Median and Quartiles from Cumulative Frequency Curves

Notes

When estimating the medians and quartiles from a cumulative frequency curve, we need to draw horizontal and vertical lines on the graphs.

The median for a set of data values is given by the $\frac{1}{2}(n+1)$th value.

Given that we are finding an estimate, we can dispense with the $+1$ part of the formula.

Therefore, horizontal lines are drawn at the following points:

$$\text{Median, } Q_2 = \frac{1}{2}n \text{ th value}$$

$$\text{Lower quartile, } Q_1 = \frac{1}{4}n \text{ th value}$$

$$\text{Upper quartile, } Q_3 = \frac{3}{4}n \text{ th value}$$

When the horizontal line hits the curve, it becomes a vertical line and goes down to the $x-$axis.

N.B. "Across and down"
It is a good idea to draw dotted lines, rather than solid lines, and label each dotted line.
The values you obtain from your graph may be slightly different to the answers given in the book but as long as they are less than $\pm 5\,\%$ your answers will probably be considered correct,

Autograph — allow user-defined, and adjust lines by dragging along the axes.
The example below refer to the graphs drawn in the previous lesson.

E.g. 1 The table below shows the heights of a set of plants, measured to the nearest cm.

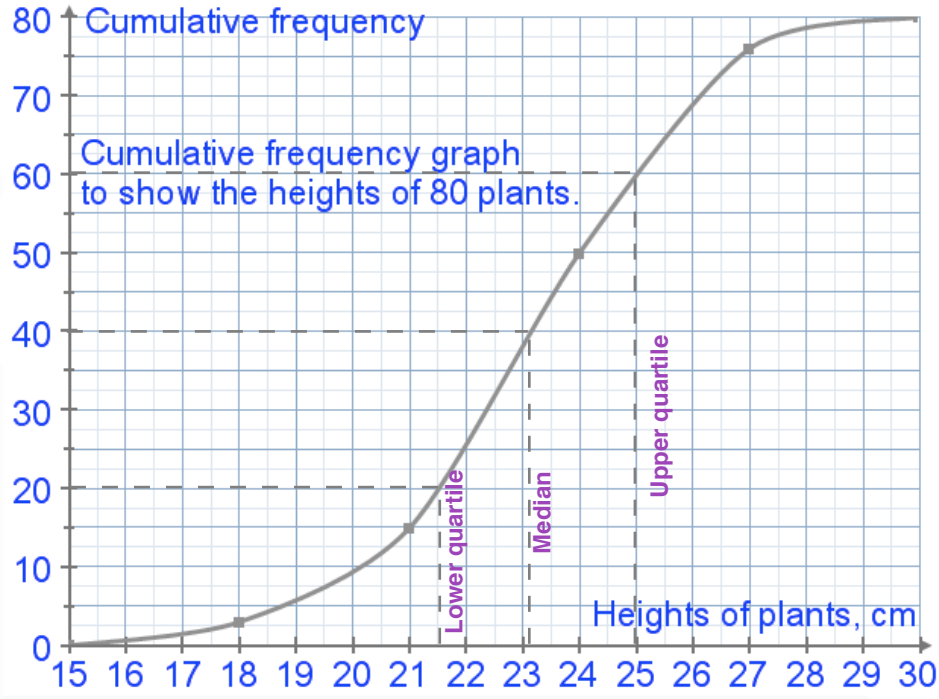
(b) Estimate the median.

(c) Estimate the upper and lower quartiles.

(d) Hence write down the interquartile range for the data.

N.B. You will need your graph from the previous lesson.

Working:



(c) There are 80 plants so $n = 80$

Median, $Q_2 = \frac{1}{2}n$ th value $= 40$th value

Draw a horizontal line at 40, then down to the horizontal axis

Median, $Q_2 \approx 23.1$ cm (± 1 cm would be correct)

(d) Lower quartile, $Q_1 = \frac{1}{4}n$ th value $= 20$th value

Draw a horizontal line at 20, then down to the horizontal axis

Lower quartile, $Q_2 \approx 21.5$ cm (± 1 cm would be correct)

Upper quartile, $Q_3 = \frac{3}{4}n$ th value $= 60$th value

Draw a horizontal line at 60, then down to the horizontal axis

Upper quartile, $Q_2 \approx 25$ cm (± 1 cm would be correct)

(e) IQR $\approx 25 - 21.5 = 3.5$ cm. (± 1 cm would be correct)

E.g. 2 The table shows Y11 marks in a Maths test.

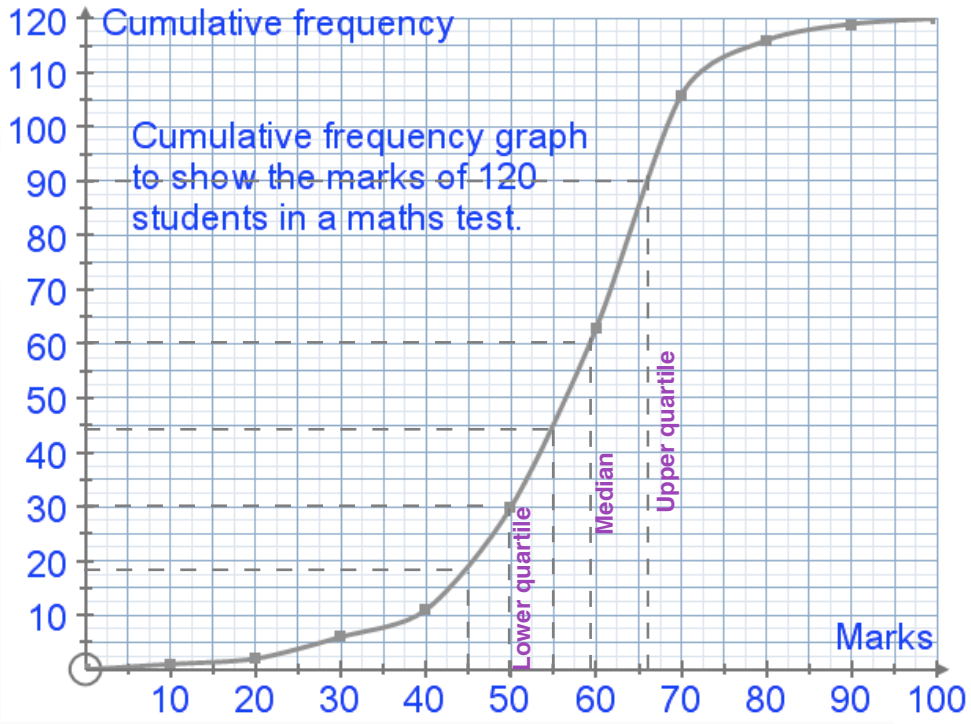
(c) Estimate the median mark.

(d) Estimate the IQR.

(e) Pupils who achieved less than 45 marks have to re-sit the test. Estimate how many pupils will re-sit.

(f) Pupils who achieved more than 55 marks will sit the higher tier exam. Estimate how many will be entered for the higher tier.

Working:



(c) There are 120 students so $n = 120$

Median, $Q_2 = \frac{1}{2}n$ th value $= 60$th value

Draw a horizontal line at 60, then down to the horizontal axis

Median, $Q_2 \approx 59$ marks (± 3 cm would be correct)

(d) Lower quartile, $Q_1 = \frac{1}{4}n$ th value $= 30$th value

Draw a horizontal line at 20, then down to the horizontal axis

Lower quartile, $Q_2 = 50$ cm (must be exact as this is a plotted point)

Upper quartile, $Q_3 = \frac{3}{4}n$ th value $= 90$th value

Draw a horizontal line at 90, then down to the horizontal axis

Upper quartile, $Q_2 \approx 66$ cm (± 3 cm would be correct)

IQR = 66 — 50 = 16±1 (± 3 cm would be correct)

(e) Draw a vertical line up at 45 marks

Then go across to the horizontal axis

Number of students who need to re-sit = 18 (± 1 correct)

(f) Draw a vertical line up at 45 marks

Then go across to the horizontal axis

The line is at 44 students but it is the students who got more than 55 marks who will take the higher tier exam
So number of students to take higher papers = 120 — 44 = 76 (± 3)

Video: Reading cumulative frequency graphs

Solutions to Starter and E.g.s

Exercise

9-1 class textbook:	p480 E14.2 Qu 1, 2bc, 3cd, 4bc, 5cde, 6
A*-G class textbook:	p480 E14.2 Qu 1, 2b, 3cd, 4cd, 5bc, 6
9-1 homework book:	p165 E14.2 Qu 1cd, 2, 3cd
A*-G homework book:	p122 M14.7 Qu 1cd, 2, 3cd

Summary

When estimating the medians and quartiles from a cumulative frequency curve, we need to draw horizontal and vertical lines on the graphs.

Horizontal lines are drawn at the following points:

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Homework book answers (only available during a lockdown)