

E9.3 Averages and measures of spread

Name: _____ Class: _____ Date: _____

Total: 17 marks

KEY WORDS median 中位数 • mode 众数 • interquartile range 四分位距 • modal class 众数组
 • estimated mean 估计平均数

Objective

Build the skills to answer Extended exam questions on **averages and measures of spread** 平均数与离散程度 — the **mean** 平均数, **median** 中位数, **mode** 众数 and **range** 极差, the **interquartile range** 四分位距, and an **estimated mean** 估计平均数 from a grouped frequency table.

You must be able to:

- find the mean, median, mode and range of a list of values
- find the quartiles and the interquartile range
- estimate the mean from a grouped frequency table, and say why it is only an estimate

1 Worked examples

■ The median needs the list in order, every time



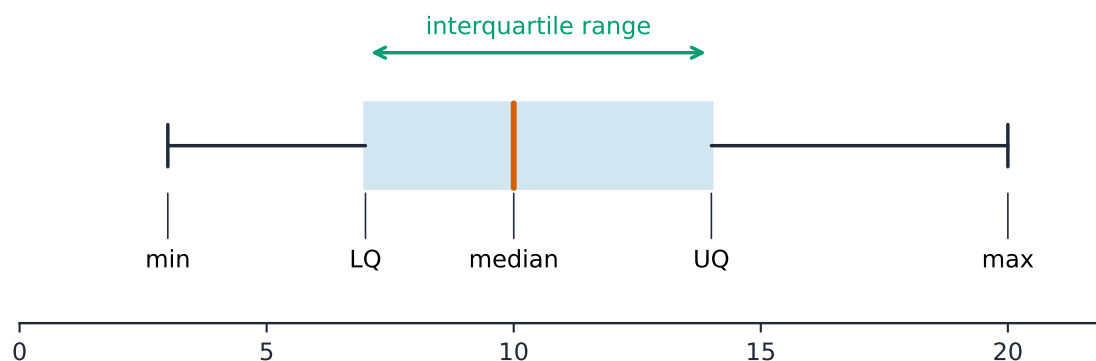
median = 3

$$\text{mean} = \frac{2+3+3+5+7}{5} = 4$$

mode = 3 (most common)

$$\text{range} = 7 - 2 = 5$$

Three different averages, three different answers



box-and-whisker: min · Q_1 · median · Q_3 · max · IQR = $Q_3 - Q_1$

The box spans the interquartile range; the whiskers reach the extremes

- **Mean** = total $\div$ how many. **Median** is the middle value of the ORDERED list. **Mode** is the most common value.
- **Range** = largest – smallest. **IQR** = $Q_3 - Q_1$, which ignores the extremes and so is less affected by an outlier.
- **Estimated mean from a grouped table:** use the MIDPOINT of each class, then $\frac{\sum fx}{\sum f}$.
- **Why it is an estimate:** the exact values inside each class are unknown, and the midpoint assumes they are evenly spread.

Answer shapes (marked by **method marks** — M1 for a correct method, A1 for the correct answer): the midpoints row, and the $\sum fx$ total, are separate method marks in an estimated-mean question.

2 Practice

2.1 Find the mean, median, mode and range of 4, 7, 7, 9, 13.

[4]

2.2 Find the median and the interquartile range of 3, 5, 8, 8, 11, 14, 17, 21. [3]

2.3 The mean of six numbers is 14. Find their total. [1]

3 Exam-style questions

3.1 The table shows the times t minutes taken by 30 students.

Time (t minutes)	Frequency
$0 < t \leq 10$	4
$10 < t \leq 20$	11
$20 < t \leq 30$	9
$30 < t \leq 40$	6

(a) Calculate an estimate of the mean time, correct to 3 significant figures. [4]

(b) Write down the modal class. [1]

(c) Explain why the mean can only be an estimate. [1]

3.2 The mean of five numbers is 12. A sixth number is added and the mean becomes 13. Find the sixth number. [3]
