

# 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



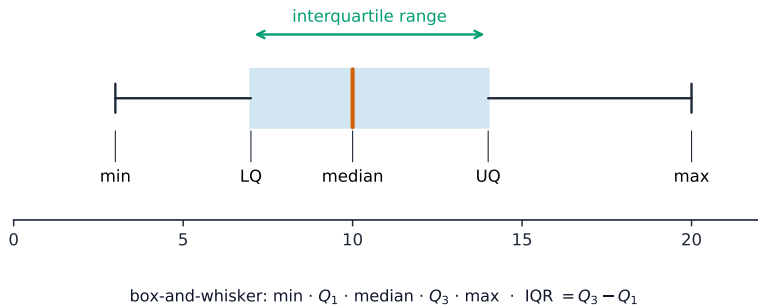
median = 3

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

mode = 3 (most common)

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

Three different averages, three different answers



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

- **Mean** = total ÷ 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]

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

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

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**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]

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

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

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

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