CHAPTER 5

Measures of Central Tendency

CBSE · Statistics for Economics, CI-11 · Class 11

WHAT THIS CHAPTER DOES

Boards prep that builds confidence, not anxiety.

TODAY'S MISSION

Today's mission

WHY THIS MATTERS

Why three averages?

TOPIC

Before we begin — quick prerequisite check

TOPIC

A

Arithmetic Mean

TOPIC

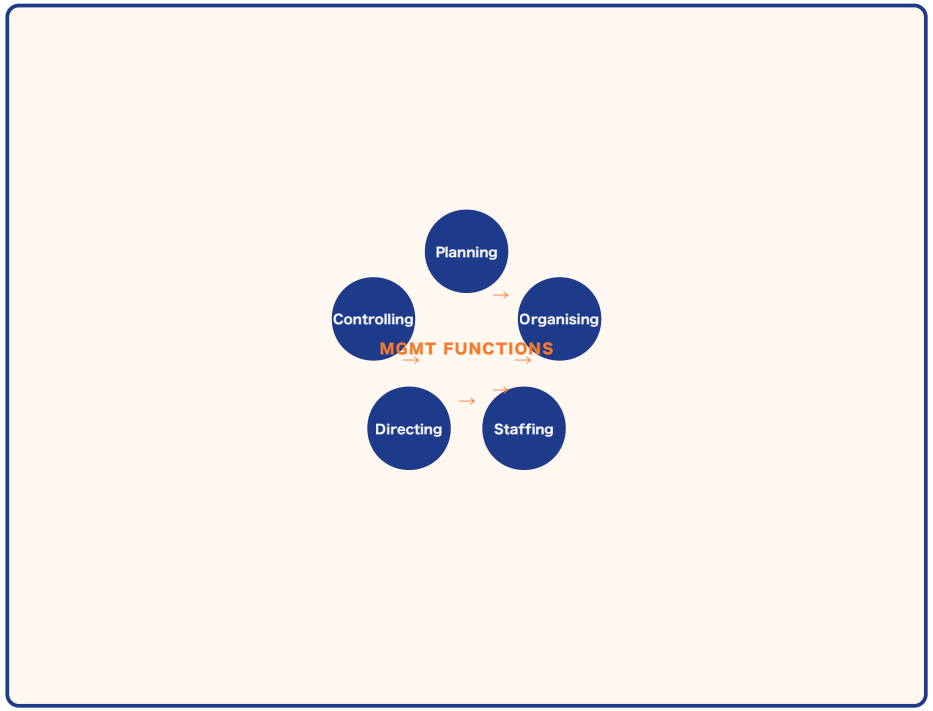
Arithmetic Mean — three methods, one answer

POINT 1	POINT 2	POINT 3

WORKED EXAMPLE

Worked Example 1 — AM by step-deviation

1. {'label': 'Set up class-marks (x)', 'work': 'x = 5, 15, 25, 35, 45. Pick A = 25 (middle class-mark). h = 10.'}
2. {'label': "Compute d' = (x – 25)/10", 'work': "d' = –2, –1, 0, 1, 2."}
3. {'label': "Compute fd'", 'work': "fd' = 5·(–2), 10·(–1), 20·0, 10·1, 5·2 = –10, –10, 0, 10, 10. Σfd' = 0."}
4. {'label': 'Apply formula', 'work': "x̄ = A + h · (Σfd'/Σf) = 25 + 10 · (0/50) = 25 + 0 = 25 marks."}



TRY IT · SOLVE BEFORE YOU PEEK

Quick check — Mean reflex

> Work it out before you flip the answer.

SOLUTION

TOPIC

Properties of Arithmetic Mean

TOPIC

Weighted Mean and Combined Mean

POINT 1	POINT 2

TOPIC

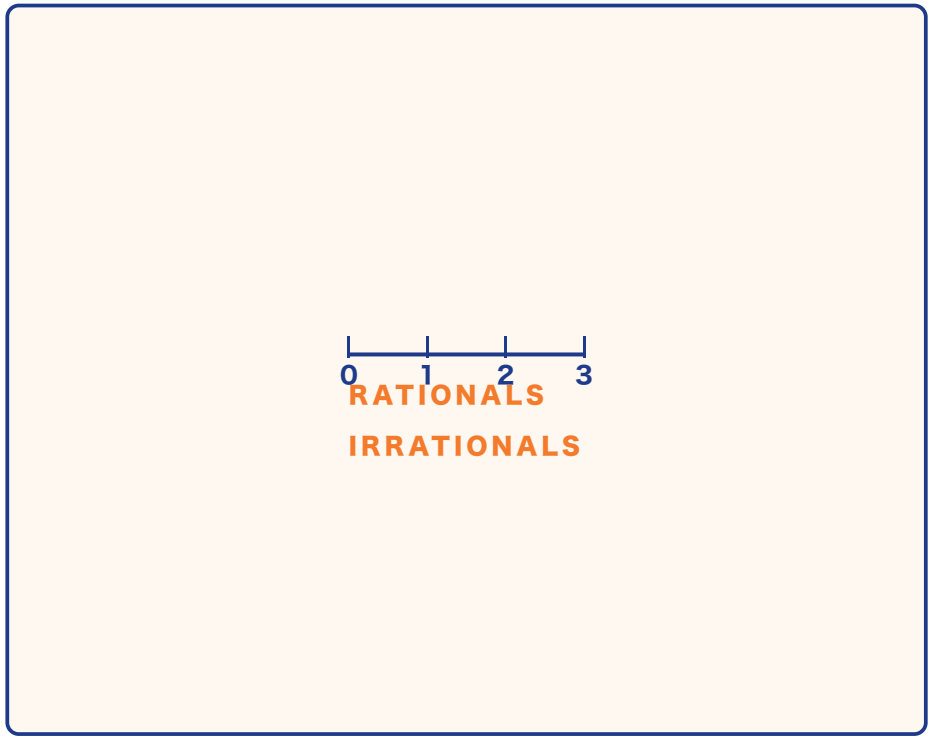
B

Median

WORKED EXAMPLE

Worked Example 2 — Median of continuous data

1. {'label': 'Build cumulative frequency (c.f.)', 'work': 'c.f. = 4, 10, 20, 25, 30. So N = 30.'}
2. {'label': 'Compute N/2', 'work': 'N/2 = 30/2 = 15.'}
3. {'label': 'Identify median class', 'work': 'The first class where c.f. ⩾ 15 is class 20-30 (c.f. = 20). So median class = 20-30.'}
4. {'label': 'Note l, c.f. (preceding), f, h', 'work': 'l = 20, c.f. of preceding class = 10, f (of median class) = 10, h = 10.'}
5. {'label': 'Apply formula', 'work': 'Median = l + [(N/2 − c.f.)/f] × h = 20 + [(15 − 10)/10] × 10 = 20 + (5/10)·10 = 20 + 5 = 25.'}



TOPIC

Quartiles, Deciles, Percentiles — quick reference

TOPIC

C

Mode

WORKED EXAMPLE

Worked Example 3 — Mode of continuous data

1. {'label': 'Identify modal class', 'work': 'Highest frequency = 20 → modal class = 20-30.'}
2. {'label': 'Note f_0, f_1, f_2', 'work': 'f_1 = 20 (modal class), f_0 = 8 (preceding), f_2 = 12 (succeeding). l = 20, h = 10.'}
3. {'label': 'Apply formula', 'work': 'Mode = l + [(f_1 – f_0) / (2f_1 – f_0 – f_2)] × h = 20 + [(20 – 8) / (40 – 8 – 12)] × 10 = 20 + [12/20] × 10 = 20 + 6 = 26.'}

TOPIC

The Empirical Relation

POINT 1	POINT 2

TOPPER TEMPLATE · MARK-BY-MARK

Model 5-mark answer — Mode by formula

1. **STEP 1 — STATE FORMULA AND IDENTIFY MODAL CLASS**
2. **STEP 2 — TABULATE VALUES**
3. **STEP 3 — SUBSTITUTE AND SIMPLIFY**
4. **STEP 4 — STATE FINAL ANSWER WITH UNITS + BRIEF INTERPRETATION**

TOPIC

Choosing the right measure

POINT 1	POINT 2	POINT 3

TOPIC

Graphical determination

PYQ PATTERNS

How this chapter is examined

MARKS DISTRIBUTION

Sub-topic weight — where marks come from

TOPIC

Trap

TRAP → TRUTH

× **MISTAKE** Mean is always the best 'average'.

✓ **CORRECT** Mean is sensitive to extreme values. For skewed data or open-end classes, median is preferred.

TOPIC

Trap

TRAP → TRUTH

× **MISTAKE** Median = middle value of the original data list.

✓ **CORRECT** Data must be arranged in ascending (or descending) order first; only then is the middle value the median.

TOPIC

Trap

TRAP → TRUTH

× **MISTAKE** Mode = the value with the highest frequency, always.

✓ **CORRECT** True for ungrouped/discrete data. For continuous data, mode is computed by formula using the modal class.

TOPIC

Trap

TRAP → TRUTH

× **MISTAKE** Mean – Mode = 3(Mean – Median) only for symmetric distributions.

✓ **CORRECT** The empirical relation holds for moderately ASYMMETRIC (skewed) distributions. For perfectly symmetric data, Mean = Median = Mode.

TOPIC

Trap

TRAP → TRUTH

× **MISTAKE** Step-deviation method gives a different mean than direct method.

✓ **CORRECT** All three methods (direct, short-cut, step-deviation) give the SAME mean — they only differ in arithmetic convenience.

TOPIC

Trap

TRAP → TRUTH

× **MISTAKE** Median can be found by simply averaging all values.

✓ **CORRECT** Averaging gives the mean. Median is a POSITIONAL average — it depends on rank, not on the values themselves.

TOPPER TEMPLATE · MARK-BY-MARK

Topper template 1

1	**STATE FORMULA** 1 m	$\bar{x} = A + h \cdot (\Sigma fd' / \Sigma f)$, where A = assumed mean, d' = (x – A)/h.
2	**BUILD COMPUTATION TABLE** 1 m	Columns: class | x (mid-value) | f | d' = (x–A)/h | fd'. Choose A as the middle class-mark; choose h = class width.
3	**SUM THE RELEVANT COLUMNS** 1 m	Compute Σf and $\Sigma fd'$ carefully; double-check signs of d'.
4	**SUBSTITUTE + STATE ANSWER WITH UNITS** 1 m	$\bar{x} = A + h \cdot (\Sigma fd'/\Sigma f)$ = computed value. Write the units (marks, ₹, kg).

TOPPER TEMPLATE · MARK-BY-MARK

Topper template 2

1	**STATE FORMULA** 1 m	Median = l + [(N/2 – c.f.) / f] × h, where l = lower limit of median class, c.f. = c.f. of preceding class, f = frequency of median class, h = class size.
2	**COMPUTE N AND N/2** 1 m	N = Σf. Locate N/2 in cumulative frequency column.
3	**IDENTIFY MEDIAN CLASS** 1 m	The class where c.f. first reaches/exceeds N/2 is the median class.
4	**SUBSTITUTE + STATE ANSWER** 1 m	Plug values and state median with units.

TOPPER TEMPLATE · MARK-BY-MARK

Topper template 3

1	**STATE FORMULA** 1 m	Mode = $l + [(f_1 - f_0) / (2f_1 - f_0 - f_2)] \times h$.
2	**IDENTIFY MODAL CLASS + F_0, F_1, F_2** 1 m	Modal class = class with highest frequency. f_1 = its frequency, f_0 = frequency just before, f_2 = frequency just after.
3	**SUBSTITUTE AND COMPUTE** 1 m	Plug in carefully and state mode with units.

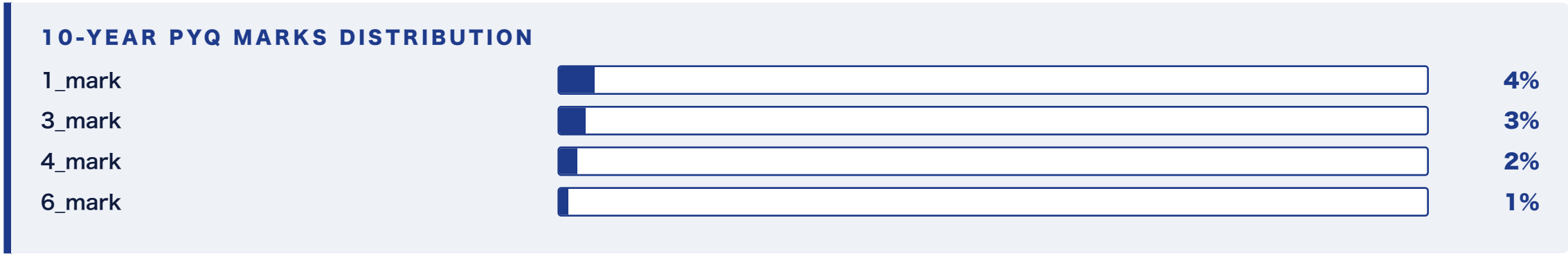
PYQ PATTERNS

Top PYQ patterns to drill

#1	AM by step-deviation method (5 classes) (4 marks)	88%
#2	Median of continuous data (4 marks)	80%
#3	Mode using formula (3 marks)	70%
#4	Empirical relation 1-mark MCQ (1 marks)	65%
#5	Choosing right measure / 1-mark conceptual (1 marks)	60%

MARKS DISTRIBUTION

10-year marks distribution



RECAP · MEMORISE THESE

What you must take away

1 Three averages: Mean (uses all data), Median (positional), Mode (most frequent).

2 Three AM methods give the SAME answer — pick by convenience.

3 Median is robust to outliers and works for open-end classes.

4 Mode is the ONLY average for qualitative data.

5 Empirical relation: Mode = 3 · Median – 2 · Mean (for moderately skewed data).

6 $\Sigma (x - \bar{x}) = 0$ — always. Sum of squared deviations from mean is minimum.

WHAT'S NEXT

Next class

Practice now

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