6.3 Cumulative frequency

Name: _____ Class: _____ Date: _____ **Total: 16 marks**

KEY WORDS cumulative frequency • quartile

Cumulative frequency

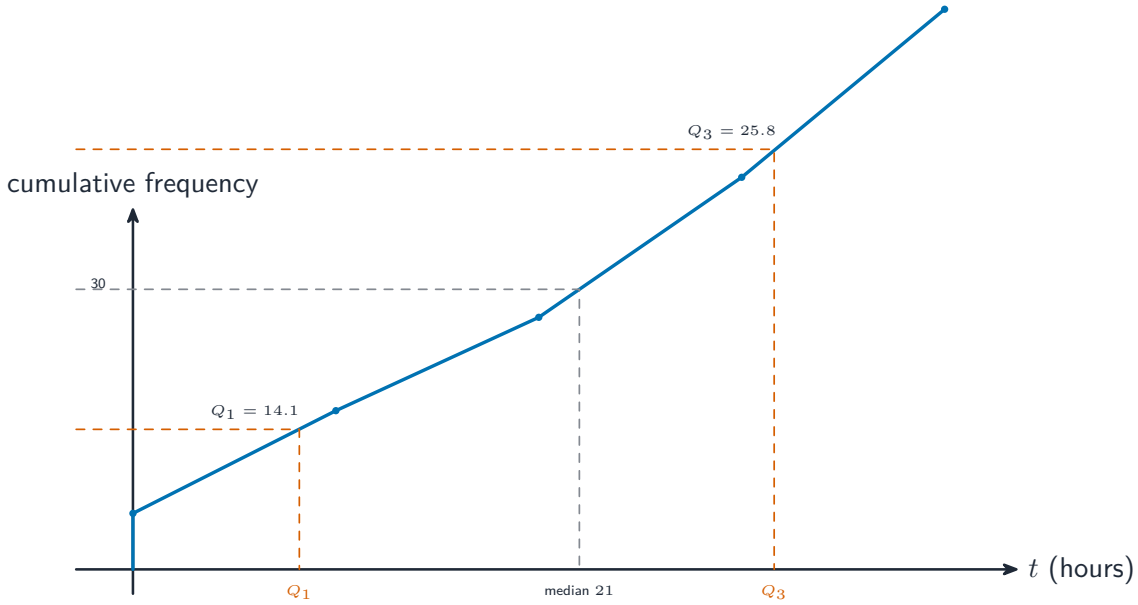
Objective

Construct cumulative frequency diagrams from tables and use them to estimate medians, quartiles, interquartile ranges and percentiles (objectives Higher 6.1 B–C and 6.2 A, D).

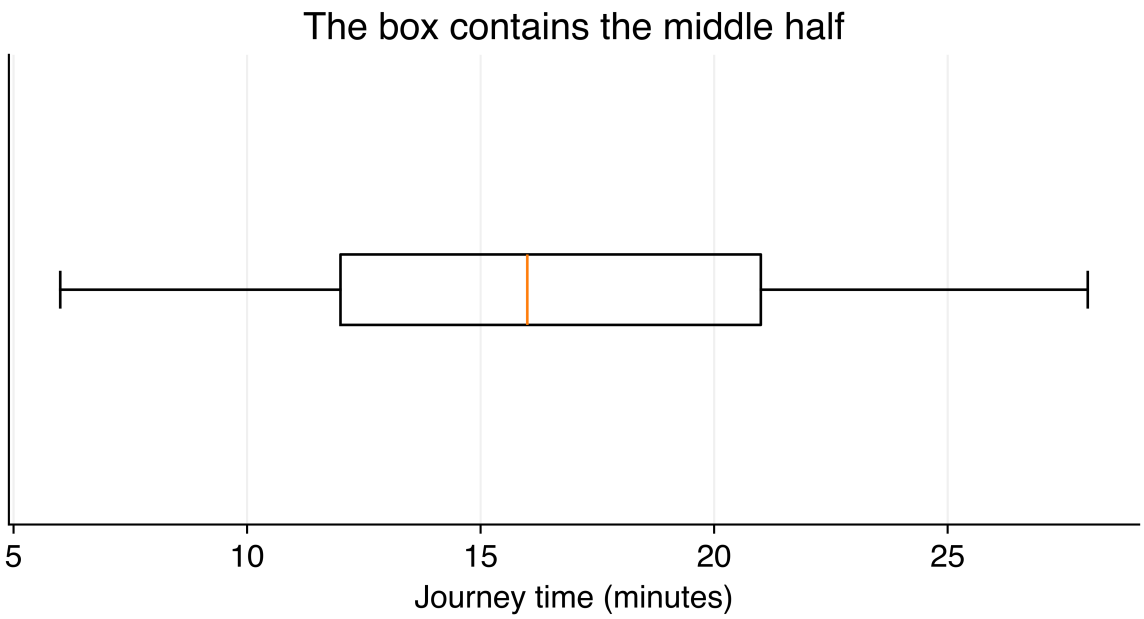
1 Key knowledge and worked examples

The ogive. Add frequencies as classes pass; plot each total at its UPPER class boundary; join with a smooth increasing curve. Median reads at $n/2$, quartiles at $n/4$ and $3n/4$; "how many above X" reads the curve at X and subtracts from n.

The paper's read. June 2024 2HR Q11 family: 60 workers, cumulative frequencies 6, 17, 27, 42, 60 at boundaries 10, 15, 20, 25, 30. Median at the 30th: $20+5\times\frac{30-27}{42-27}=21$; $Q_1=10+5\times\frac{15-6}{17-6}=14.1$; $Q_3=25+5\times\frac{45-42}{60-42}=25.8$; IQR $=11.7$.



read at $n/2$ for the median;
IQR $= \ 25.8 - 14.1 \ = \ 11.7$



Original native-lesson illustration; labels belong to its worked example.

2 Practice

2.1 For classes 0–5, 5–10, 10–15 with frequencies 4, 7, 9, write the cumulative frequencies. [2]

2.2 At which x-values are the plotted points for that table? [2]

2.3 Where does the median read on a curve for 40 values? [1]

3 Exam-style questions

3.1 *(Edexcel 4MA1 2HR June 2024 Q11 family, adapted.)* The times 60 workers spend working from home have cumulative frequencies 6, 17, 27, 42, 60 at upper boundaries 10, 15, 20, 25, 30 (hours). (a) Draw, or describe the plotting points of, the cumulative frequency graph. (b) Estimate the median. (c) Estimate the interquartile range. [5]

3.2 *(Original.)* For the same data: (a) estimate the 90th percentile; (b) how many workers spent MORE than 22 hours? [4]

3.3 *(Original.)* Explain, in one sentence each: (a) why the cumulative frequency curve never decreases; (b) why the median is read at 30 not 29.5 for this data. [2]