

## Guidance for tutors

Outcome	S5	Student can consistently:	Draw and interpret a cumulative frequency diagram.								
How the topic is examined	<ul style="list-style-type: none"> <li>Examinated through test paper questions.</li> <li>This topic is equally likely to appear on calculator and non-calculator papers.</li> <li>Questions could ask students to draw a cumulative frequency diagram or interpret one.</li> <li>Subsequent questions on determining the median and interquartile range are often asked.</li> </ul>										
Prior knowledge	<ul style="list-style-type: none"> <li>Students should be confident with: <ul style="list-style-type: none"> <li>Mean, median and mode of data (S2)</li> </ul> </li> <li>In addition questions on this topic can have links to: <ul style="list-style-type: none"> <li>Box and whisker diagrams (S6)</li> </ul> </li> </ul>										
Suggested tuition approaches	<ul style="list-style-type: none"> <li>Students should understand that a cumulative frequency is a running total of the frequency. To find the set of cumulative frequency students add on the next frequency in the table.</li> <li>Questions could then ask students to draw a cumulative frequency curve (curve), cumulative frequency polygon (straight lines) or a cumulative frequency diagram (either curve or straight lines)</li> <li>To draw a cumulative frequency diagram students should plot the cumulative frequency value at the point that is at the end of the interval. Points should then be joined up with a curve or straight line.</li> <li>When drawing a curve, the curve should pass smoothly through the points plotted.</li> <li>From this students can be asked to find numerous values:</li> </ul> <table> <tr> <th>Median</th><th>Lower quartile</th><th>Upper quartile</th><th>Interquartile range</th></tr> <tr> <td> <p>This is calculated by drawing a line across from the value that is half way up the cumulative frequency scale.</p> <p>You will need to read the value on the <math>x</math> axis for which this corresponds.</p> </td><td> <p>This is calculated by drawing a line across from the value that is a quarter of the way up the cumulative frequency scale.</p> <p>You will need to read the value on the <math>x</math> axis for which this corresponds.</p> </td><td> <p>This is calculated by drawing a line across from the value that is three quarters of the way up the cumulative frequency scale.</p> <p>You will need to read the value on the <math>x</math> axis for which this corresponds.</p> </td><td> <p>This is calculated by subtracting the value of the lower quartile from the upper quartile.</p> </td></tr> </table>			Median	Lower quartile	Upper quartile	Interquartile range	<p>This is calculated by drawing a line across from the value that is half way up the cumulative frequency scale.</p> <p>You will need to read the value on the <math>x</math> axis for which this corresponds.</p>	<p>This is calculated by drawing a line across from the value that is a quarter of the way up the cumulative frequency scale.</p> <p>You will need to read the value on the <math>x</math> axis for which this corresponds.</p>	<p>This is calculated by drawing a line across from the value that is three quarters of the way up the cumulative frequency scale.</p> <p>You will need to read the value on the <math>x</math> axis for which this corresponds.</p>	<p>This is calculated by subtracting the value of the lower quartile from the upper quartile.</p>
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Here is some data about the diameter of 40 tree trunks.

Diameter (cm)	Frequency	Cumulative Frequency
$0 < x \leq 10$	5	5
$10 < x \leq 15$	12	17
$15 < x \leq 20$	14	31
$20 < x \leq 25$	7	38
$25 < x \leq 30$	2	40

The cumulative frequency column had to be completed. You can see that the next CF value is the previous one with the new frequency added on.

A good check is to ensure that the final CF value is equal to the number given within the question. In this case we were told the data represented 40 trees and we got 40 as our last CF value.

The **median** line is drawn across from 20 (as this is half way up the cumulative frequency scale). If we draw a line down we get the value 16.

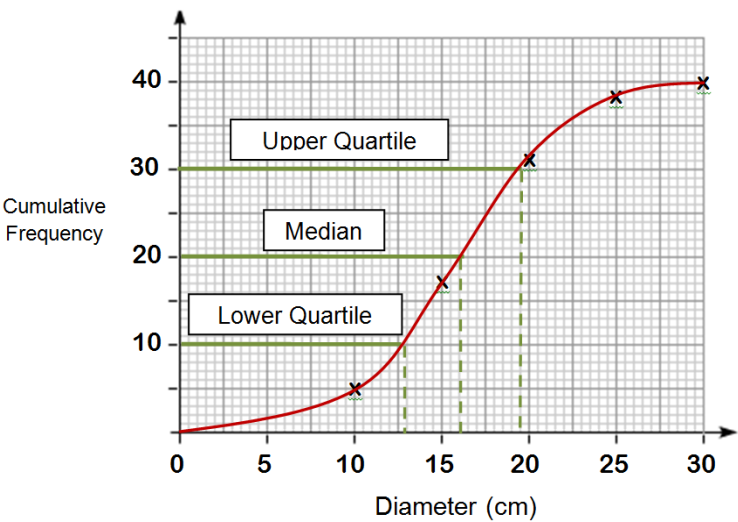
The **lower quartile** is drawn across from 10 and we get the value 13.

The **upper quartile** is drawn across from 30 and we get the value 19.5

The **interquartile range (IQR)** is found using

$$\text{IQR} = \text{UQ} - \text{LQ} = 19.5 - 13 = 6.5$$

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- Sometimes students are asked to find out how many trees have a diameter less than or more than a particular value. If this is the case you would do the opposite and draw a line up from this value and read off the cumulative frequency scale.
- When the question asks for “how many .... have a value more than....” You need to subtract the cumulative frequency value you have read off from the total frequency.

Common errors and misconceptions

- Students incorrectly add up the total frequency. Ensure that they check their final value is equal to the number given at the start of the question. It is surprising how many students get this wrong.
- A large number of students end up plotting the wrong points. They either use the start of the interval, middle of the interval or the frequency values – rather than the cumulative frequency values.
- When finding the median, LQ and UQ they don't read off the values on the x scale, instead they just take the value they have drawn the lines across from.

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	<ul style="list-style-type: none"><li>• Students make lots of mistakes reading off values from the scale. Encourage them to work out what one small square represents before they start the question. The same applies when plotting the cumulative frequency values.</li><li>• When finding “how many are more than a particular value ....” Students forget to subtract the value they find from the total frequency.</li></ul>
<b>Suggested resources</b>	<ul style="list-style-type: none"><li>• Questions<ul style="list-style-type: none"><li>◦ <a href="http://www.cimt.org.uk/projects/mepres/book9/bk9_16.pdf">http://www.cimt.org.uk/projects/mepres/book9/bk9_16.pdf</a></li><li>◦ <a href="https://corbettmaths.files.wordpress.com/2013/02/cumulative-frequency-pdf1.pdf">https://corbettmaths.files.wordpress.com/2013/02/cumulative-frequency-pdf1.pdf</a></li></ul></li><li>• Past GCSE Questions<ul style="list-style-type: none"><li>◦ <a href="https://keshgcsemaths.files.wordpress.com/2013/11/91_cumulative-frequency-and-box-plots.pdf">https://keshgcsemaths.files.wordpress.com/2013/11/91_cumulative-frequency-and-box-plots.pdf</a></li></ul></li><li>• Video tutorial<ul style="list-style-type: none"><li>◦ <a href="http://corbettmaths.com/2012/08/09/drawing-cumulative-frequency-graphs/">http://corbettmaths.com/2012/08/09/drawing-cumulative-frequency-graphs/</a></li><li>◦ <a href="http://corbettmaths.com/2012/08/09/reading-cumulative-frequency-graphs/">http://corbettmaths.com/2012/08/09/reading-cumulative-frequency-graphs/</a></li></ul></li></ul>