MATHS FIELD GUIDE · GRADE 10

Grouped mean: direct and assumed-mean methods

OPENING PROBLEM

Estimate the mean using all ten observations.

Class	0–10	10–20	20–30
Frequency	2	6	2
Midpoint	5	15	25

02 Read the frequencies before estimating
03 Rules and worked cases
04 From the givens to the answer
05 Ask what one observation represents
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07 Check your reasoning

ILLUSTRATED PROBLEM SHEET

Read the frequencies before estimating

For grouped values, a midpoint, an interpolation or a frequency peak answers a different question.

1

Class	0–10	10–20	20–30
Frequency	2	6	2
Midpoint	5	15	25

Estimate the mean using all ten observations.

Weighted total = 2 × 5 + 6 × 15 + 2 × 25 = 150. Divide by ten for 15.

2

Class	0–10	10–20	20–30
Frequency	4	10	6
Cumulative	4	14	20

Where does the median lie?

Half the total is 10. Interpolate six tenths of the way across the middle class: 10 + 6 = 16.

3

Class	0–10	10–20	20–30
Frequency	3	9	6

Estimate the mode of these equal-width classes.

The rise to the peak is 6 and the fall is 3. Estimate 10 + 10 × 6/9 = 16⅔.

4

Midpoint	10	20	30
Frequency	2	1	3
Step code	−1	0	1

Choose centre 20 and step 10. Estimate the mean.

Weighted code sum = 1. The mean is 20 + 10/6 = 65/3.

Halve every frequency proportionally grouped mean unchanged.

Add five to every class boundary grouped mean rises by five.

CHAPTER PROBLEM

Find the midpoint of class 30–40.

35. Average the boundaries.

MATHS REFERENCE · GRADE 10

Grouped mean: direct and assumed-mean methods

Rules, conditions and worked cases

Recognise the case	Mathematical reasoning
Direct method	Midpoints 5,15,25 with frequencies 2,4,2 give ∑fx = 120 and N = 8. Estimated mean 15.
Assumed mean	Choose A = 15. Weighted deviations −20,0,+20 sum to zero, so A + ∑fd/N = 15.
Interpretation	The class counts are exact but the mean is estimated because each class is represented by its midpoint.

Read the representations

Midpoints represent intervals, not exact raw values

A grouped table records how many observations lie in each interval. The exact individual values are no longer known.

Use class midpoint x=(lower+upper)/2 to represent each interval. The estimated mean is ∑fx/∑f. Frequencies are weights, so do not average midpoints without them.

Grouped observations

Class	Frequency f	Midpoint x	Cumulative f
0–10	2	5	2
10–20	6	15	8
20–30	2	25	10

An assumed mean changes the arithmetic, not the answer

Choose A near the centre and set d=x−A. Since x=A+d, ∑fx=A∑f+∑fd.

Dividing by N=∑f gives mean=A+∑fd/N. This is algebraically the same midpoint estimate as the direct method.

1. **Direct**Mean ≈ ∑fx / N
2. **Centre the values**d=x−A
3. **Reconstruct**Mean ≈ A + ∑fd/N

Scores	2	4	9
Total	15		

What is the mean?

Redistribute fifteen points equally across three scores. Each gets five.

WORKED EXAMPLES

From the givens to the answer

Calculate the midpoint mean in two ways

1. For classes 0–10,10–20,20–30 with frequencies 3,4,3, the midpoints are 5,15,25 and N=10.
2. ∑fx=15+60+75=150; mean estimate=15.
3. Choose A=15. Deviations −10,0,10 give ∑fd=−30+0+30=0; reconstruction gives 15.
4. The two calculations agree, but raw observations could yield a slightly different exact mean.

Why can two means agree?

For intervals 0–10, 10–20, 20–30 the frequencies are 2, 5, 3. Estimate the mean using 15 as the centre.

1. Midpoints are 5, 15, 25. Weighted deviations from 15 total −20 + 0 + 30 = 10. Divide by 10 observations and add 15 to get 16. Direct check: (10 + 75 + 75)/10 = 16.

Check another case

Example 1

With A=70,N=20 and ∑fd=60, find the mean estimate.

73

Mean estimate = A + ∑fd/N = 70 + 60/20 = 73.

Example 2

A=30, class midpoint=38. Find deviation d.

8

d=x−A.

Which score is the median?

2 4 9

Four is in the middle of the ordered list. It differs from the mean of five.

ILLUSTRATED PROBLEM SHEET

Ask what one observation represents

Combine totals and counts before dividing. A mean of group means weights groups equally.

1

Group	Count	Mean
A	4	80
B	16	60

What is the combined mean?

(320 + 960)/20 = 64. The larger group pulls the mean towards 60.

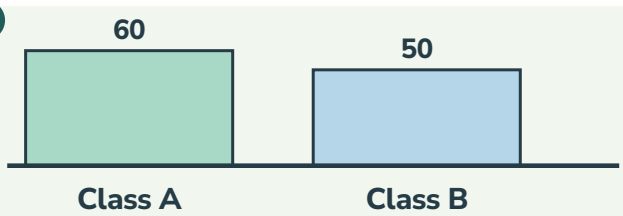
2

Value	2	5	8
Count	1	2	1

Find the mean without writing the full list.

Weighted total 2 + 10 + 8 = 20. Four observations give mean 5.

3



Bars show percent cycling. A has 20 pupils and B has 30. Which has more cyclists?

A has 12 cyclists and B has 15. A higher percentage need not mean a higher count.

4

Fresh sample: 20 pupils

↓

Only cycling-club members asked

Why might its travel survey overstate cycling?

The selection method favours cyclists. More responses from that same club do not remove the bias.

A group with zero observations **contributes zero weight.**

All groups of equal size **group means receive equal weights.**

CHAPTER PROBLEM

With A=50,N=20 and ∑fd=60, find the mean estimate.

53. Mean estimate = A + ∑fd/N = 50 + 60/20 = 53.

QUESTION BANK · FOLD OR COVER THE RIGHT COLUMN

Check your reasoning

Data A

grouped data

Class	20–30	30–40	40–50
Frequency	2	6	2

Classes are lower-inclusive, upper-exclusive; equal width 10.

Try the problem	Solution and reasoning
01 · Data A Estimate the mean of the supplied grouped data.	35 The class midpoints are 25, 35 and 45. Their weighted total is 2 × 25 + 6 × 35 + 2 × 45 = 350. Divide by the 10 observations to estimate the mean as 35.
02 Why can the grouped mean differ from the exact mean of the original data?	The calculation puts every observation at its class midpoint. Their actual positions are unknown.
03 What if both group sizes are equal?	Then the combined mean equals the simple average of the two group means.
04 Why are grouped means usually estimates? A) Midpoints replace unknown individual observations. B) Division always rounds. C) Frequencies are ignored. D) Intervals have no width.	Midpoints replace unknown individual observations. The within-class values have been lost.
05 A grouped table has frequencies 4,7,9. Find N.	20 Add all frequencies.
06 A=10, class midpoint=18. Find deviation d.	8 d=x−A.

1 3 3 9

Which score is most frequent?

Three occurs twice. It is also the median. The range is 9 − 1 = 8.

QUESTION BANK · FOLD OR COVER THE RIGHT COLUMN

Check your reasoning

Data A

grouped data

Class	30–40	40–50	50–60
Frequency	2	6	2

Classes are lower-inclusive, upper-exclusive; equal width 10.

Try the problem	Solution and reasoning
07 Derive the assumed-mean formula from the direct mean formula.	Use $x=A+d$ in $\sum fx$. Expand to $A\sum f+\sum fd$, then divide by $N=\sum f$.
08 · Data A Explain why simply averaging the three supplied midpoints is not a generally valid method.	Their frequencies can differ, so observations in each interval must carry their full weight. The mean must use $\sum fx/N$; equality with an unweighted average here follows from symmetry, not a universal rule.
09 Find the midpoint of class 40–50.	45 Average the boundaries.
10 Find the midpoint of class 50–60.	55 Average the boundaries.
11 Find the midpoint of class 60–70.	65 Average the boundaries.

List	Low	High
A	4	6
B	1	9

The two-value lists both average five. Do they spread equally?

No. The ranges are two and eight.

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