

5.1 Representation of data

Name: _____ Class: _____ Date: _____

Total: 12 marks

KEY WORDS mean

- box-and-whisker plot

- standard deviation

- median

- cumulative frequency

Objective

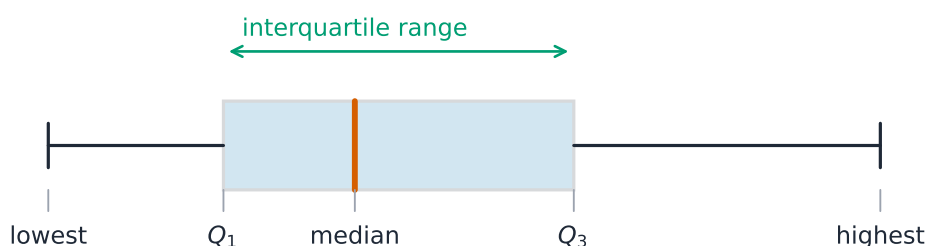
Build the skills to answer exam questions on **representation of data** – diagrams, averages, and **measures of spread** (range, IQR, standard deviation).

You must be able to:

- read a box-and-whisker plot and a cumulative frequency graph
- find the mean, median and mode
- find the standard deviation from $\sum x$ and $\sum x^2$

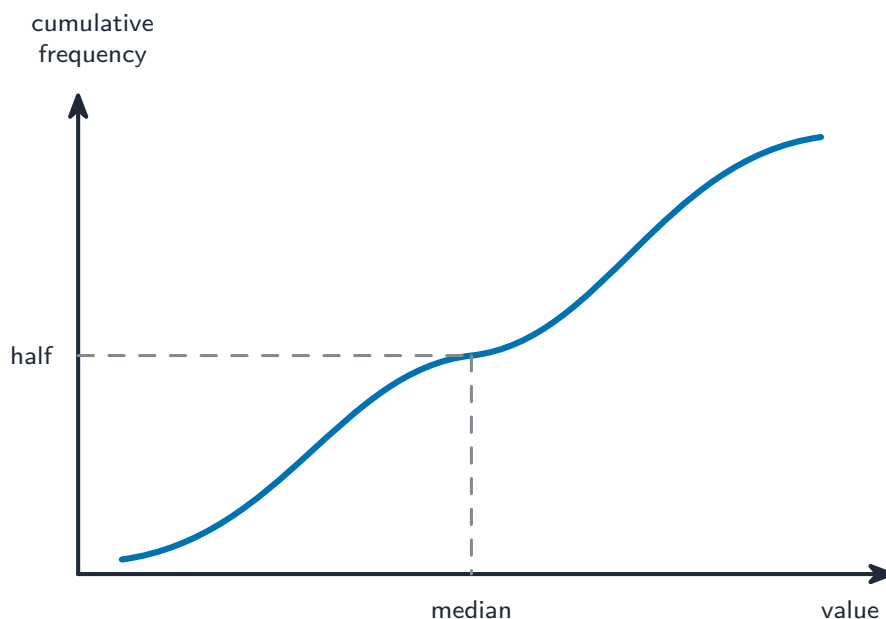
1 Key knowledge and worked examples

■ Spread from totals



box: Q_1 – Q_3 · median line · whiskers: min/max

The box spans Q_1 to Q_3 ($IQR = Q_3 - Q_1$); the whiskers reach the extremes



Read the median across from half the total frequency; the quartiles from $\frac{1}{4}$ and $\frac{3}{4}$

$$n = 10, \sum x = 50, \sum x^2 = 300: \bar{x} = 5; \sigma = \sqrt{\frac{300}{10} - 5^2} = \sqrt{5} = 2.24.$$

■ Key knowledge: Unequal histogram intervals

Histogram area represents frequency. The height is frequency density, so unequal class widths cannot use raw frequency as bar height.

■ Worked example: Unequal histogram intervals

Two classes are $0 \leq x < 10$ with frequency 20 and $10 \leq x < 30$ with frequency 30. Their densities are $d_1 = 20/10 = 2$ and $d_2 = 30/20 = 1.5$. The second bar is lower but has the greater area: $20(1.5) = 30$. This is why the vertical axis must say frequency density.

2 Practice

2.1 Find the interquartile range when $Q_1 = 14$ and $Q_3 = 23$.

[1]

2.2 For 8 values, $\sum x = 96$. Find the mean.

[1]

3 Exam-style questions

3.1 For data with $\sum x = 200$, $\sum x^2 = 4500$ and $n = 10$, the variance is: [1]

- ☐ **A** 25
B 50
C 450
D 5

3.2 The masses (kg) of 7 parcels are 3, 5, 5, 8, 9, 12, 16.

(a) Find the median and the interquartile range. [3]

(b) Find the mean and the standard deviation. [4]

3.3 A cumulative frequency graph for 200 students rises smoothly. The median is read as 52, $Q_1 = 40$ and $Q_3 = 63$. Estimate how many students scored more than 63. [2]

Solutions

Each answer shows the steps, then the **result**.

2.1

- $\text{IQR} = 23 - 14 = 9$

2.2

- $\bar{x} = \frac{96}{8} = 12$

3.1 B

- $\text{Variance} = \frac{4500}{10} - \left(\frac{200}{10}\right)^2 = 450 - 400 = 50$

3.2

(a)

- ordered already; median (4th) = 8; $Q_1 = 5$, $Q_3 = 12$, $\text{IQR} = 7$

(b)

- $\sum x = 58$, $\bar{x} = \frac{58}{7} = 8.29$; $\sum x^2 = 9 + 25 + 25 + 64 + 81 + 144 + 256 = 604$;
 $\sigma = \sqrt{\frac{604}{7} - 8.29^2} = \sqrt{86.29 - 68.7} = \sqrt{17.6} = 4.20$

3.3

- above Q_3 is the top quarter = $\frac{1}{4} \times 200 = 50$ students