

Exercise walk-through

C9.3

Averages and range

IGCSE Mathematics

You must be able to

- Find mean, median, mode and range from lists or frequencies
- Use frequency-weighted totals for a table mean
- Calculate a missing value from a given mean

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The method

Method — Key knowledge: Averages and range

Mean is sum divided by count. Median is the middle value after sorting; with an even count, average the two middle values. Mode is the most frequent value; there may be more than one or none. Range is maximum minus minimum. For an ungrouped frequency table, $\bar{x} = \sum fx / \sum f$ and cumulative counts locate the median. An extreme value can change mean and range a lot; median is less affected.

Exercises 2.1-2.3

2.1 Find the mean of 3, 5, 7, 9.

[2]

2.2 Find the median of 8, 1, 6, 3, 5.

[2]

2.3 Find the mode and range of 2, 6, 6, 8, 11.

[2]

Exercises 2.1·2.3

2.1 Find the mean of 3, 5, 7, 9. [2]

2.1

- $\bar{x} = 24/4 = \mathbf{6}$.

2.2 Find the median of 8, 1, 6, 3, 5. [2]

2.2

- Sort to 1, 3, 5, 6, 8; the middle is **5**.

2.3 Find the mode and range of 2, 6, 6, 8, 11. [2]

2.3

- Most frequent gives **mode 6**; $R = 11 - 2 = \mathbf{9}$.

Exercise 2.4

2.4 Values 0, 1, 2 have frequencies 2, 4, 2. Find the mean.

[2]

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- $\bar{x} = (0(2) + 1(4) + 2(2))/(2 + 4 + 2) = 8/8 = \mathbf{1}.$

Exercise 3.1 (a)

3.1 Apply the averages and range methods below. Show working and include units where appropriate.

(a) The scores are 4, 7, 7, 8, 9, 13. Find their mean and median.

[2]

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(a)

- $\bar{x} = 48/6 = \mathbf{8}$; median $M = (7 + 8)/2 = \mathbf{7.5}$.

Exercise 3.1 (b)

3.1 Apply the averages and range methods below. Show working and include units where appropriate.

(b) Find their mode and range.

[2]

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(b) Find their mode and range.

[2]

(b)

- **Mode 7; $R = 13 - 4 = 9$.**

Exercise 3.1 (c)

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(c) The score 13 is corrected to 25. Find the new mean and median, and state which changes less. [2]

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(c)

- New sum is 60: $\bar{x} = 60/6 = \mathbf{10}$; median stays **7.5**, so **median changes less**.

Exercise 3.2 (a)

3.2 A measurement table has masses 1, 2, 3, 4 kg with frequencies 2, 3, 4, 1 respectively.

(a) Find the mean mass, median mass and mode. [3]

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(a)

- Weighted total $T = 1(2) + 2(3) + 3(4) + 4(1) = 24$; total frequency 10, so mean **2.4 kg**.
- Positions 5 and 6 are 2 and 3, so median **2.5 kg**.
- Highest frequency gives mode **3 kg**.

Exercise 3.2 (b)

3.2 A measurement table has masses 1, 2, 3, 4 kg with frequencies 2, 3, 4, 1 respectively.

(b) An eleventh mass is added and the new mean is exactly 2.5 kg. Find the added mass and the new range. [3]

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(b)

- New total $T_n = 11(2.5) = 27.5$.
- Added mass $x = T_n - 24 = \mathbf{3.5}$ kg.
- Extremes stay 1 and 4, so new range $R = 4 - 1 = \mathbf{3}$ kg.