

# Median of Grouped Data — Class 10

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The median is the middle-most observation. **Median** =  $l + ((n/2 - cf) / f) \times h$   
 Start at the lower limit of the median class, then walk into it by the fraction you still have to cross.

## The two definitions everything rests on

**Median.** The value of the middle-most observation once the data is in order — half the observations lie below it, half above. Because it depends on **position** and not on size, extreme values do not pull it up or down.

**Cumulative frequency (cf).** The running total of frequencies up to and including a class — how many observations fall below that class's upper limit. **Build this column first.** Without it you cannot find the median class, and the formula has nothing to stand on.

**Condition:** the class intervals must be **continuous**. Classes such as 118–126, 127–135 become 117.5–126.5, 126.5–135.5 by moving each boundary 0.5 before you start.

## The method, worked on one data set

| Class interval | Frequency (f) | Cumulative frequency (cf) |                                                       |
|----------------|---------------|---------------------------|-------------------------------------------------------|
| 0–10           | 7             | 7                         |                                                       |
| 10–20          | 10            | 17                        | ► cf of the class <i>before</i>                       |
| <b>20–30</b>   | <b>15</b>     | <b>32</b>                 | ► first cf $\geq n/2 \Rightarrow$ <b>median class</b> |
| 30–40          | 8             | 40                        |                                                       |
| 40–50          | 10            | 50                        | ► $n = 50$ , so $n/2 = 25$                            |

$l = 20$ ,  $cf = 17$ ,  $f = 15$ ,  $h = 10 \Rightarrow$  Median =  $20 + ((25 - 17)/15) \times 10 = 20 + (8/15) \times 10 = 20 + 5.33 = \mathbf{25.33}$ .

**Cross-check with the empirical relationship.**  $3 \text{ Median} = \text{Mode} + 2 \text{ Mean}$ . On this same data mean = 25.8 and mode = 24.17, so Median  $\approx (24.17 + 51.6)/3 \approx 25.26$  — close to 25.33, as an approximate relationship should be.

## Every symbol, and where it came from

| Symbol | What it is                                                       | Here | The trap                                |
|--------|------------------------------------------------------------------|------|-----------------------------------------|
| $l$    | Lower limit of the median class                                  | 20   | Not the lower limit of the first class  |
| $n$    | Total frequency, $\Sigma f$                                      | 50   | Use $n/2$ , never $(n + 1)/2$           |
| $cf$   | Cumulative frequency of the class <i>before</i> the median class | 17   | Taking 32, the median class's own cf    |
| $f$    | Frequency of the median class                                    | 15   | Using cf instead of f                   |
| $h$    | Class size                                                       | 10   | Forgetting to multiply by it at the end |

**Where this sits.** NCERT Class 10 Maths **Chapter 13, Statistics, Section 13.4**, "Median of Grouped Data", with **Exercise 13.3 (7 questions)** — note the offset: the topic is §13.4 but the exercise is 13.3, because §13.1 is the introduction and carries no exercise. The CBSE scope for Statistics reads in full: "*Mean, median and mode of grouped data (bimodal situation to be avoided).*" The cumulative frequency **table** is examinable; the cumulative frequency **graph (ogive)** was removed in the rationalisation, so no median is read off a curve. Unit VII, Statistics and Probability, is **11 of the 80** theory marks.

## Key takeaways

- **Median** =  $l + ((n/2 - cf) / f) \times h$  — five values, all read off one table.
- **Build the cf column first.** It is the step the whole method stands on, and it carries method marks.
- **Median class** = the first class whose cf is  $\geq n/2$ . Use  $n/2$ , not  $(n + 1)/2$ .
- **cf** is the cumulative frequency of the class **before** the median class — the single most common slip.
- Make classes **continuous** first; convert "less than" tables back to ordinary frequencies.
- **3 Median = Mode + 2 Mean** is approximate — a sanity check, not a substitute for the formula.

# Two questions the board actually sets

Page 2 of 2 · A “less than” table, then a missing frequency — the two variations that cost marks

## QUESTION 1 · 3 MARKS · SECTION C

The marks obtained by 80 students are given as a “less than” distribution. Find the median.

|                    |    |    |    |    |    |    |
|--------------------|----|----|----|----|----|----|
| Marks less than    | 10 | 20 | 30 | 40 | 50 | 60 |
| Number of students | 3  | 12 | 27 | 57 | 75 | 80 |

**Step 1 – convert back to ordinary frequencies.** Subtract each cumulative value from the next: 3, 9, 15, 30, 18, 5. They total 80, so nothing has been lost.

**Step 2 – write the cf column.** 3, 12, 27, **57**, 75, 80 – the numbers you were given, now beside their classes 0–10, 10–20, 20–30, 30–40, 40–50, 50–60.

**Step 3 – find  $n/2$  and the median class.**  $n = 80$ ,  $n/2 = 40$ . The first cf that reaches 40 is **57**, so the median class is **30–40**.

**Step 4 – read off l, cf, f, h.**  $l = 30$ ,  $cf = 27$  (the class before),  $f = 30$ ,  $h = 10$ .

**Step 5 – substitute.** Median =  $30 + ((40 - 27)/30) \times 10 = 30 + (13/30) \times 10 = 30 + 4.33 = \mathbf{34.33 \text{ marks}}$ .

**Check:** 40 lies between cf 27 and cf 57, so the median must lie inside 30–40 – and 34.33 does. An answer outside the median class is always an arithmetic error, never a new discovery.

## QUESTION 2 · THE MISSING FREQUENCY

The median of the following distribution is **28.5** and the total frequency is **60**. Find  $x$  and  $y$ .

|           |      |       |       |       |       |       |
|-----------|------|-------|-------|-------|-------|-------|
| Class     | 0–10 | 10–20 | 20–30 | 30–40 | 40–50 | 50–60 |
| Frequency | 5    | $x$   | 20    | 15    | $y$   | 5     |

**Step 1 – use the total.**  $5 + x + 20 + 15 + y + 5 = 60$ , so  $x + y = 15$ .

**Step 2 – locate the median class from the answer.** 28.5 lies in **20–30**, so  $l = 20$ ,  $f = 20$ ,  $h = 10$  and  $cf = 5 + x$ .

**Step 3 – substitute and solve.**  $28.5 = 20 + ((30 - (5 + x))/20) \times 10 \Rightarrow 8.5 = (25 - x)/2 \Rightarrow 17 = 25 - x \Rightarrow x = 8$ , and so  $y = 7$ .

**Check:** with  $x = 8$  the cf column is 5, 13, **33**, 48, 55, 60.  $n/2 = 30$ , the first cf past it is 33  $\Rightarrow$  median class 20–30  $\checkmark$ , and  $20 + ((30 - 13)/20) \times 10 = 20 + 8.5 = \mathbf{28.5 \checkmark}$ .

## WHERE THE MARKS ACTUALLY GO

- **No cf column on the page.** The examiner cannot award the method mark for a step you did in your head.
- **cf of the median class instead of the class before it.** One row too far down and every later line is wrong.
- **$(n + 1)/2$  instead of  $n/2$ .** Right for ungrouped data, wrong here – and it can move the median class.
- **Classes left discontinuous.** 118–126 must become 117.5–126.5 before  $l$  and  $h$  mean anything.

## NOW TRY THIS ONE

Find the median: 0–10  $\rightarrow$  5, 10–20  $\rightarrow$  15, 20–30  $\rightarrow$  20, 30–40  $\rightarrow$  8, 40–50  $\rightarrow$  2.

**Answer:** cf = 5, 20, **40**, 48, 50;  $n = 50$ ,  $n/2 = 25$ ; median class 20–30;  $l = 20$ ,  $cf = 20$ ,  $f = 20$ ,  $h = 10 \Rightarrow$  Median =  $20 + ((25 - 20)/20) \times 10 = \mathbf{22.5}$ .

## Practise this until the cf column is automatic

- ✓ **Chapter 1 is free** – start on examfront today, no payment needed.
- ✓ **Mistake identification** – find out whether it is your cf column or the formula that keeps slipping.
- ✓ **Anytime tests** – a timed set on median problems whenever you have twenty minutes.
- ✓ **Weekly tests** – keep Statistics warm while you move on to the next chapter.
- ✓ **Mock tests before the exam** – full 80-mark papers under real board timing.

[examfront.com](https://examfront.com)