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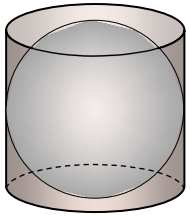

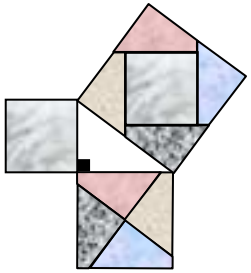

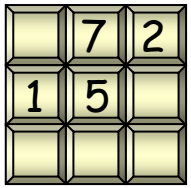

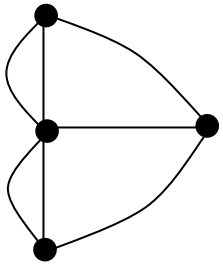

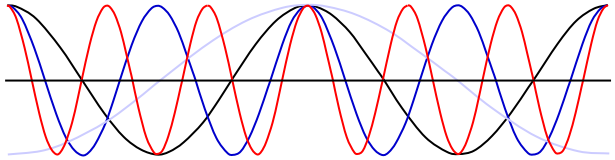

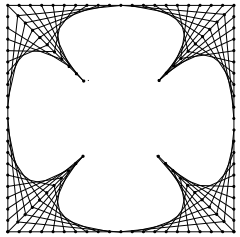

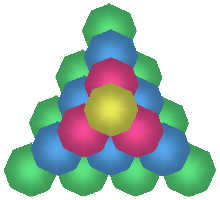

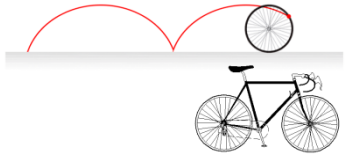

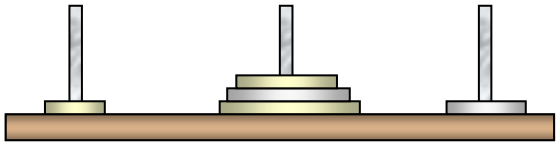

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Cumulative Frequency Curves

Remember:

- When data is grouped we don't know the actual value of either the mean, median, mode or range.
- We can get an estimate for the mean by using mid-points from the frequency table.

minutes late	frequency	midpoint(x)	mp x f
0 - 10	27		
10 - 20	10		
20 - 30	7		
30 - 40	5		
40 - 50	4		
50 - 60	2		

We can also use the grouped data to obtain an estimate of the median and a measure of spread called the inter-quartile range. We do this by plotting a cumulative frequency curve (Ogive).

The measure of spread used with the median is the inter- quartile range. This is a better measure of spread as it only uses the middle half of the data that is grouped around the median. This means that unlike the range it is not subject to extreme values.

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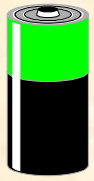
minutes late	frequency	midpoint(x)	mp x f
0 - 10	27		
10 - 20	10		
20 - 30	7		
30 - 40	5		
40 - 50	4		
50 - 60	2		

Discuss the calculations below

Battery Life: The life of 12 batteries recorded in hours is:

2, 5, 6, 6, 7, 8, 8, 8, 9, 9, 10, 15



Mean = 93/12 = 7.75 hours and the range = 15 – 2 = 13 hours.

2, 5, 6, 6, 7, 8, 8, 8, 9, 9, 10, 15

Median = 8 hours and the inter-quartile range = 9 – 6 = 3 hours.

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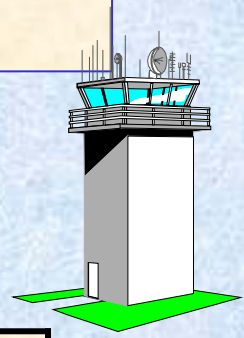
Cumulative Frequency Curves

Cumulative frequency diagrams are used to obtain an estimate of the median, and quartiles. from a set of grouped data. Constructing a cumulative frequency table is first step.



Example 1.
During a 4 hour period at a busy airport the number of late-arriving aircraft was recorded.

Cumulative frequency table

Minutes Late	Frequency	Upper Limit	Cumulative Frequency
0 - 10	5	< 10	5
10 - 20	8	< 20	13
20 - 30	22	< 30	35
30 - 40	12	< 40	47
40 - 50	8	< 50	55
50 - 60	5	< 60	60

Cumulative frequency just means running total.

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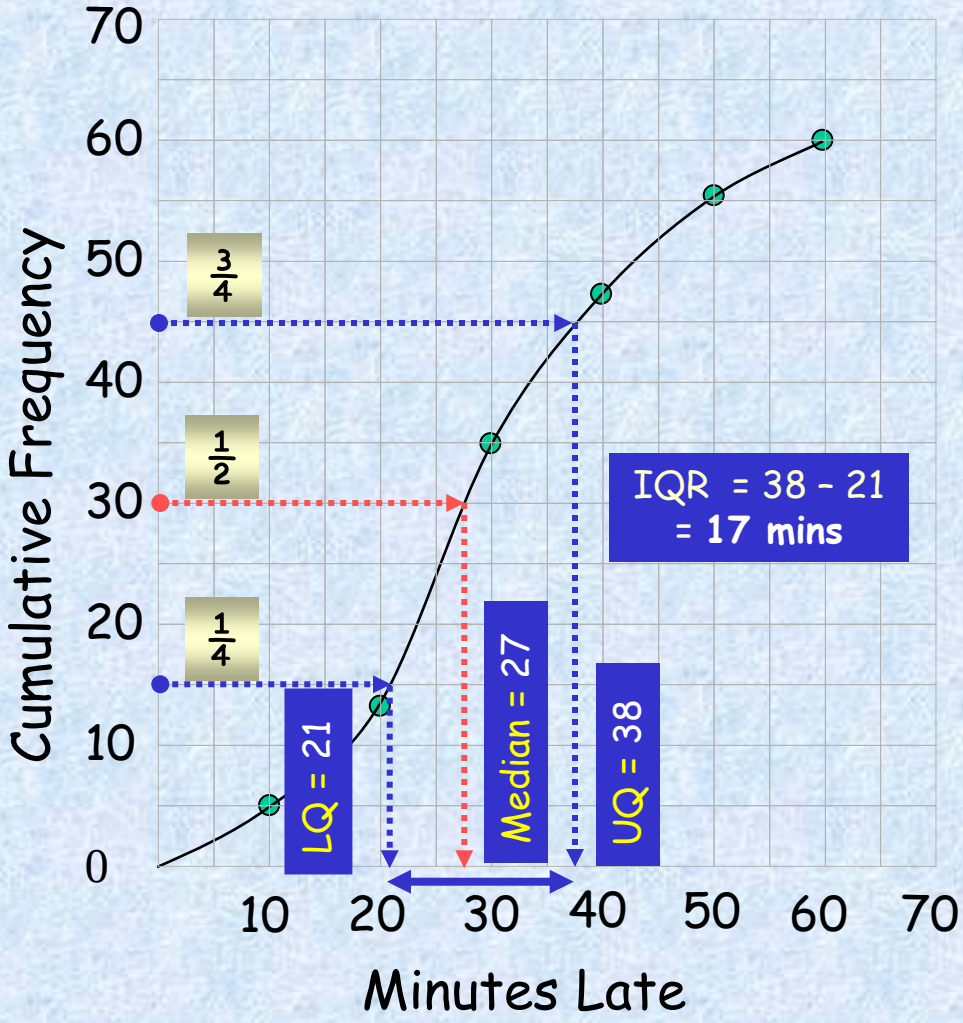
Plotting the curve



Cumulative frequency table

Mins Late	f	Upper Limit	CF
0 - 10	5	< 10	5
10 - 20	8	< 20	13
20 - 30	22	< 30	35
30 - 40	12	< 40	47
40 - 50	8	< 50	55
50 - 60	5	< 60	60

Plot the end point of each interval against cumulative frequency, then join the points to make the curve.

Get an estimate for the median.

Find the lower quartile.

Find the Upper Quartile.

Find the Inter Quartile Range.(IQR = UQ - LQ)

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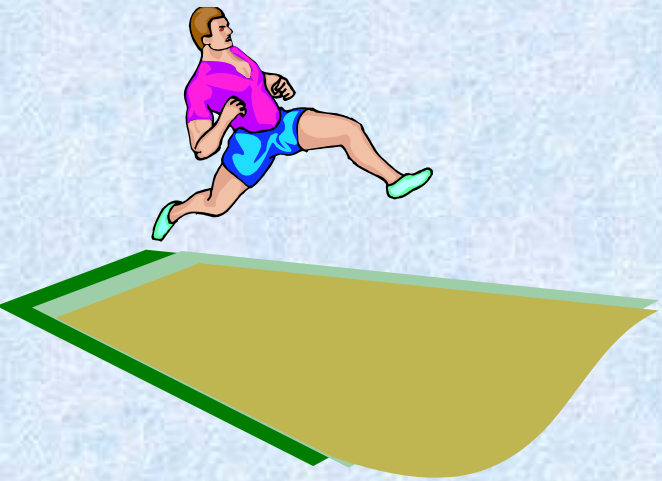
Cumulative Frequency Curves

Cumulative frequency diagrams are used to obtain an estimate of the median and quartiles from a set of grouped data. Constructing a cumulative frequency table is first step.

Example 2.
A P.E teacher records the distance jumped by each of 70 pupils.



Cumulative frequency table

Distance (cm)	N° of pupils	Upper Limit	Cumulative Frequency
$180 \leq d < 190$	2	$d < 190$	2
$190 \leq d < 200$	6	$d < 200$	8
$200 \leq d < 210$	9	$d < 210$	17
$210 \leq d < 220$	7	$d < 220$	24
$220 \leq d < 230$	15	$d < 230$	39
$230 \leq d < 240$	18	$d < 240$	57
$240 \leq d < 250$	8	$d < 250$	65
$250 \leq d < 260$	5	$d < 260$	70

Cumulative frequency just means running total.

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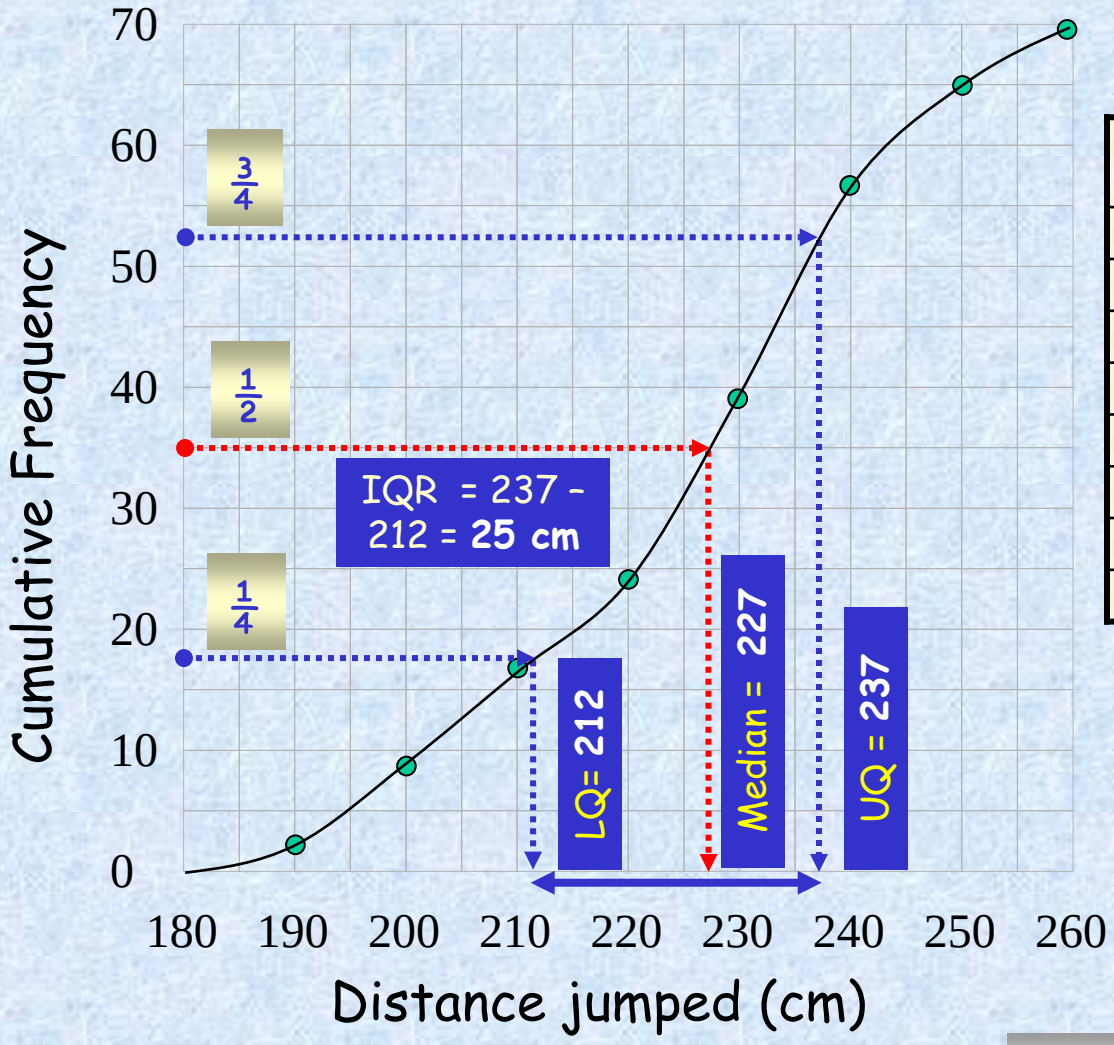
Plotting The Curve



Cumulative Frequency Table

Distance jumped (cm)	Number of pupils	Cumulative Frequency
$180 \leq d < 190$	2	2
$190 \leq d < 200$	6	8
$200 \leq d < 210$	9	17
$210 \leq d < 220$	7	24
$220 \leq d < 230$	15	39
$230 \leq d < 240$	18	57
$240 \leq d < 250$	8	65
$250 \leq d < 260$	5	70

Plot the end point of each interval against cumulative frequency, then join the points to make the curve.

Get an estimate for the median.

Find the Lower Quartile.

Find the Upper Quartile.

Find the Inter Quartile Range.(IQR = UQ - LQ)

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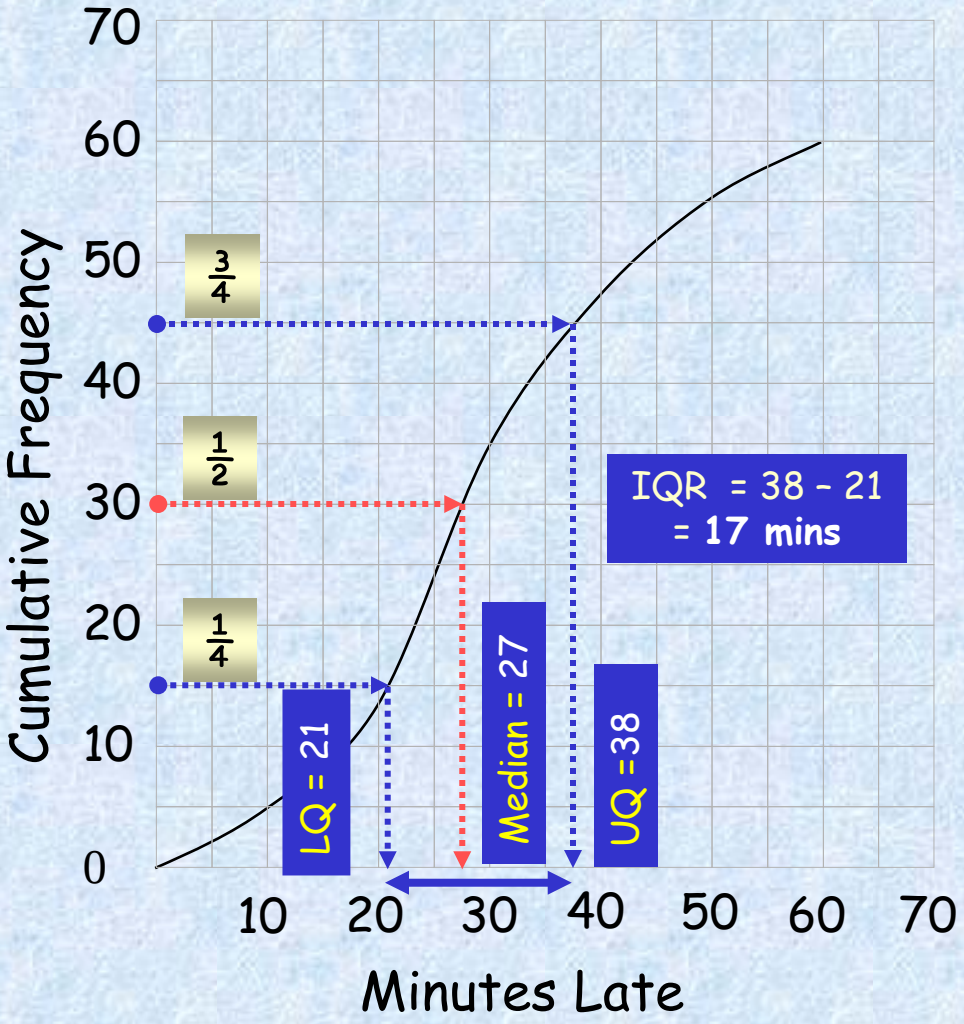
Interpreting Cumulative Frequency Curves



The cumulative frequency curve gives information on aircraft arriving late at an airport. Use the curve to find estimates to

(a) The median

(b) The inter-quartile range

(c) The number of aircraft arriving less than 45 minutes late.

(d) The number of aircraft arriving more than 25 minutes late.

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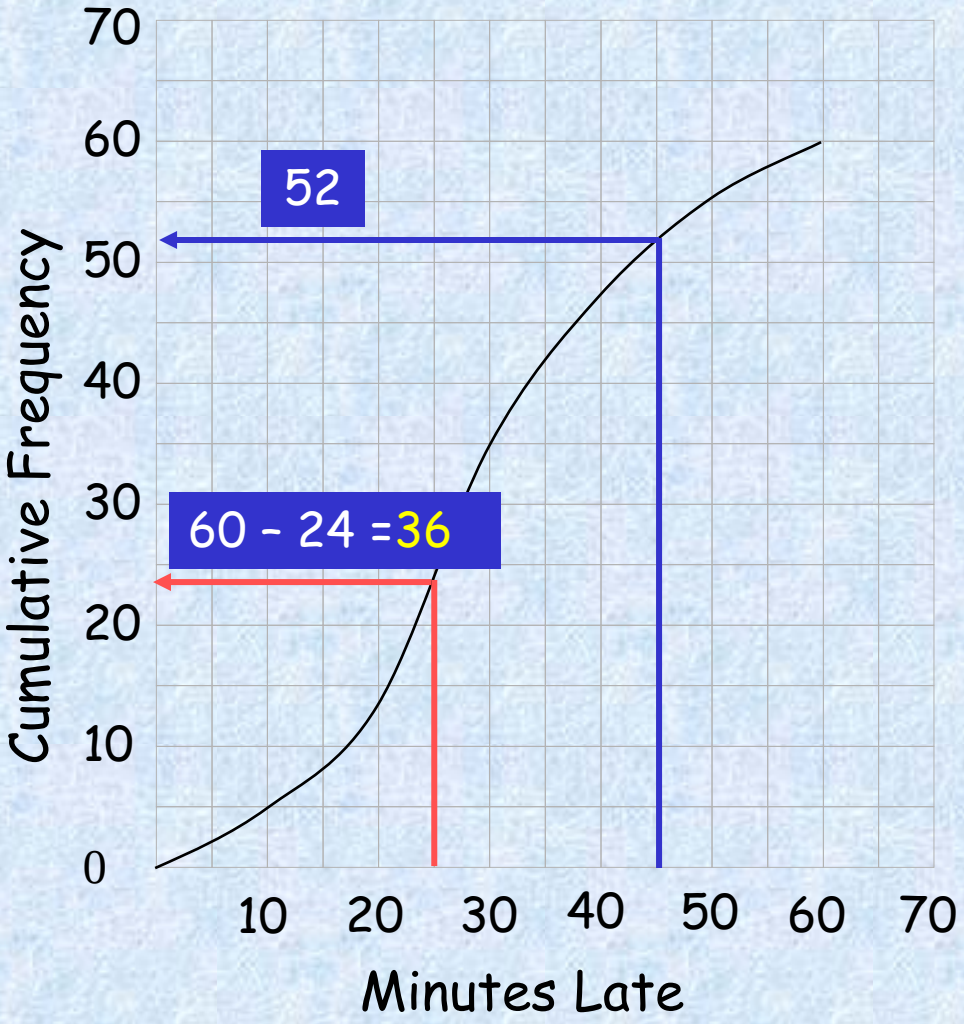
Interpreting Cumulative Frequency Curves



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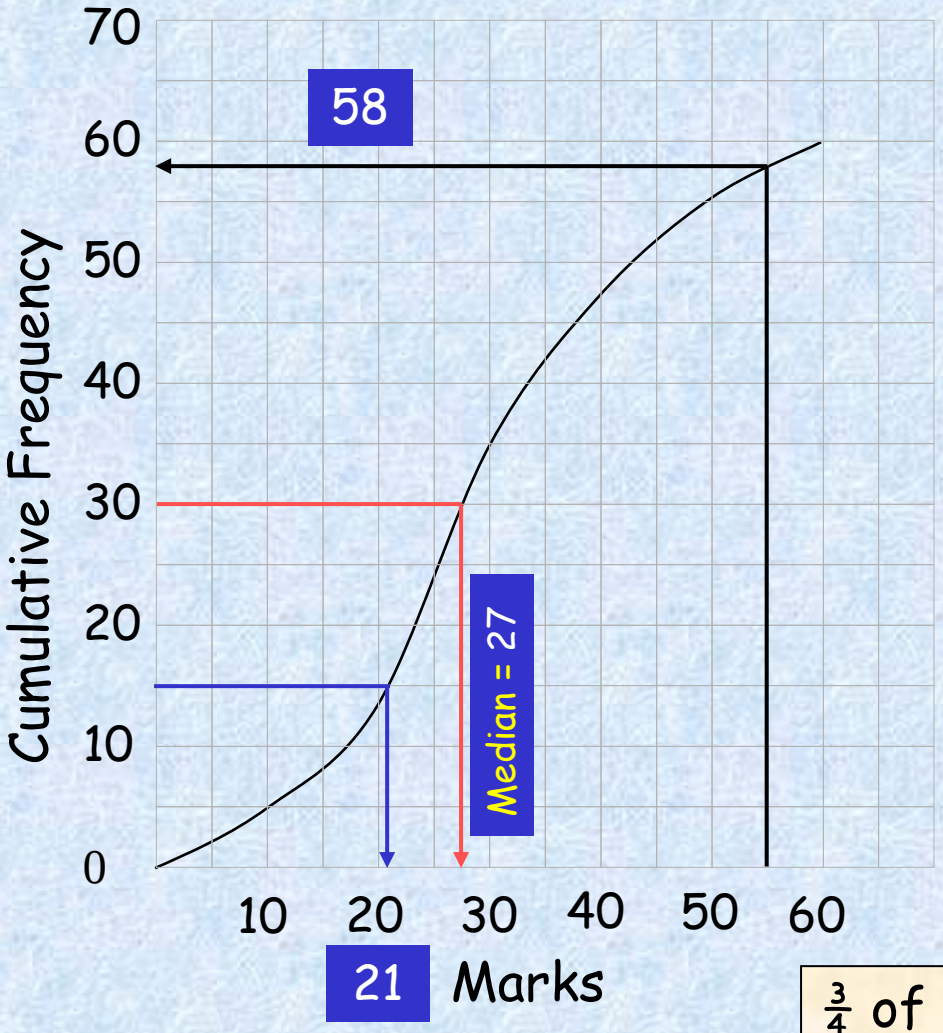

The graph shows the cumulative frequency curve of the marks for students in an examination. Use the graph to find:

(a) The median mark.

(b) The number of students who got less than 55 marks.

(c) The pass mark if $\frac{3}{4}$ of the students passed the test.

$\frac{3}{4}$ of the students passing the test implies that $\frac{1}{4}$ failed. (15 students)

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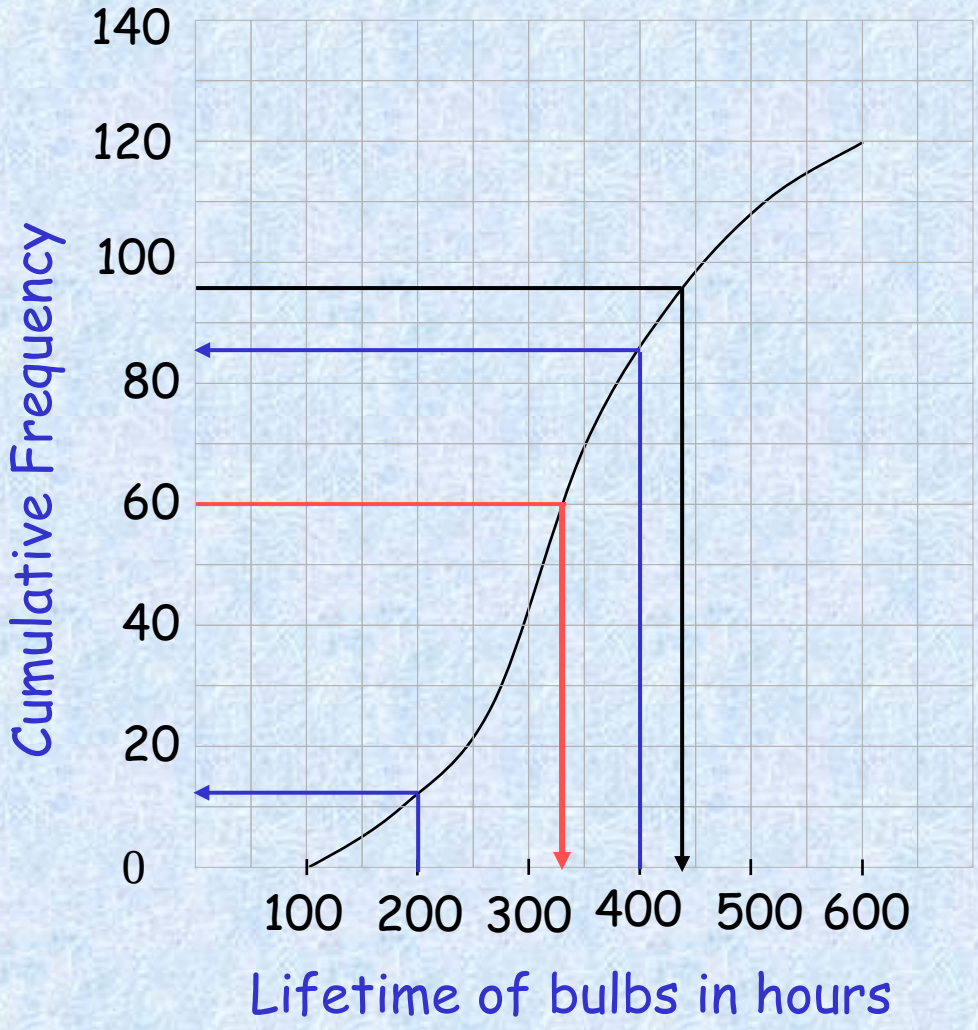
Interpreting Cumulative Frequency Curves



The lifetime of 120 projector bulbs was measured in a laboratory. The graph shows the cumulative frequency curve for the results. Use the graph to find:

(a) The median lifetime of a bulb.

(b) The number of bulbs that had a lifetime of between 200 and 400 hours?

(c) After how many hours were 80% of the bulbs dead?.

(d) What was the shortest lifetime of a bulb?

(a) 330 hours

(b) 86 - 12 = 74

(c) 440 hours

(d) 100 hours

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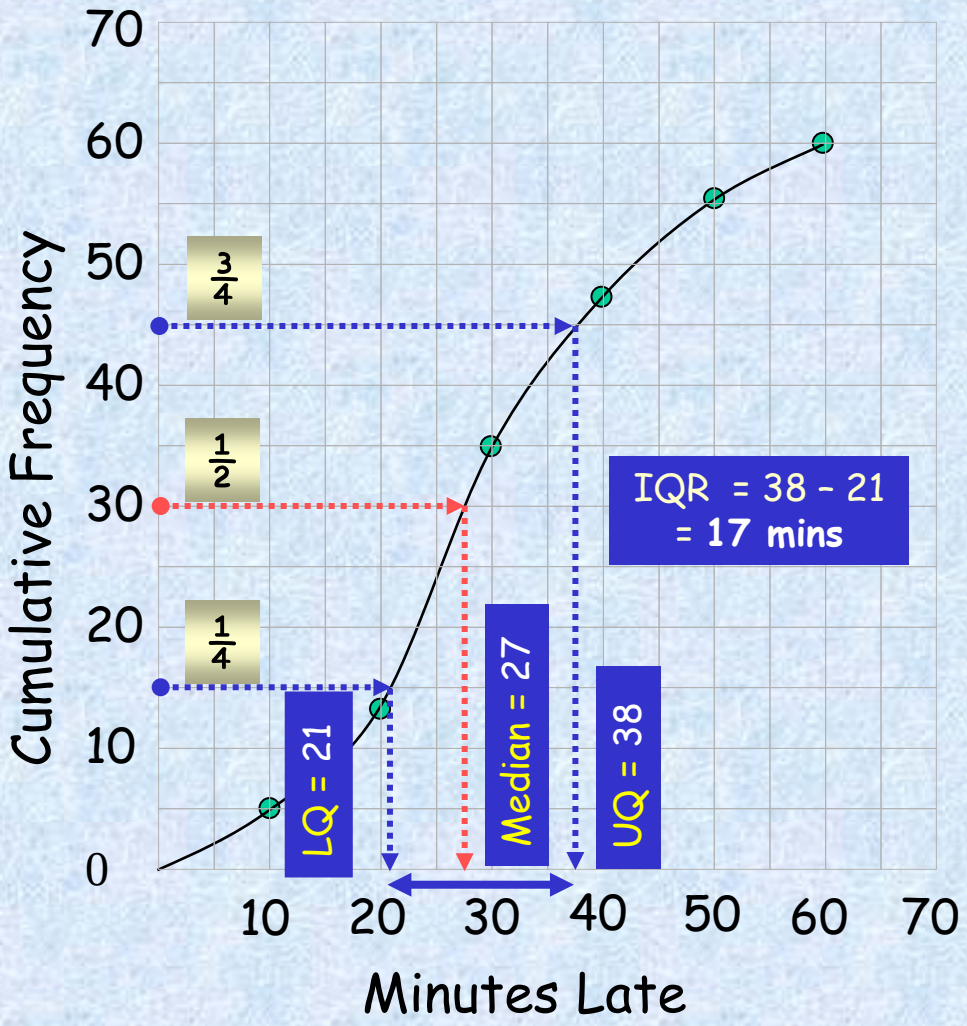
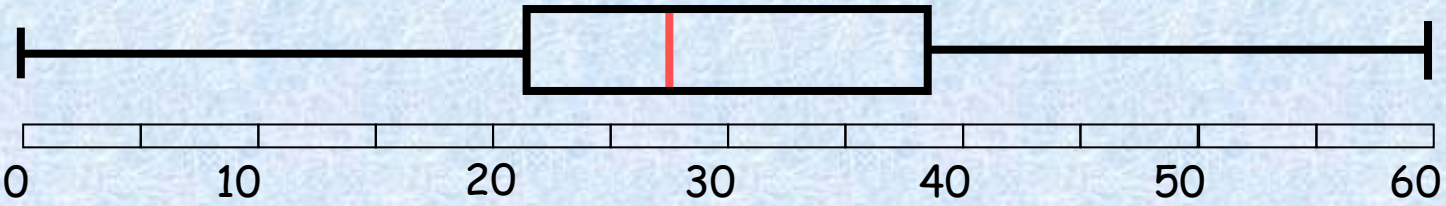
Box Plot from Cumulative Frequency Curve





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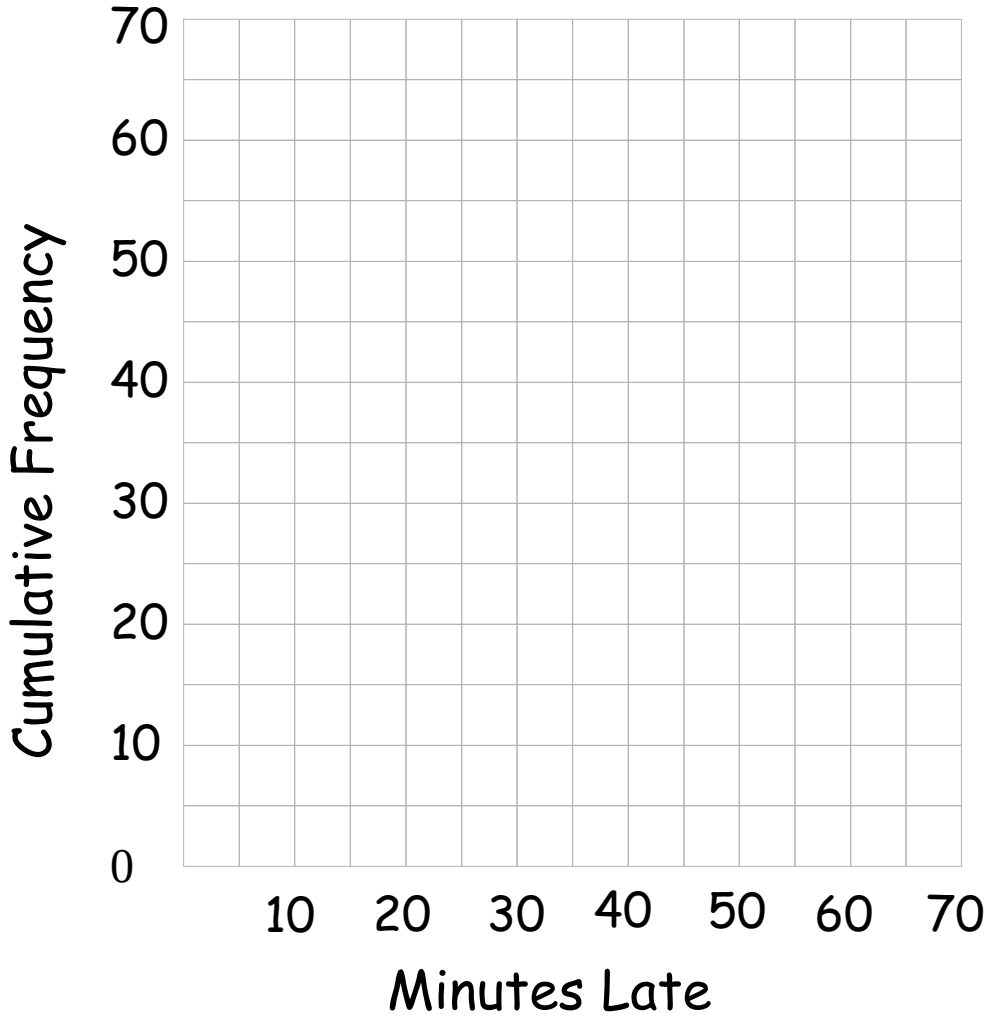
Example 1



Mins Late	f	Upper Limit	CF
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20 - 30	22	< 30	
30 - 40	12	< 40	
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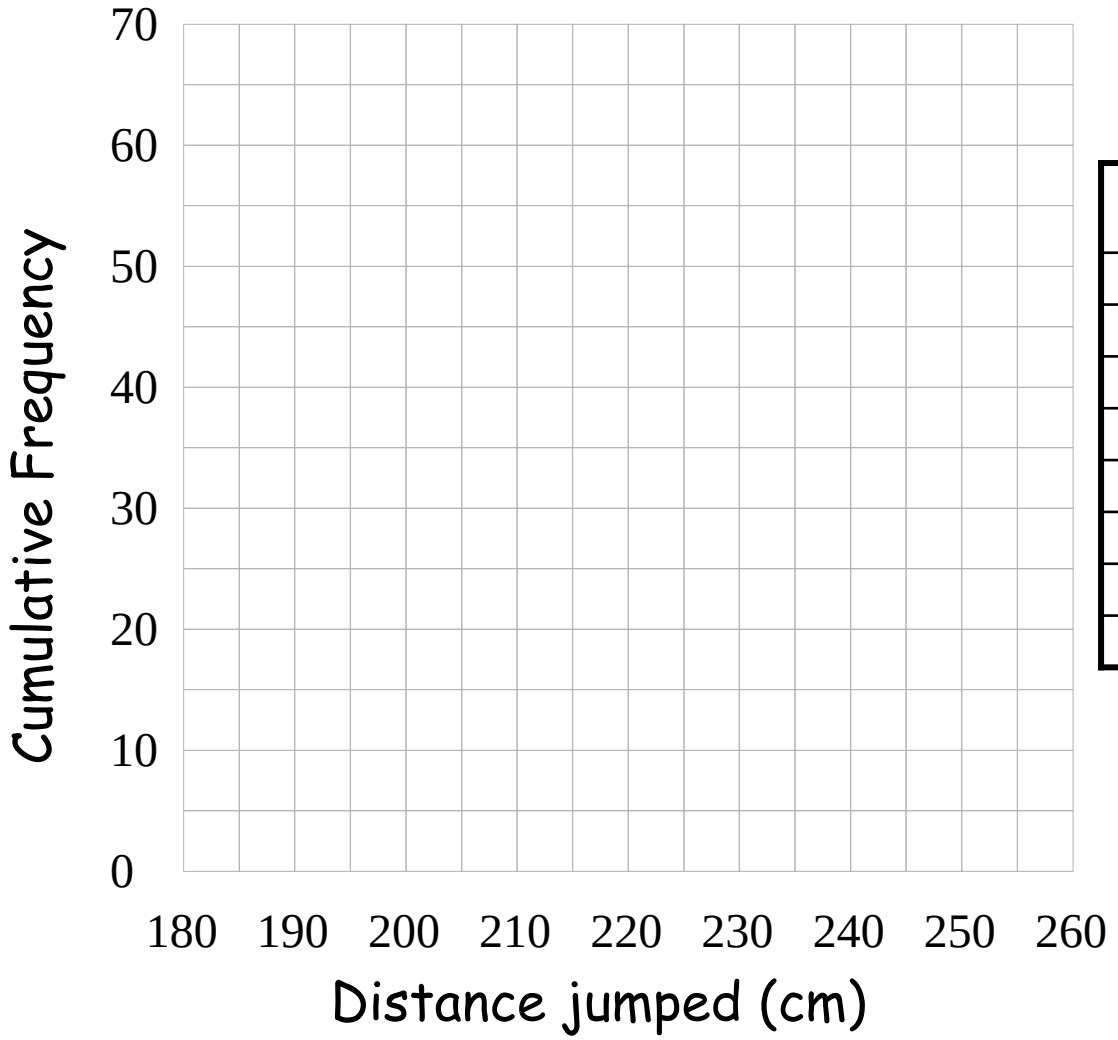
Example 2



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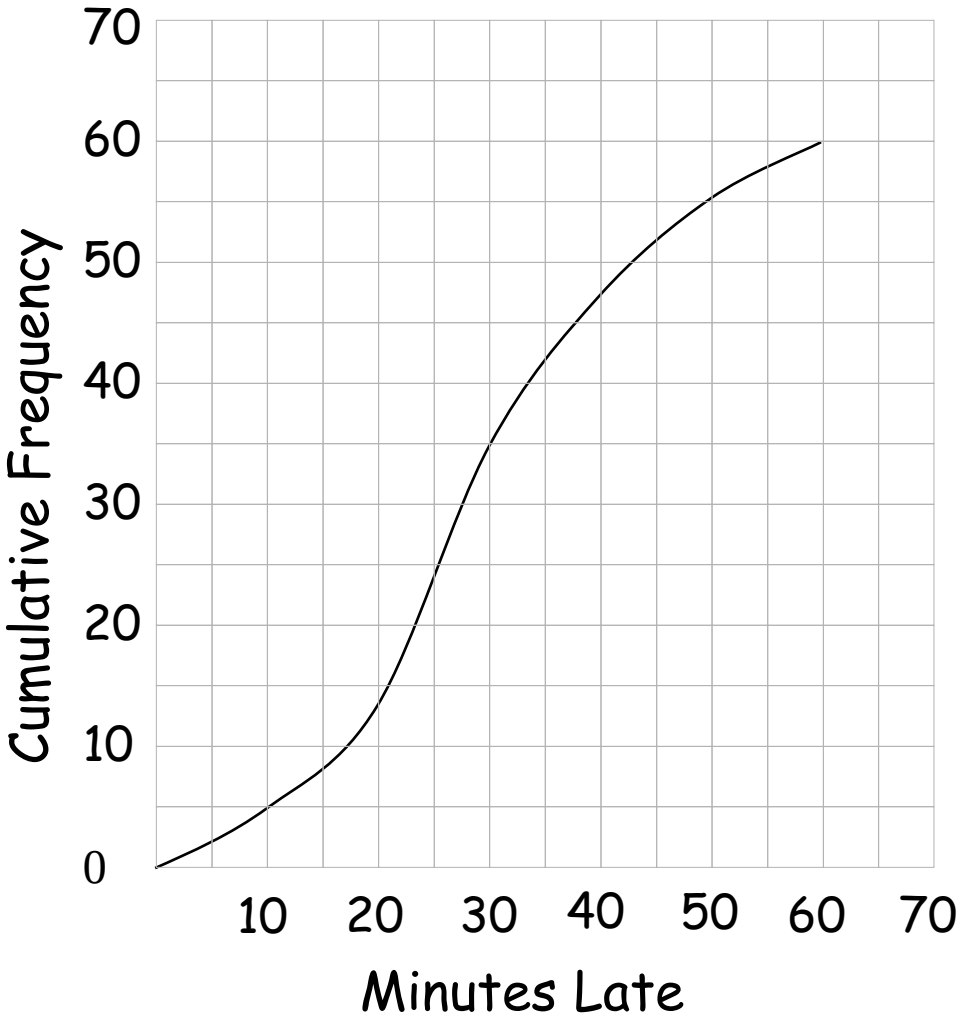

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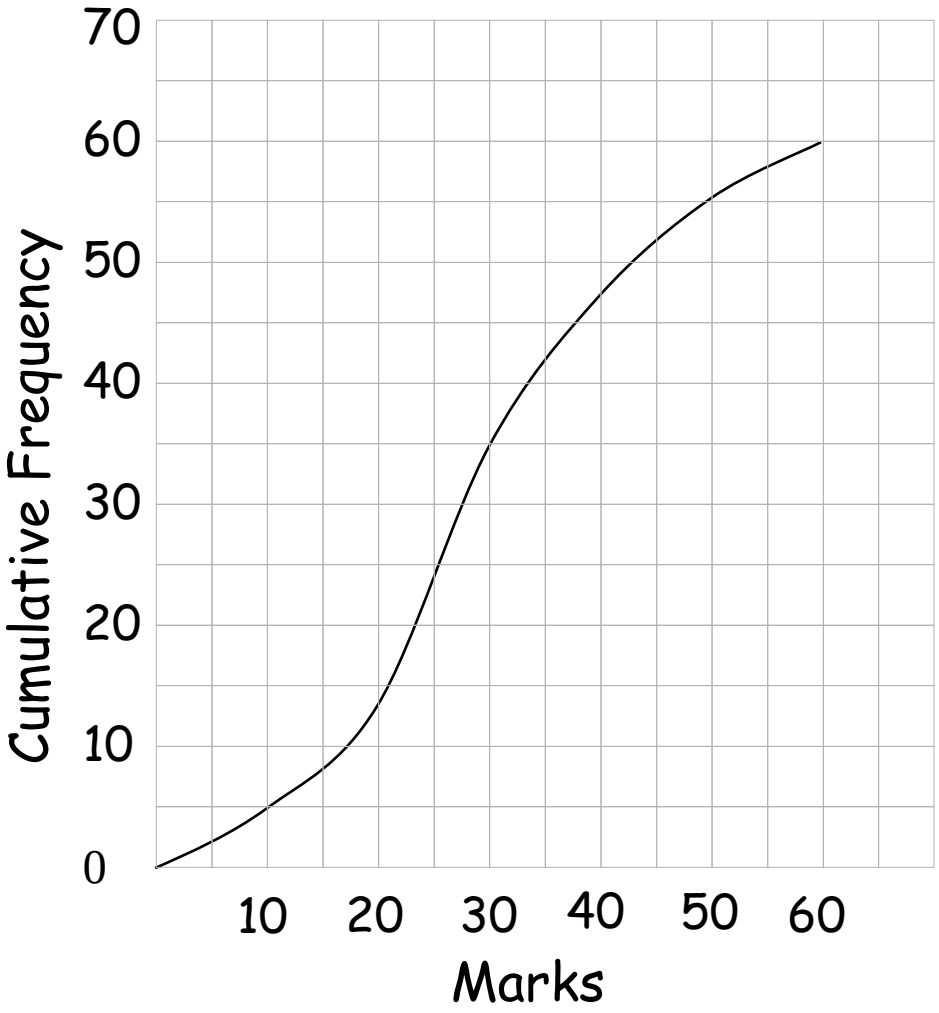

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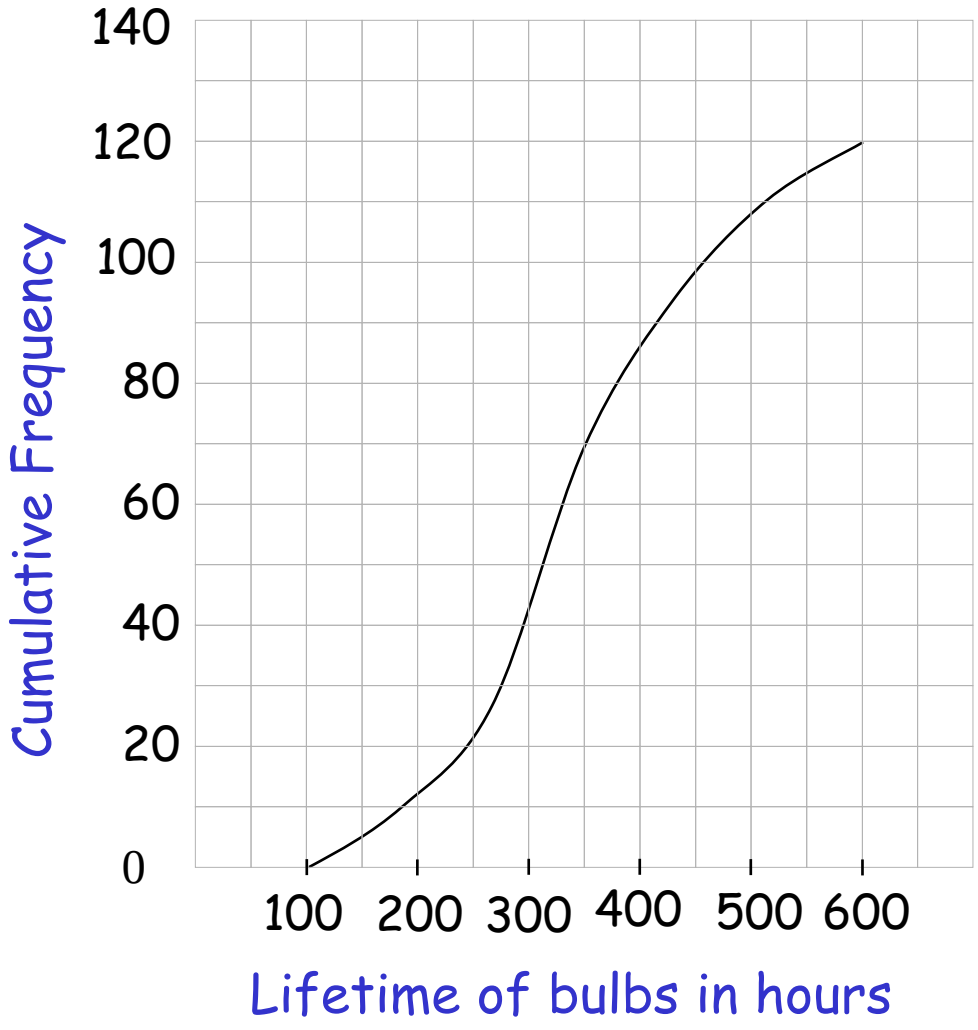

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(d) What was the shortest lifetime of a bulb?

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Cumulative Frequency Curves

- Cumulative Frequency = a running total of the data
- Median = Half way up the Cumulative Frequency
- Lower Quartile (LQ) = $\frac{1}{4}$ way up Cum Freq
- Upper Quartile (UQ) = $\frac{3}{4}$ way up Cum Freq
- Inter Quartile Range = UQ - LQ

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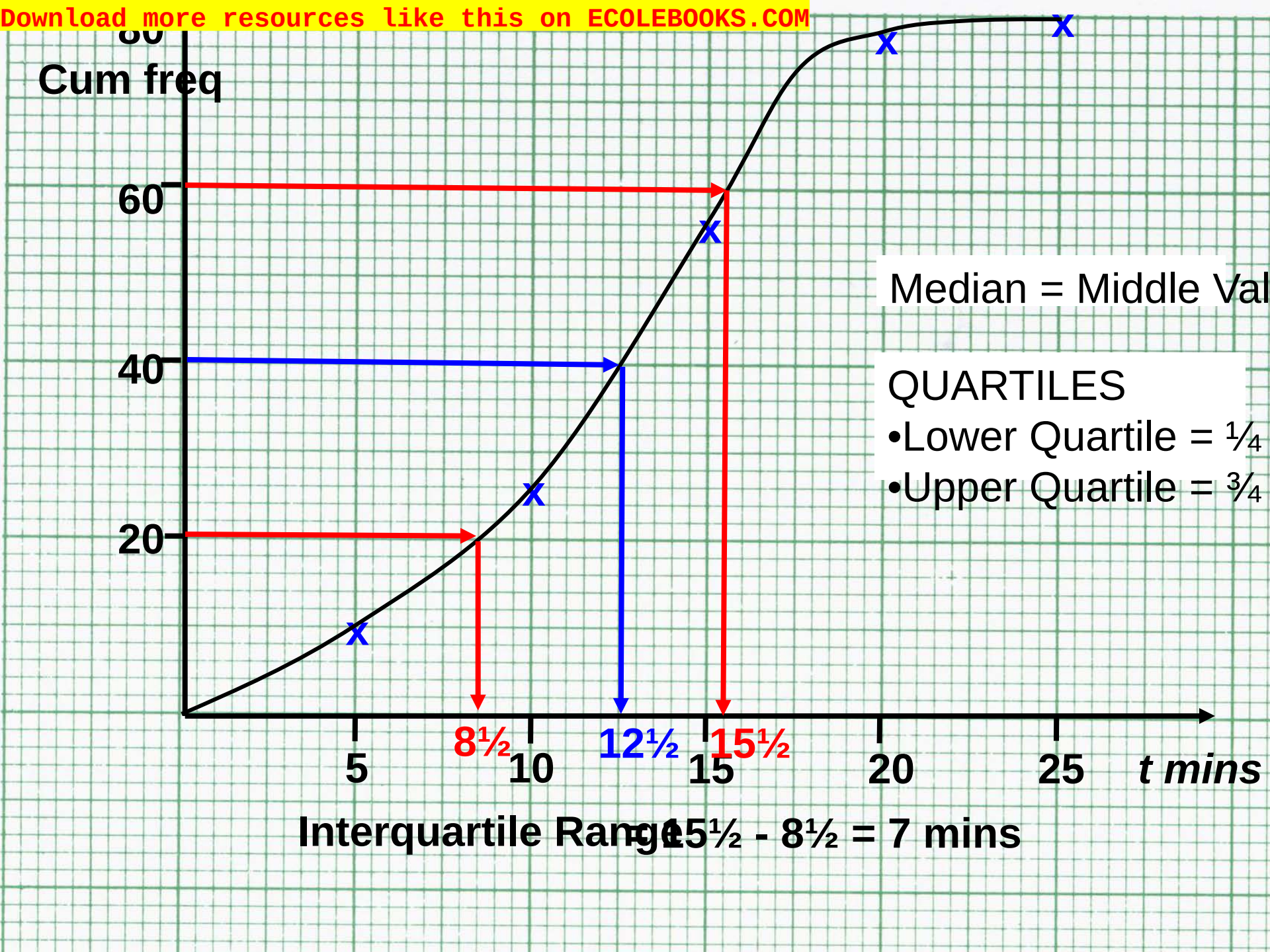
Big Worked Example

The table below shows the number of minutes students were late for their fun algebra lesson.

(a) Draw a Cumulative Frequency Diagram of the data

(b) Use it to find the Median, Lower Quartile, Upper Quartile, and Inter Quartile Range.

(c) Draw a Box-Plot assuming a minimum time of 0 minutes and a maximum of 25 minutes

Time t (mins)	Number of Students	Cumulative Frequency
$0 < t \leq 5$	10	
$5 < t \leq 10$	16	
$10 < t \leq 15$	30	
$15 < t \leq 20$	22	
$20 < t \leq 25$	2	

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