# 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.

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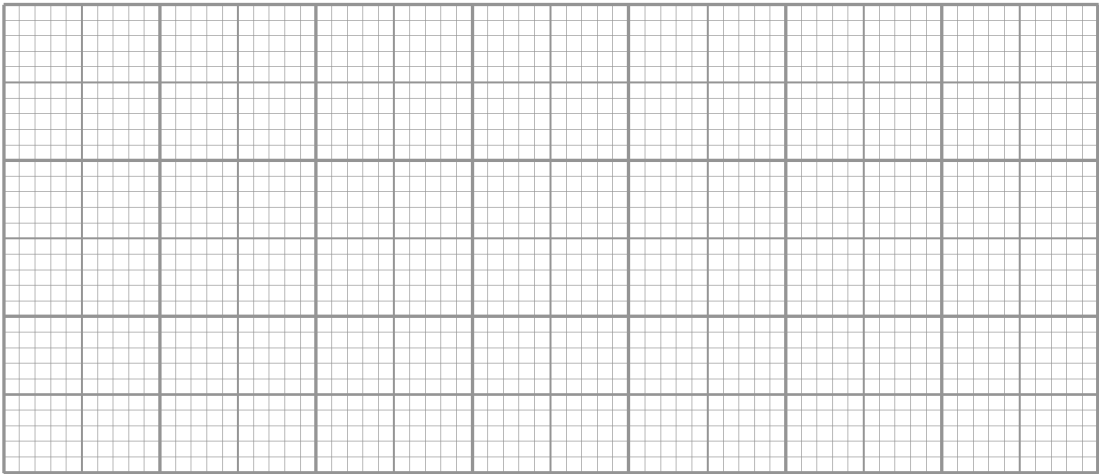
[4]

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			

(b) On the graph paper below, draw a cumulative frequency diagram to show this information.
[2]

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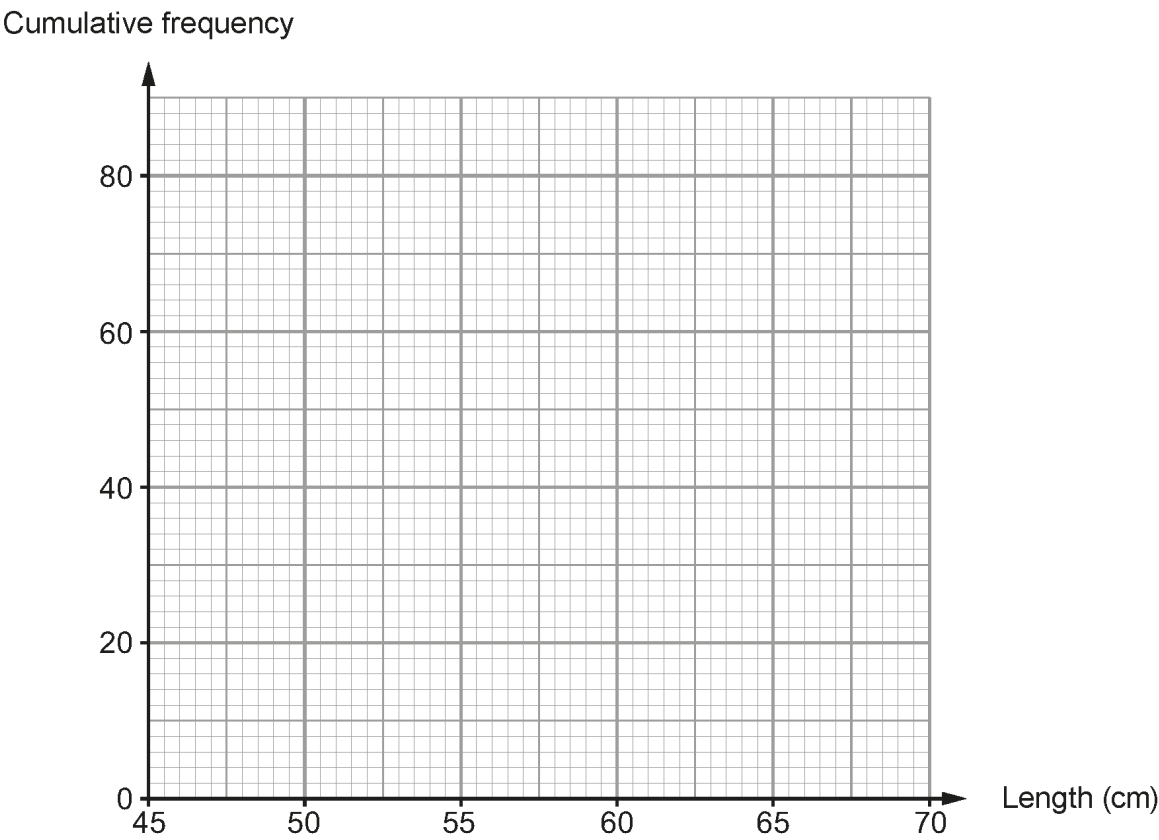
(c) Use your cumulative frequency diagram to find an estimate for the median, the lower quartile, the upper quartile and the interquartile range of the lengths of the electrical cords in centimetres. [4]

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Median	
Lower quartile	
Upper quartile	
Interquartile range	

(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]
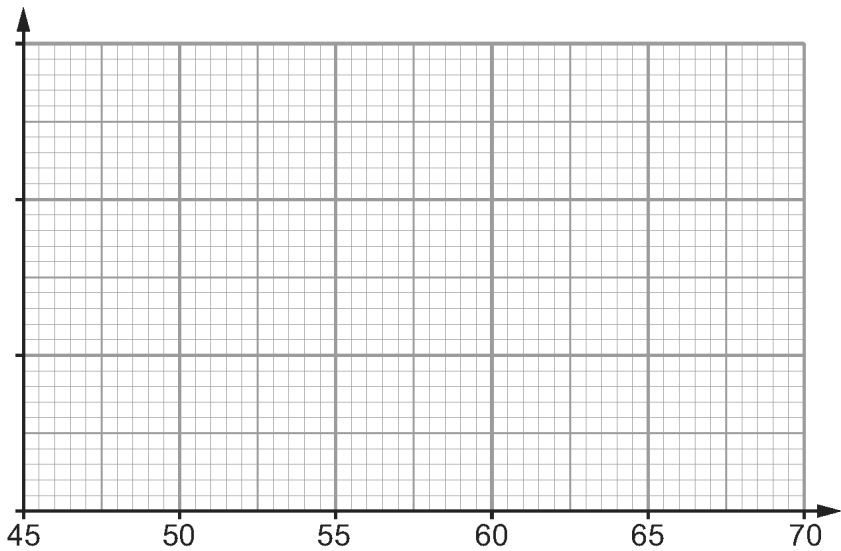
3.

The table gives a grouped frequency distribution of the arm lengths of 100 women each measured correct to the nearest centimetre.
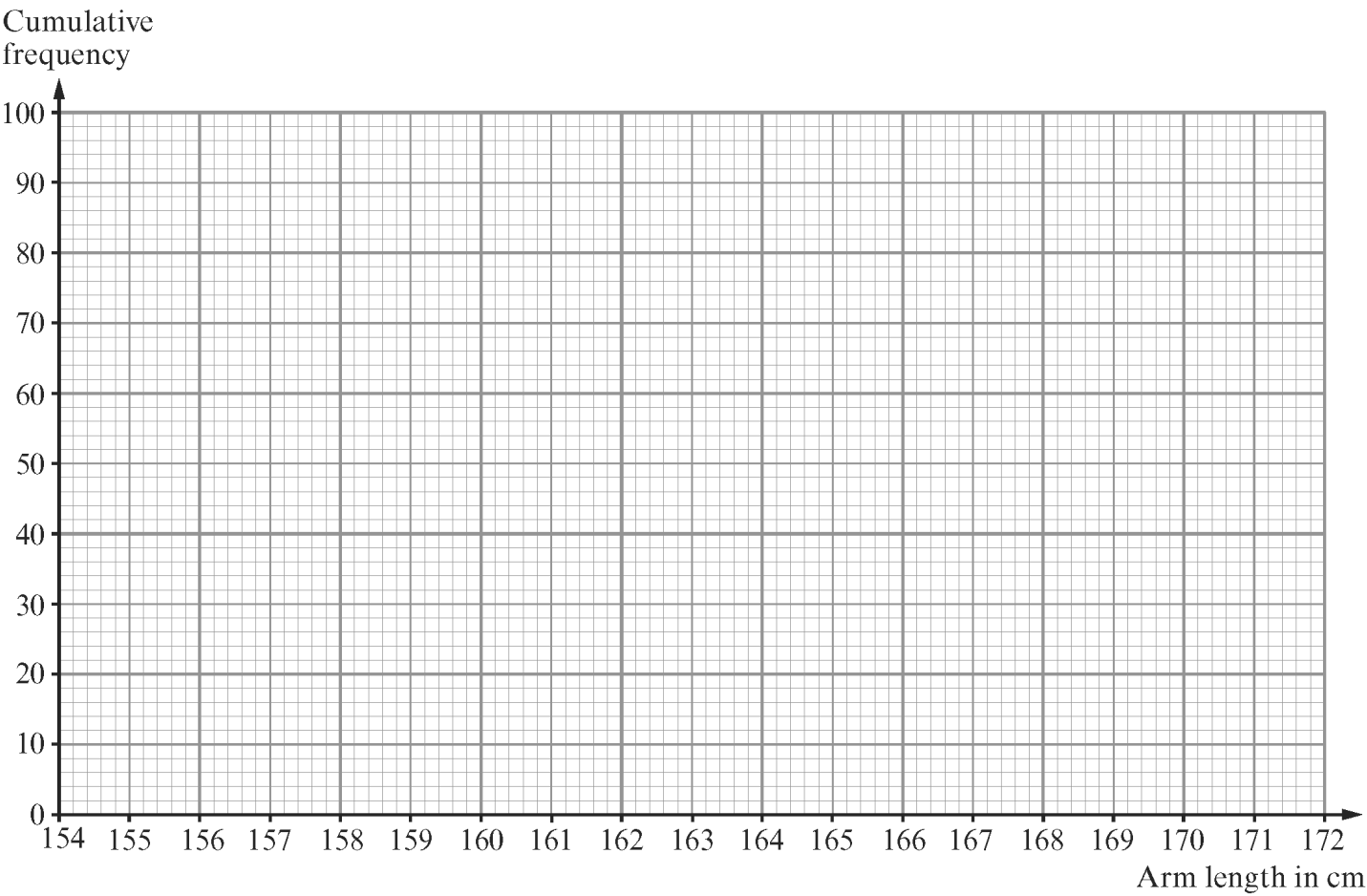
Arm length, a cm	156 to 158	159 to 161	162 to 164	165 to 167	168 to 170
Number of women	5	15	35	40	5

(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				

[1]

(b) On the graph paper below, draw a cumulative frequency diagram to show this information.
[2]

Cumulative frequency

Arm length in cm

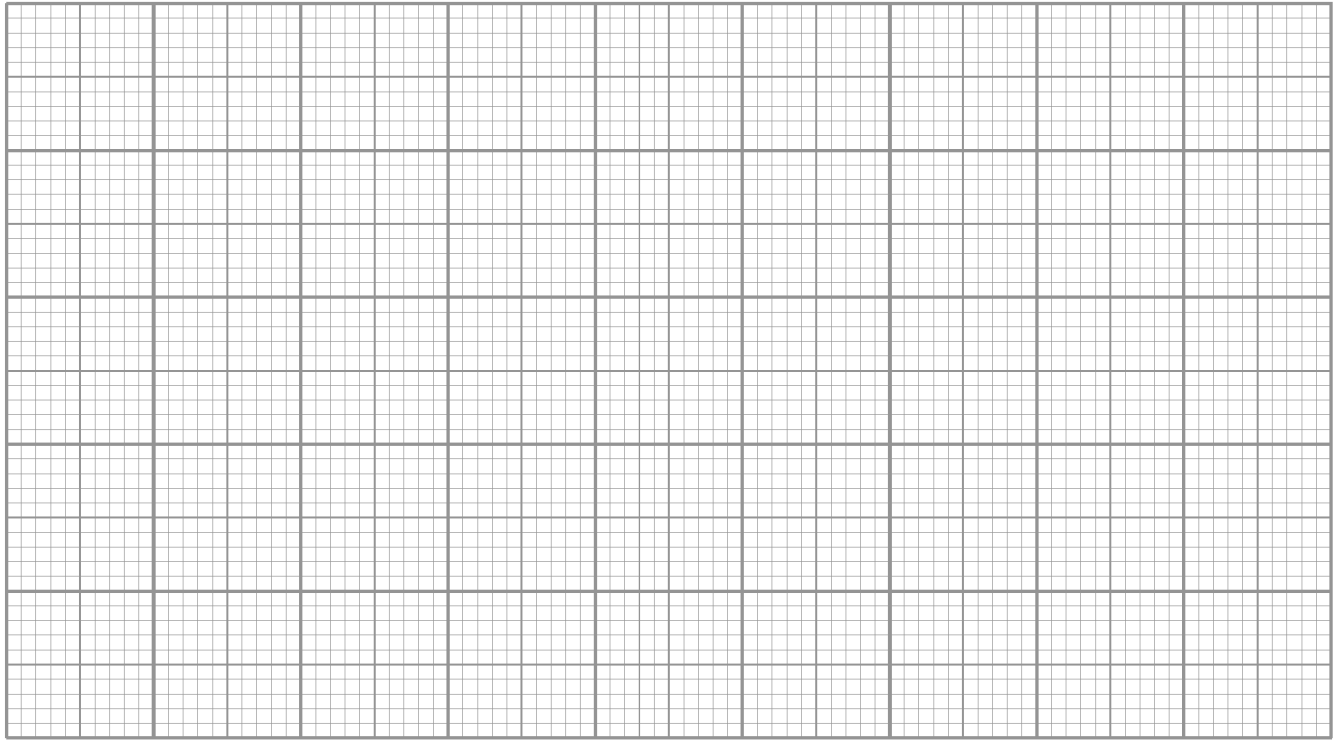*(c)*   Use your cumulative frequency diagram to estimate the median and the interquartile range.

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....

Median ....   Interquartile range ....

[3]

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

[4]

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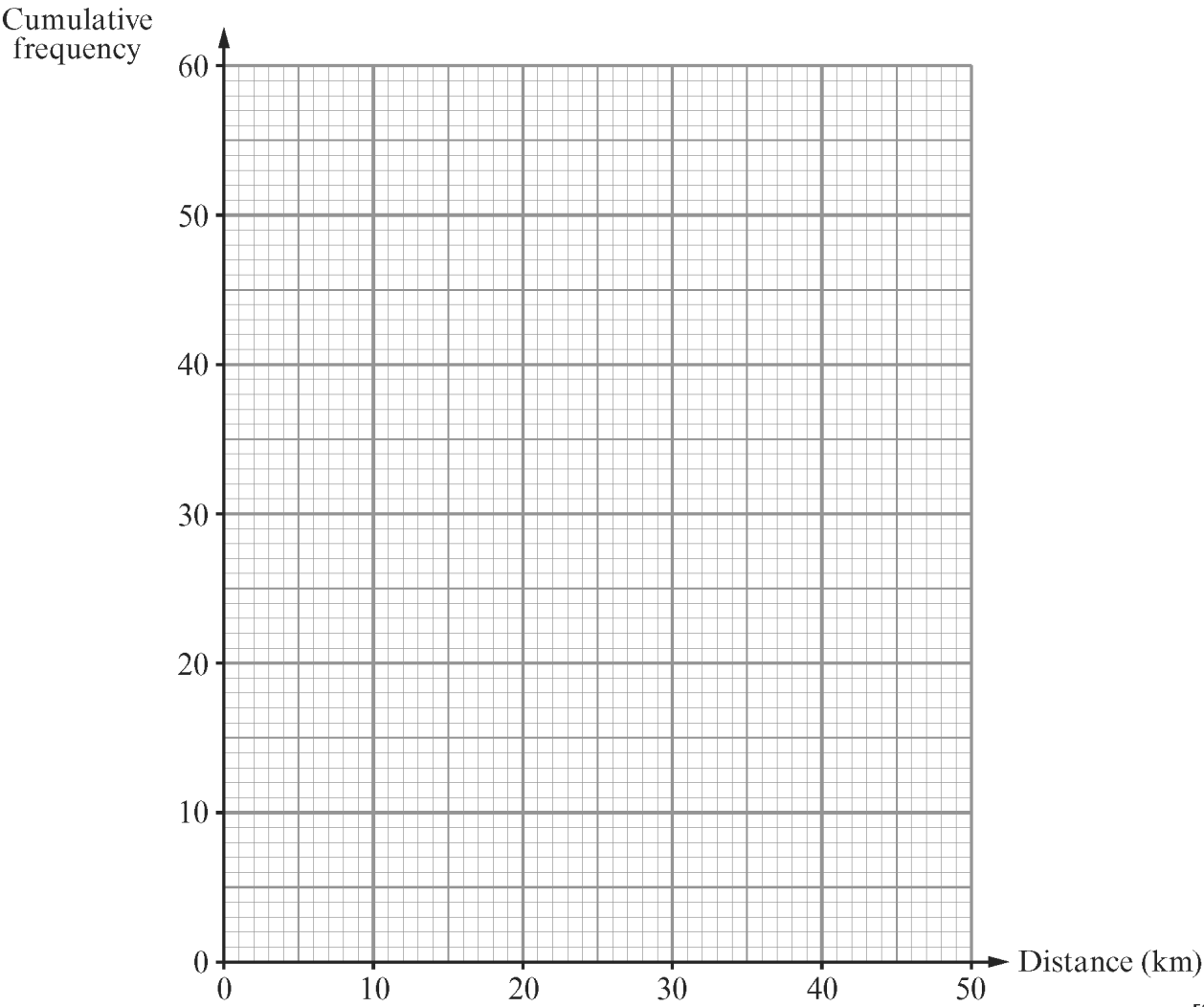
Distance, to the nearest km	1 - 10	11 - 20	21 - 30	31 - 40
Number of parcels	10	30	15	5

(a) Complete the following cumulative frequency table.

Distance (km)	$<0\cdot5$	$<10\cdot5$	$<20\cdot5$	$<30\cdot5$	$<40\cdot5$
Cumulative frequency	0	10			

[1]

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

Cumulative frequency

[2]

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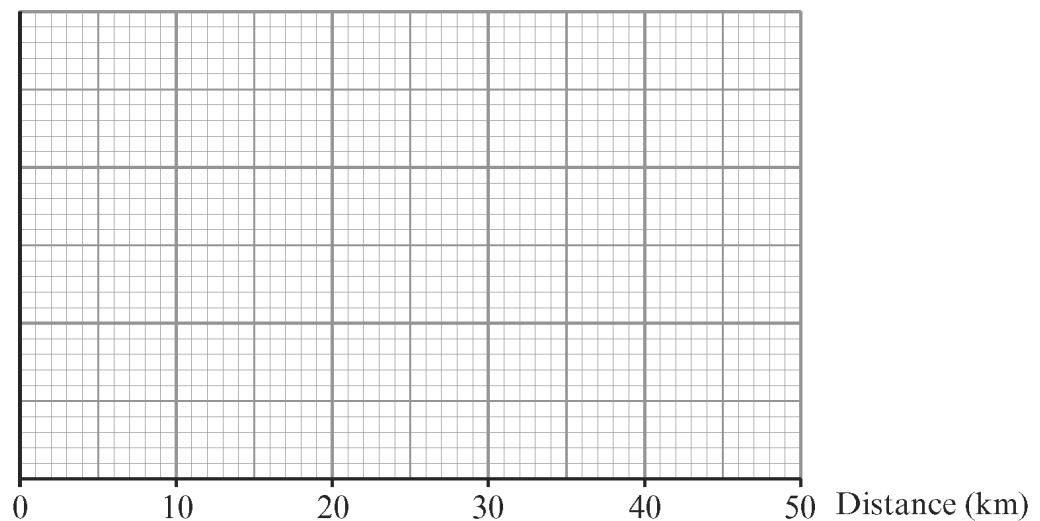You **must** show your working.

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Median .... Interquartile range ....

[3]

(d) For these 60 parcels, the shortest delivery distance is 2 km and the longest delivery distance is 37 km.
Draw a box and whisker diagram to illustrate this information.

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0          10          20          30          40          50   Distance (km)
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[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?
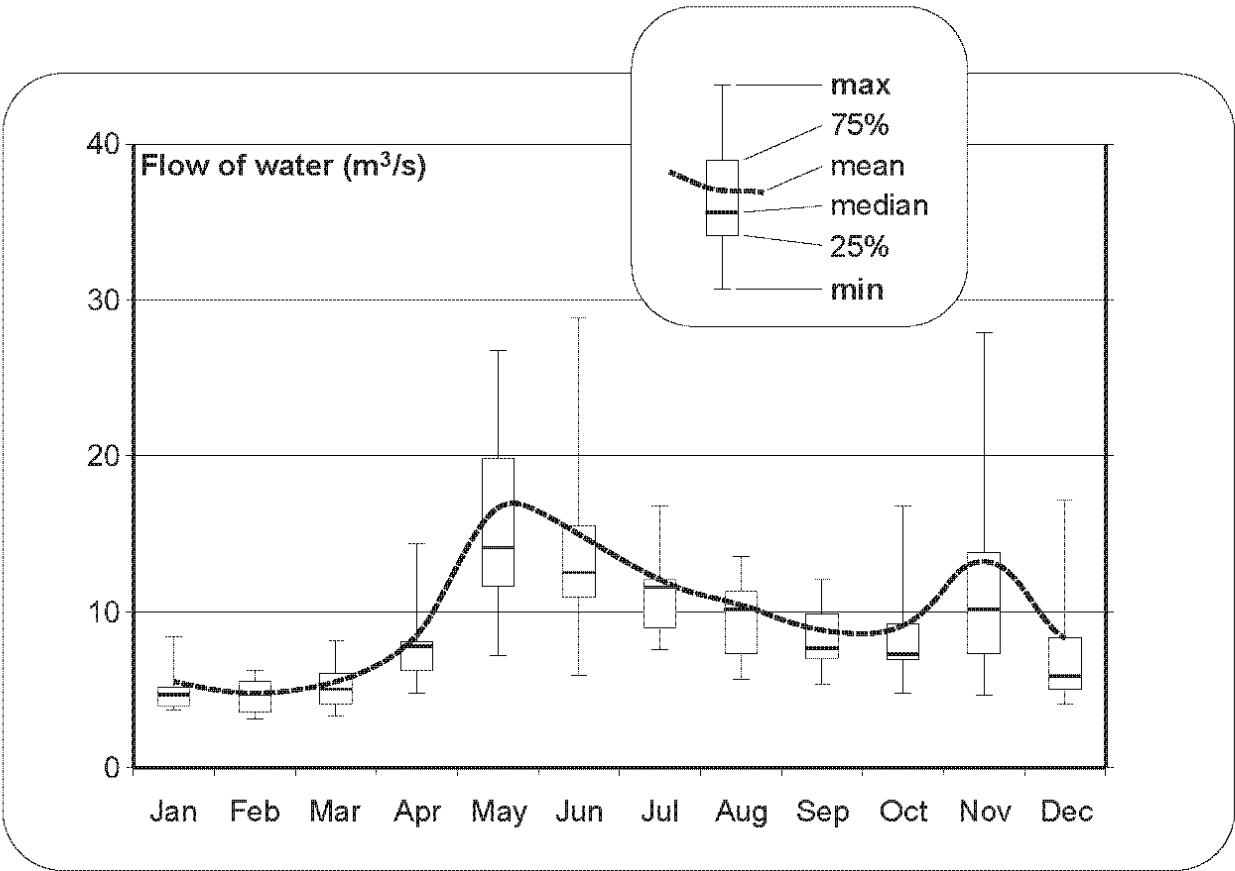Explain your answer.

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....

[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 ....

Greatest mean flow ....

(b) Which month had the smallest range of water flow?
Estimate this range.
Your **must** show all your working.   [2]

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....

Month ....

Range ....

(c) Which month had the greatest interquartile range of water flow?
Estimate this interquartile range.
You **must** show all your working.   [3]

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....

....

Month ....

Interquartile range ....

(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]

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....

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11

Marking Scheme

1.

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

2.

10(a) 44, 76, 80	B1	
(b) Correct cumulative frequency diagram, points plotted at upper bounds and joined by a curve or straight line	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
(c)		FT from their **cumulative** entries. Not cumulative means no FT. Accuracy of readings ±0.5
Median ≈ 58 reading from graph	B1	
Low quartile ≈ 55.5 reading from graph	B1	
Upper quartile ≈ 61 reading from graph	B1	
Interquartile range ≈ 5.5	B1	FT their UQ – their LQ correctly evaluated. Independent FT
		In (d) FT consistent previous misread of scale Whiskers should be shown
(d) Range ends correctly indicated (50(cm) and 68(cm))	B1	
Median line correctly indicated (approx. 58)	B1	If incorrect then FT their median
UQ and LQ correctly indicated (approx. 61 & 55.5)	B1	If incorrect then FT their UQ and LQ readings
	10	

3.

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

4.

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

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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)	M1	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
÷12 Answer in the range 8.8 (m^3/s) or 10.5 (m^3/s)	ml A1	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) *If no marks allow SC1 for attempt to sum at least 9 of the values with ÷12 shown*
	11	