

2.7 Calculate spread with an explicit quartile and variance convention

Name: _____ Class: _____ Date: _____

Total: 24 marks

KEY WORDS range 全距 • interquartile range (IQR) 四分位距 • standard deviation 标准差

Objective

Calculate spread with an explicit quartile and variance convention. Original GAC004-aligned practice, not an official assessment. Show the method as well as the result. All applied scenarios are invented classroom problems.

1 Key knowledge and worked examples

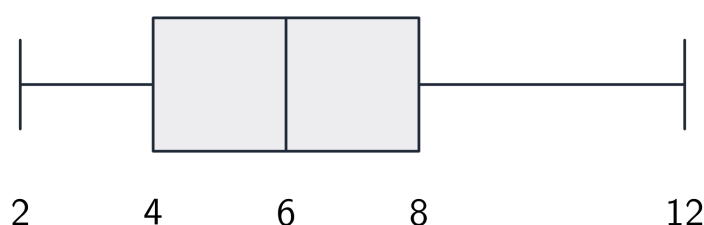
■ Key knowledge: equal means can conceal different distributions

The **range** 全距 is maximum minus minimum. The **interquartile range (IQR)** 四分位距 is $Q_3 - Q_1$. For this sheet, order the data, split an even-sized list into equal halves, and use each half's median for its quartile. For an odd list, exclude the overall median before finding half-list medians. Other software may use different conventions.

A box plot shows the median and quartiles; this sheet's whiskers run to minimum and maximum, not to an automatic outlier fence. **Standard deviation** 标准差 measures spread using squared deviations. Use population $\sigma = \sqrt{\sum(x - \mu)^2/n}$ for a complete supplied population; sample estimate $s = \sqrt{\sum(x - \bar{x})^2/(n - 1)}$ requires the stated sample convention. Standard deviation has the original units; variance has squared units.

■ Worked example: read a five-number summary rather than every observation

whiskers: minimum to maximum



Known five-number summary: minimum 2, $Q_1 = 4$, median 6, $Q_3 = 8$, maximum 12. The overall span and middle-half span are different.

$$R = x_{max} - x_{min} = 12 - 2 = 10$$

$$IQR = Q_3 - Q_1 = 8 - 4 = 4$$

The box does not identify every original value, the sample size or why the spread arose.

2 Practice

2.1 Find the range of 3, 5, 8 and 12. [2]

2.2 A five-number summary is minimum 4, first quartile 7, median 9, third quartile 13, maximum 20. Find its IQR and range. [2]

2.3 Using the stated half-list convention, find the median, first quartile and third quartile of 2, 4, 6, 8, 10, 12, 14, 16. [3]

2.4 The complete population is 2, 4, 6. Find its mean, population variance and population standard deviation, giving the latter to 3 significant figures. [3]

3 Exam-style questions

3.1 Two complete populations are A: 4, 5, 6 and B: 1, 5, 9. Find each mean and population standard deviation, to 3 significant figures. Compare their spread without claiming a cause. [6]
