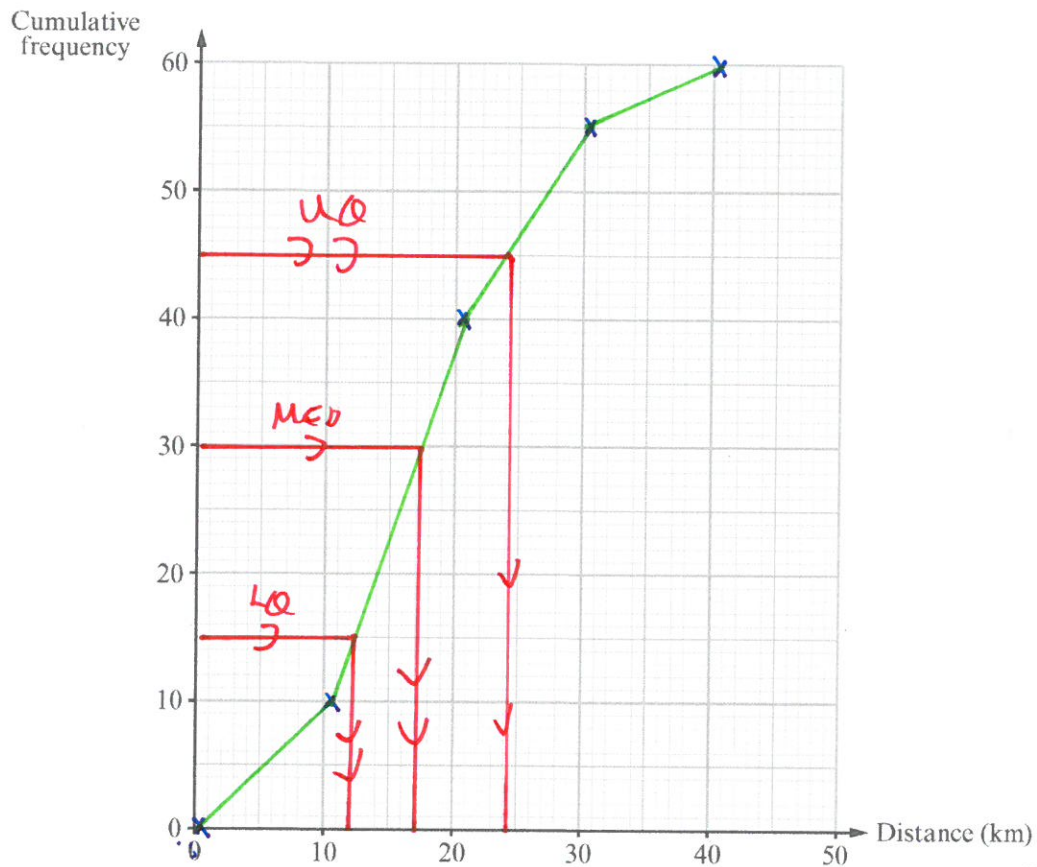
Distance, to the nearest km	1 - 10	11 - 20	21 - 30	31 - 40
Number of parcels	10	30	15	5

(a) Complete the following cumulative frequency table.

Distance (km)	<0.5	<10.5	<20.5	<30.5	<40.5
Cumulative frequency	0	10	40	55	60

[1]

(b) On the graph paper below, draw a cumulative frequency diagram to show this information.



[2]

- (c) Use your cumulative frequency diagram to find an estimate for the median and the interquartile range of the delivery distances.
You **must** show your working.

$$LQ = 12$$

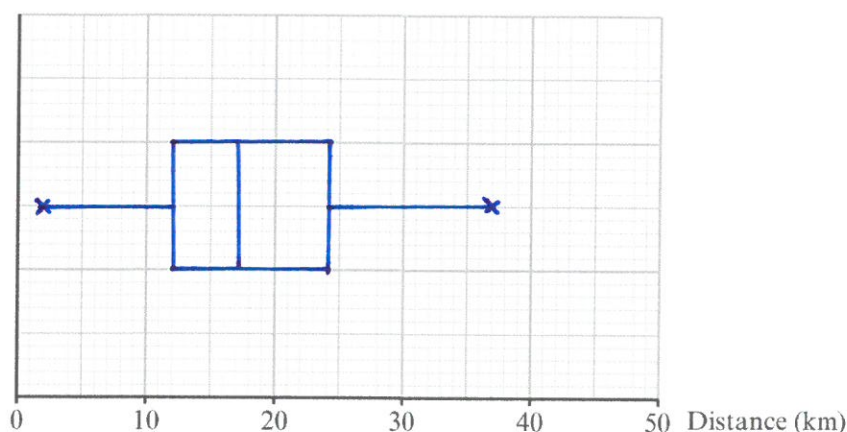
$$UQ = 24$$

Median 17 Interquartile range 12

[3]

- (d) For these 60 parcels, the shortest delivery distance is 2km and the longest delivery distance is 37km.

Draw a box and whisker diagram to illustrate this information.



[4]

- (e) Previously, the delivery charge was £2 for each parcel.

The new pricing plan being considered is:

- free delivery for all parcels up to the median delivery distance;
- £4 per parcel for all other deliveries.

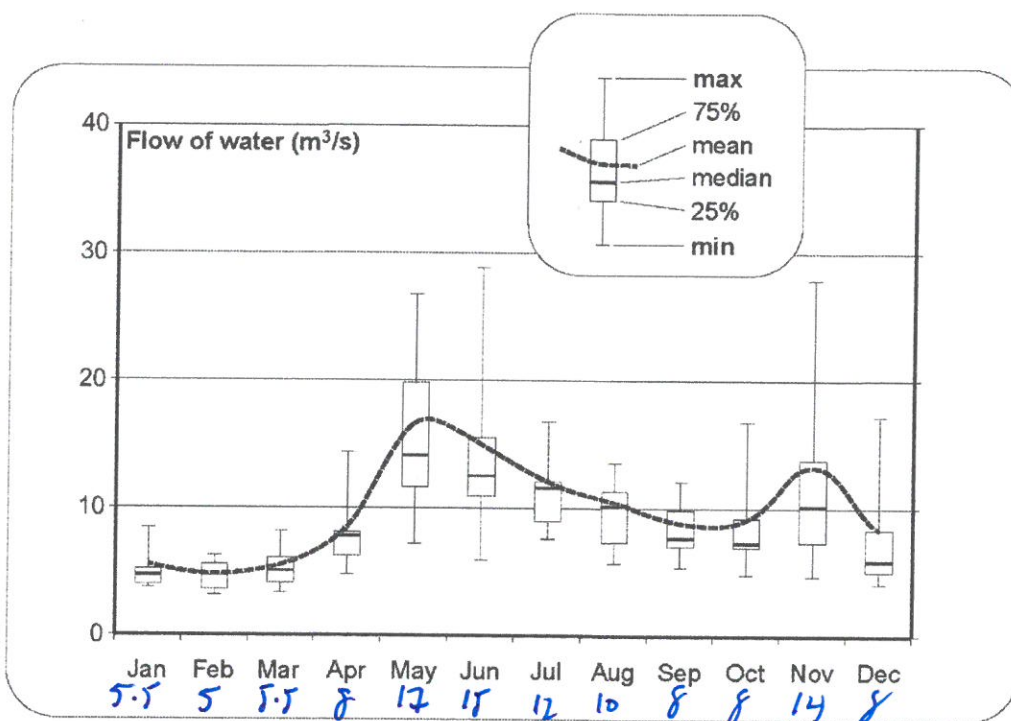
Would you expect the company to profit from the new pricing for parcel delivery?
Explain your answer.

previously parcel delivery charge totalled = $60 \times 2 = £120$
 above median = $30 \text{ parcels} \times £4 = £120$
 below median = $30 \times £0 = £0$
 So no difference to company

[3]

5.

The information board shown below was seen by a river in the Italian mountains.



The information board gives monthly data about the volume of water flowing past a cross-section of the river every second.

- (a) Write down the month with the greatest mean flow of water.
Estimate this greatest mean flow of water, giving the units of your answer.

[3]

Month MAY
Greatest mean flow 17 m^3/s

- (b) Which month had the smallest range of water flow?
Estimate this range.
Your **must** show all your working.

[2]

MAX 7
min 4

Month Feb
Range 3 m³/s

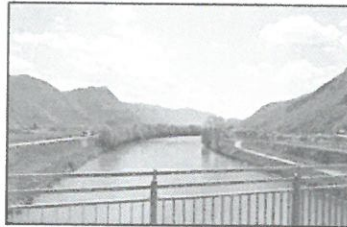
- (c) Which month had the greatest interquartile range of water flow?
Estimate this interquartile range.
You **must** show all your working.

[3]

UQ 19.5
LQ 12

Month May
Interquartile range 7.5

- (d) The local newspaper publishes a picture of the river with a caption.



The mean flow of the river for the year was

Complete this caption.
You **must** show all your working.

[3]

$$5.5 + 5 + 5.5 + 8 + 17 + 15 + 12 + 10 + 8 + 8 + 14 + 8 = 116$$

$$116 \div 12 = 9.6 \text{ m}^3/\text{s}$$

Marking Scheme

1.	6.A uniform scale used (shown) at least 30 to 140 with idea of box-and-whisker plot AND with label '£' Range of whiskers correct Lower and upper quartiles used as ends of the box Median shown correctly within the box	B1	Award B4 for a correct response
		B1	
		B1	
		B1	
		4	

2.

10(a) 44, 76, 80

(b) Correct cumulative frequency diagram, points plotted at upper bounds and joined by a curve or straight line

(c)

Median	≈ 58 reading from graph
Low quartile	≈ 55.5 reading from graph
Upper quartile	≈ 61 reading from graph
Interquartile range	≈ 5.5

(d) Range ends correctly indicated
(50(cm) and 68(cm))
Median line correctly indicated (approx. 58)
UQ and LQ correctly indicated (approx. 61 & 55.5)

B1

B2

Accuracy: nearer the intersection of correct lines than any others
FT only if cumulative in (a)
B1 for points correct but not joined, OR
B1 correct apart from 0.5 translation, OR
B1 if one error in plotting but joined correctly

FT from their **cumulative** entries. Not cumulative means no FT. Accuracy of readings ±0.5

B1

B1

B1

B1

FT their UQ – their LQ correctly evaluated.
Independent FT

In (d) FT consistent previous misread of scale
Whiskers should be shown

B1

B1

B1

B1

10

3.	6.(a) Entries 20 55 95 100 (b) Correct cumulative frequency diagram, points plotted and joined with a curve or straight lines (c) Median (approximately 164) Intention to subtract horiz. reading for vertical 75 & 25 Interquartile range (approximately 4) (d) Horizontal scale correctly indicated Range correct as whiskers, from 155.5 to 170.5 LQ, median, UQ to form box	B1	FT from <u>cumulative</u> (a). B1 points plotted but not joined, correct diagram with 1 point incorrectly plotted, or correct apart from be a 0.5 horizontal translation From their <u>cumulative</u> diagram only (Approximately 166 – 162) FT from (c) if possible, if LQ and UQ given Do not penalise break in scale not indicated Accept 156 to 170 FT their answers. B1 if one error
		B2	
		B1	
		M1	
		A1	
		B1	
		B1	
		B2	
		10	

4.	10(a) 40, 55, 60 (b) Correct cumulative frequency diagram, points plotted at bounds and joined by a curve or straight line (c) Median 17 (±0.5) Intention to subtract readings from horizontal axis for vertical 45 & 15 Interquartile range (12±1) (d) General idea of what box – whisker should be Range ends 37 and 2 correctly indicated Median line correctly indicated UQ and LQ correctly indicated (e) Strategy: use of median as same number above and below Interpretation: half free + half at £4 Conclusion based on appropriate working that no difference expected, i.e. compares with all at £2	B1	FT from cumulative (i) . Allow initial plot at the origin. B1 for points correct but not joined, OR B1 correct apart from 0.5 translation, OR B1 if one error in plotting but joined correctly FT from their cumulative diagram. Not cumulative no FT FT from their cumulative diagram. <i>Watch for an answer of 12 from LQ rather than interquartile range, must be IQR is (24-12 =) 12 if working shown</i> FT their median FT their UQ and LQ readings
		B2	
		B1	
		M1	
		A1	
		S1	
		B1	
		B1	
		B1	
		S1	
		M1	
		A1	
		13	

5.

Applications Unit 1 Summer 2015	Mark	Comment
7(a) May Answer in the range 16 to 18 m^3/s	B1 B1 U1	
(b) February A value between 2 and 4 (m^3/s) inclusive	B1 B1	Do not accept from incorrect working, but allow a correct unsupported answer No FT from incorrect month
(c) May Correct method of calculating the interquartile range, '19.5 to 20' - '11 to 12' (m^3/s) Answers in the range 7.5 to 9 (m^3/s) from correct working where UQ - LQ values are '19.5 to 20' - '11 to 12' (m^3/s)	B1 M1 A1	No FT from incorrect month Do not accept from incorrect working, but allow a correct unsupported answer
(d) Intention to sum 12 mean readings e.g. $5.5+4.5+5.5+8.5+17+15+12+11+9+9.5+13.5+8.5$ (=119.5) $\div 12$ Answer in the range 8.8 (m^3/s) or 10.5 (m^3/s)	M1 m1 A1 11	The majority of readings should be >10 or <10 as appropriate and the majority of individual readings should not differ by more than ± 1.5 Rounded or truncated. Must be from working. No working, no marks for answer only, an example of minimal acceptable working $118/12 = 9.8$ (m^3/s) <i>If no marks allow SC1 for attempt to sum at least 9 of the values with $\div 12$ shown</i>