MATHS FIELD GUIDE · GRADE 10

Mode of grouped data

OPENING PROBLEM

Which exact value is the mode?

1 2 2 4 6

02 Read the height of a frequency peak
03 Rules and worked cases
04 From the givens to the answer
05 Read the frequencies before estimating
06 Check your reasoning
07 Check your reasoning

ILLUSTRATED PROBLEM SHEET

Read the height of a frequency peak

For equal-width classes, look for the highest frequency. Adjacent frequencies help locate a grouped estimate.

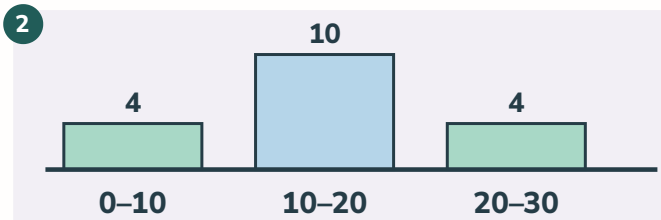
1

1 2 2 4 6

Which exact value is the mode?

Two appears twice. Each other value occurs once.

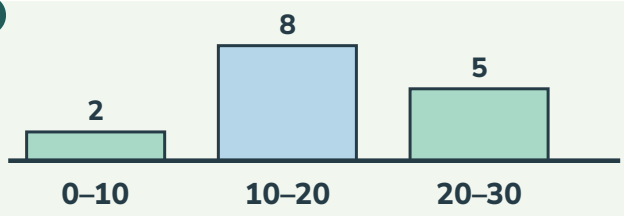
2



Where is the estimated peak with equal rises and falls?

Halfway through 10–20. The estimate is 15.

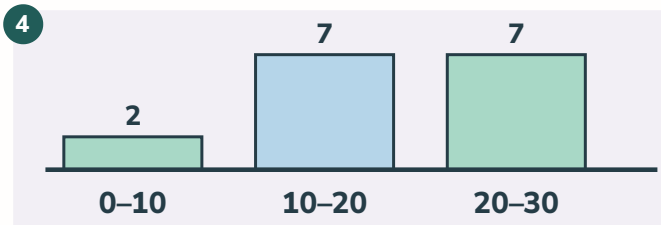
3



How does an unequal peak move the estimate?

Rise 6, fall 3. Move 6/9 of the class width above 10. The estimate is 16⅔.

4



Can the usual one-peak calculation select a unique modal class?

Two classes tie. Report the tie instead of forcing a unique class.

All individual values occur once
no uniquely most frequent value.

Two values share the greatest frequency
both are modes.

CHAPTER PROBLEM

$l=30, h=10, f_0=4, f_1=10, f_2=6$. Estimate the mode.

36. The fraction is $6/(20-4-6)=0.6$.

MATHS REFERENCE · GRADE 10

Mode of grouped data

Rules, conditions and worked cases

Recognise the case	Mathematical reasoning
Find the modal class	Equal-width classes [0,10), [10,20), [20,30) have counts 3,9,6. The middle class peaks.
Estimate the mode	Rise from previous count = 6 and fall to next = 3. Estimate $10 + 10 \times 6/(6 + 3) = 16\frac{2}{3}$.
Read the result	The estimate falls inside the modal class, towards its higher end. Tied peaks need separate interpretation.

Read the representations

A modal class contains the largest frequency

For equal-width grouped data with one clear modal class, estimate mode$\approx l + [(f_1 - f_0)/(2f_1 - f_0 - f_2)]h$.

Here f_1 is the modal-class frequency, f_0 the preceding frequency and f_2 the following one. Use class boundaries and width h.

Grouped observations

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

Do not turn an empirical relation into an identity

Mode$\approx$3 median−2 mean is a rough empirical relationship sometimes useful for suitable unimodal data.

It is not true for every distribution. Use ≈ and do not replace the grouped-mode formula with it when the table is available.

1. **Locate one clear peak**Find the unique highest-frequency interval
2. **Neighbour comparison**Identify f_0, f_1, f_2
3. **Estimate location**Use l and h from the modal class

Class	0–10	10–20	20–30
Frequency	4	7	3

How many observations are at least 10 and below 30?

Seven plus three gives ten. Use the stated interval endpoints.

WORKED EXAMPLES

From the givens to the answer

Estimate the mode from the neighbouring heights

1. Classes 0–10,10–20,20–30 have frequencies 3,8,5, so the modal class is 10–20.
2. $l=10, h=10, f_0=3, f_1=8, f_2=5$.
3. Mode$\approx 10+[(8-3)/(16-3-5)]10=16.25$.
4. The modal class is certain from the table; its exact raw-data mode is not known.

Find where the frequency peak falls

For equal-width intervals 0–10, 10–20, 20–30 the frequencies are 3, 9, 6. Estimate the mode.

1. The middle class peaks. Its rise from the previous frequency is 6 and its fall to the next is 3. Move 6/(6 + 3) of 10 past the lower boundary 10. The estimated mode is 50/3.

Check another case

Example 1

Mean=72, median=73. Use the empirical relationship to estimate the mode.

75

The empirical estimate is 3 × median − 2 × mean = 219 − 144 = 75.

Example 2

$l=70, h=10, f_0=4, f_1=10, f_2=6$. Estimate the mode.

76

The fraction is $6/(20-4-6)=0.6$.

Which comparison makes a modal class?

For equal-width classes 0–5, 5–10, 10–15 with frequencies 4, 10, 4, the middle class is modal. Its rise and fall are both six.

The grouped estimate lies halfway along that class, at 7.5. The actual most frequent individual value cannot be recovered from group totals.

Class	0–10	10–30
Frequency	4	8
Freq/width	0.4	0.4

How can unequal-width histogram bars have equal height?

Frequency density is frequency divided by width. The wider bar has twice the area and twice the frequency.

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

Mean=52, median=53. Use the empirical relationship to estimate the mode.

55. The empirical estimate is 3 × median − 2 × mean = 159 − 104 = 55.

QUESTION BANK · FOLD OR COVER THE RIGHT COLUMN

Check your reasoning

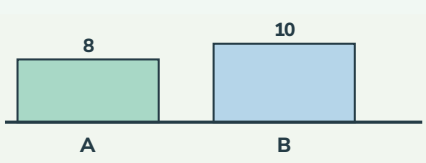
Data A

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 mode of the supplied grouped data.	35 The 30–40 class has the highest frequency, 6. Both neighbouring classes have frequency 2. The grouped estimate is $30 + (6 - 2)/((6 - 2) + (6 - 2)) \times 10 = 35$.
02 Does the grouped mode identify the most frequent exact recorded value?	No. Within-class values were combined, so their individual counts are unknown.
03 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.
04 A table has two separated classes tied for highest frequency. What should happen? A) Force either into the single-mode formula. B) Report the tied peaks and seek an appropriate description. C) Average their boundaries to obtain an exact mode. D) Ignore one peak.	Report the tied peaks and seek an appropriate description. The single clear modal-class assumption is not satisfied.
05 For $f_0=5, f_1=12, f_2=9$, find $2f_1-f_0-f_2$.	10 $24-5-9=10$.
06 Classes 5–15, 15–25, 25–35 have frequencies 2, 9, 4. Give l for the modal class.	15 The unique maximum frequency 9 occurs in 15–25.



These bars share a zero baseline. How large is the ratio B:A?

10/8 = 1.25. Starting an axis at 7 instead could exaggerate the apparent difference.

QUESTION BANK · FOLD OR COVER THE RIGHT COLUMN

Check your reasoning

Try the problem	Solution and reasoning
07 Why should mode≈3 median−2 mean use an approximation symbol?	It is an empirical pattern, not an algebraic identity for all datasets. Actual mean, median and mode can violate it.
08 Distinguish a modal class from an estimated mode.	The modal class is the interval with greatest frequency. The formula estimates a value within it from the neighbouring frequencies and boundaries.
09 $l=40, h=10, f_0=4, f_1=10, f_2=6$. Estimate the mode.	46 The fraction is $6/(20-4-6)=0.6$.
10 $l=50, h=10, f_0=4, f_1=10, f_2=6$. Estimate the mode.	56 The fraction is $6/(20-4-6)=0.6$.
11 $l=60, h=10, f_0=4, f_1=10, f_2=6$. Estimate the mode.	66 The fraction is $6/(20-4-6)=0.6$.

Group	Under 10	Total
A	6	10
B	10	25

Which group has the larger proportion under ten?

A has 60%; B has 40%. Compare shares when sample sizes differ.

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