IGCSE MATHEMATICS • EXERCISE SHEET

E9.6 Cumulative frequency diagrams

Name: _____ Class: _____ Date: _____ **Total: 21 marks**

KEY WORDS cumulative frequency 累积频数 • cumulative frequency diagrams 累积频数图 • percentile 百分位数 • frequency 频数 • quartile 四分位数

Objective

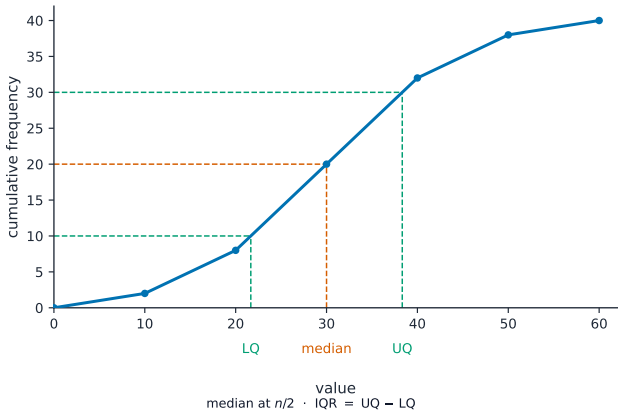
Build the skills to answer Extended exam questions on **cumulative frequency diagrams** 累积频数图 — the running total, and reading the **median, quartiles and percentiles** 中位数、四分位数、百分位数 from the curve.

You must be able to:

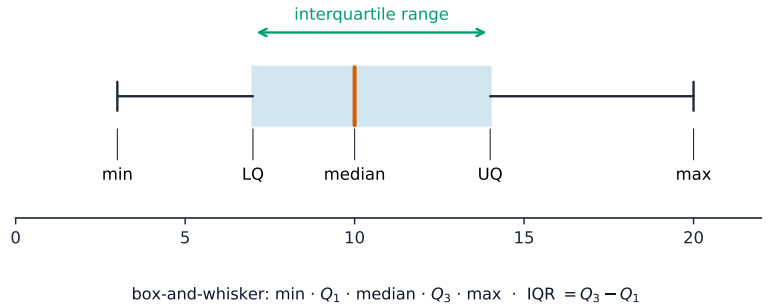
- complete a cumulative frequency table
- read the median and quartiles from a cumulative frequency curve
- find the interquartile range

1 Worked examples

■ Reading a cumulative frequency curve



The cumulative frequency is a running total



Quartiles from the curve feed a box-and-whisker plot

- **Cumulative frequency** 累积频数: add each frequency to the running total; plot at the **upper** end of each class.
- **Median** at $\frac{1}{2}$ of the total; **LQ** at $\frac{1}{4}$; **UQ** at $\frac{3}{4}$.
- **IQR** = UQ − LQ.

Answer shapes: **M1** a correct method, **A1** the correct answer.

2 Practice

2.1 The frequencies of four classes are 5, 8, 10, 7. Write down the cumulative frequencies. [2]

2.2 A data set has a total cumulative frequency of 80. At what cumulative frequency do you read the median? [1]

2.3 At what cumulative frequency do you read the lower quartile if the total is 80? [1]

3 Exam-style questions

3.1 A cumulative frequency curve is drawn for 200 students' test marks.

(a) State the cumulative frequency at which you read the upper quartile. [1]

(b) From the curve, the lower quartile is 42 and the upper quartile is 63. Find the interquartile range. [2]

3.2 The cumulative frequencies $0, 6, 20, 45, 60$ are given for five class boundaries. Find the total frequency, and the cumulative frequency used to read the median. [2]

3.3 The times, t minutes, taken by 80 students to finish a task are summarised below.

Time (t min)	$0 < t \leq 10$	$10 < t \leq 20$	$20 < t \leq 30$	$30 < t \leq 40$	$40 < t \leq 50$
Frequency	6	18	30	20	6

(a) Complete a cumulative frequency table and draw the cumulative frequency diagram. [4]

(b) Use your diagram to estimate the median and the interquartile range. [4]

(c) Estimate how many students took longer than 35 minutes. [2]

(d) Explain why every value read from this diagram is an **estimate**. [2]

Solutions

Marking: **M1** a correct method, **A1** the correct answer.

2.1 $5, 13, 23, 30$.

2.2 at $\frac{80}{2} = 40$.

2.3 at $\frac{80}{4} = 20$.

3.1 (a) at $\frac{3}{4} \times 200 = 150$. (b) IQR $= 63 - 42 = 21$.

3.2 total frequency $= 60$; the median is read at $\frac{60}{2} = 30$.

3.3 (a) Cumulative frequencies 6, 24, 54, 74, 80; points plotted at the **upper** class boundaries $10, 20, 30, 40, 50$; a smooth increasing curve drawn through them.
(b) The median is at the 40th value, giving about 27 minutes. The lower quartile is at the 20th value, about 18 min, and the upper quartile at the 60th, about 32 min; interquartile range $\approx 32 - 18 = 14$ minutes.
(c) Reading up from 35 gives a cumulative frequency of about 64; so about $80 - 64 = 16$ students took longer.
(d) The original data were **grouped**, so the individual times are no longer known; the curve assumes the values are spread evenly within each class, which is only an assumption — so every reading from it is an estimate.