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Mathematics Class 8 — Punjab Board (SNC)

UNIT 12

Information Handling

Key Concepts · Definitions · Short & Long Questions · MCQs · Diagrams · Exam Tips

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Unit 12: Information Handling

Information handling is about collecting, organising, displaying and interpreting data. Unit 12 explains the types of data, frequency distributions with class limits, class boundaries and cumulative frequency, and how to show data in bar graphs, pie charts and histograms.

It then covers measures of central tendency — mean, median and mode — for ungrouped and grouped data, and measures of spread — variance and standard deviation — which show how far the data are scattered around the mean.

Learning Objectives

- Distinguish discrete and continuous data, and grouped and ungrouped data.
- Make frequency tables with class limits, class boundaries, class marks and cumulative frequency.
- Draw and read bar graphs, pie charts, histograms and cumulative frequency graphs.
- Find the mean, median and mode of ungrouped and grouped data.
- Find the variance and standard deviation of ungrouped data.
- Interpret averages and spread in real-life situations.

Key Concepts

12.1 Types of Data

Discrete data can take only separate values, usually counted (number of students, goals). Continuous data can take any value in a range, usually measured (height, mass, time).

Ungrouped (raw) data are listed one by one. Grouped data are arranged in classes such as 10–19, 20–29 with a frequency for each class.

12.2 Frequency Distribution

Class limits are the end values of a class (lower 20, upper 29 in 20–29). Class boundaries close the gaps: subtract 0.5 from the lower limit and add 0.5 to the upper, giving 19.5–29.5. The class size (width) is the difference between boundaries, here 10.

The class mark (midpoint) is (lower limit + upper limit)/2 = 24.5.

Cumulative frequency (c.f.) is the running total of frequencies. It tells how many values lie below each upper boundary and is used for the median and for a cumulative frequency graph (ogive).

12.3 Graphs

Bar graph: separate bars of equal width for categories or discrete data. Histogram: touching bars drawn on class boundaries for continuous grouped data.

Pie chart: a circle divided into sectors; angle of a sector = (frequency ÷ total) × 360°. If 15 of 60 students like Science, its angle is 90°.

Cumulative frequency graph: plot c.f. against upper class boundaries and join with a smooth curve or line segments.

12.4 Mean, Median and Mode

Ungrouped data: mean = $\Sigma x/n$; median = middle value after arranging in order (average of the two middle values if n is even); mode = most frequent value.

Grouped data: mean = $\Sigma fx/\Sigma f$, where x is the class mark.

Median = $l + (h/f)(n/2 - c)$, where l is the lower boundary of the median class, h the class size, f its frequency and c the cumulative frequency before it.

Mode = $l + [(fm - f1)/((fm - f1) + (fm - f2))] \times h$, where fm is the frequency of the modal class and f1, f2 are the frequencies of the classes before and after it.

12.5 Worked Example (Grouped Data)

Marks of 30 students: 10–19 (4), 20–29 (6), 30–39 (10), 40–49 (7), 50–59 (3). Class marks 14.5, 24.5, 34.5, 44.5, 54.5; $\Sigma fx = 1025$, so mean = $1025/30 \approx 34.17$.

c.f.: 4, 10, 20, 27, 30. $n/2 = 15$ lies in 30–39, so median = $29.5 + (10/10)(15 - 10) = 34.5$.

Modal class 30–39 ($fm = 10$, $f1 = 6$, $f2 = 7$): mode = $29.5 + [4/(4 + 3)] \times 10 \approx 35.21$.

12.6 Variance and Standard Deviation

Variance $S^2 = \Sigma x^2/n - (\Sigma x/n)^2$; standard deviation $S = \sqrt{(\text{variance})}$. A larger S means the data are more spread out.

For 4, 6, 8, 10, 12: $\Sigma x = 40$, $\Sigma x^2 = 360$, $n = 5$. $S^2 = 72 - 64 = 8$ and $S = \sqrt{8} \approx 2.83$.

Standard deviation is never negative. If all values are equal (e.g., 5, 5, 5), the variance and standard deviation are 0.

Important Definitions

Discrete data
Data with separate countable values.

Continuous data
Data that can take any value in a range.

Frequency
The number of times a value or class occurs.

Class boundaries
Limits adjusted by 0.5 so that classes have no gaps.

Class mark
The midpoint of a class.

Cumulative frequency
The running total of frequencies.

Histogram
A graph of touching bars for grouped continuous data.

Mean
The sum of values divided by their number.

Median
The middle value of ordered data.

Mode
The most frequent value.

Variance
The mean of squares minus the square of the mean.

Standard deviation
The positive square root of variance.

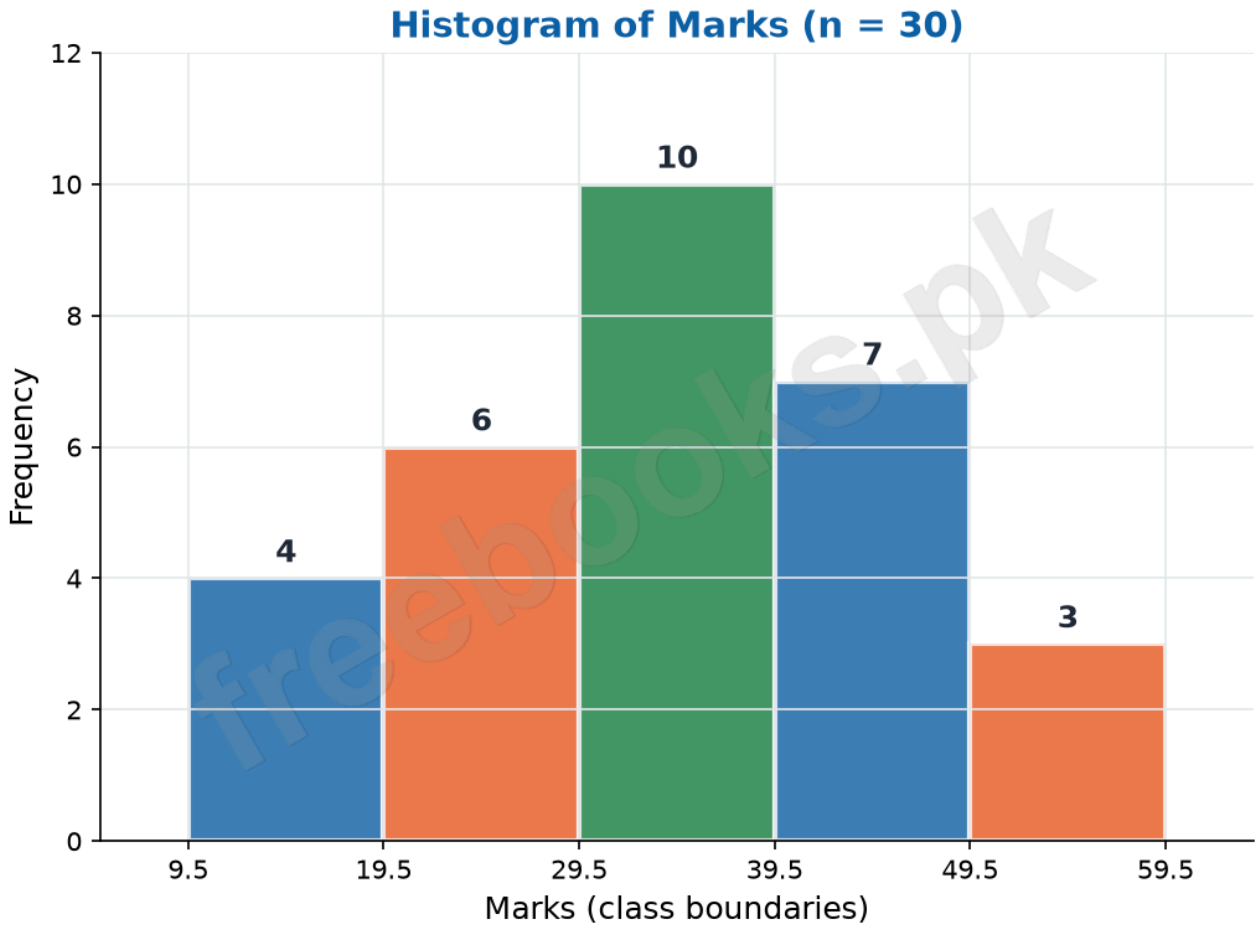
Key Facts at a Glance

Measure	Formula / result
Class boundaries of 20–29	19.5–29.5
Class mark of 20–29	24.5
Pie chart angle	(f ÷ total) × 360°
Mean (grouped)	$\Sigma fx / \Sigma f$
Median (grouped)	$l + (h/f)(n/2 - c)$
Mode (grouped)	$l + (fm - f1)/((fm - f1) + (fm - f2)) \times h$
Variance	$\Sigma x^2/n - (\Sigma x/n)^2$
Standard deviation	√variance
Worked mean	≈ 34.17
Worked median	34.5
Worked mode	≈ 35.21

SD of 4, 6, 8, 10, 12	$\sqrt{8} \approx 2.83$

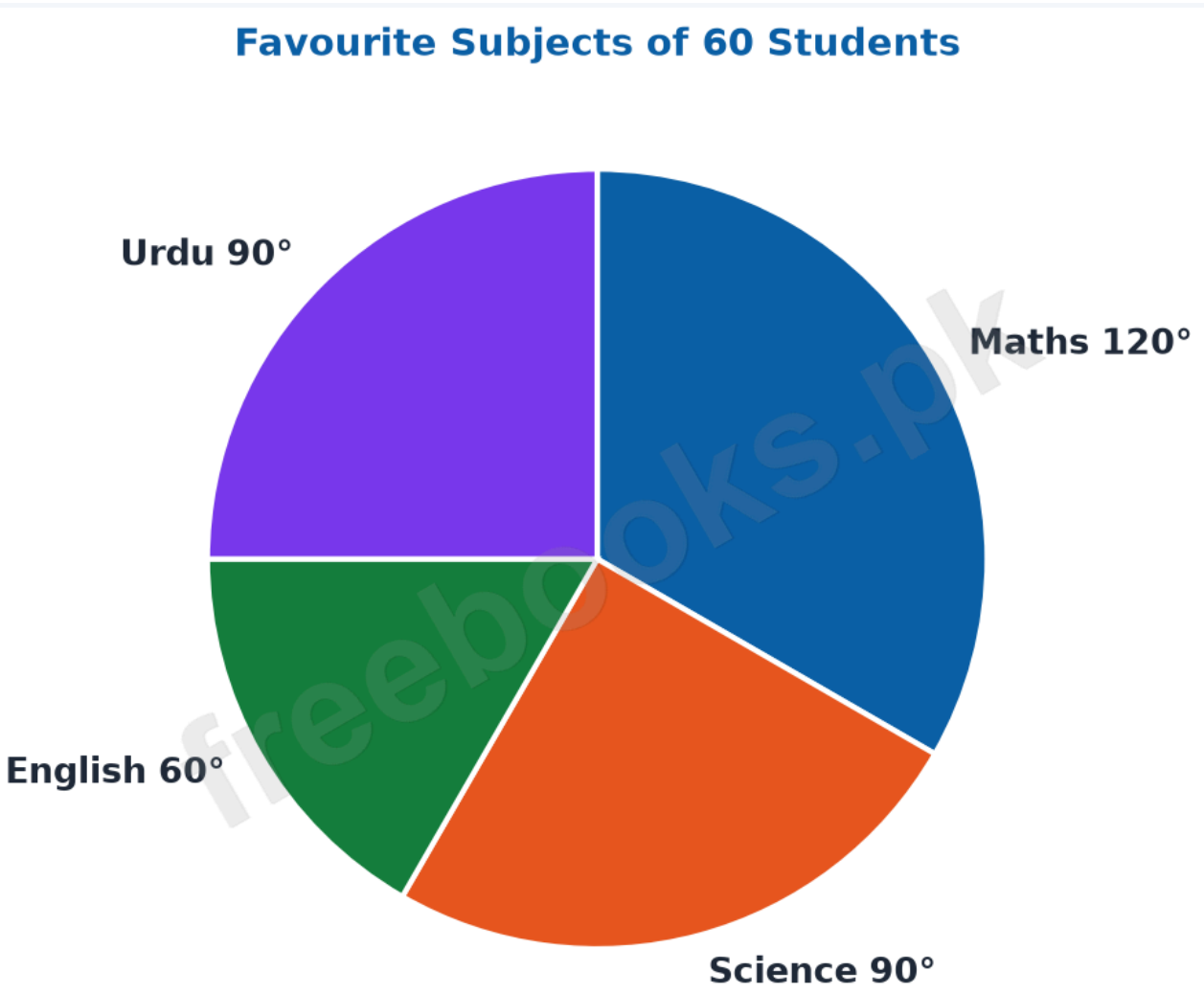
Diagrams

Histogram: Histogram of the marks of 30 students drawn on class boundaries.

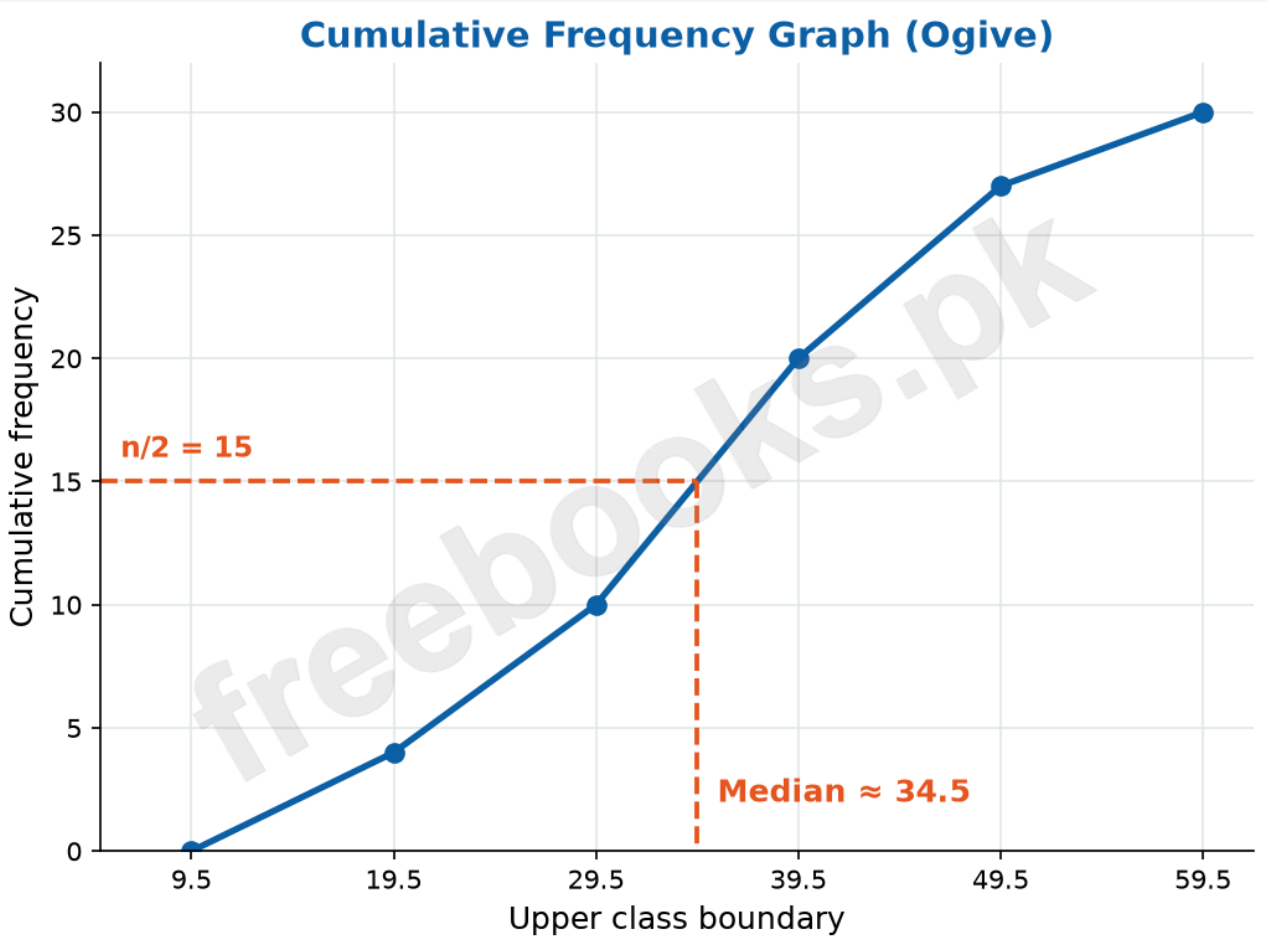


Pie chart: Pie chart of the favourite subjects of 60 students with sector angles.

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Cumulative frequency graph: Ogive of the marks data with the median read at n/2 = 15.



Short Questions and Answers

Is the number of cars in a car park discrete or continuous?
Discrete.

Is the mass of a baby discrete or continuous?
Continuous.

Write the class boundaries of 40–49.
39.5–49.5.

Find the class mark of 40–49.
44.5.

What is cumulative frequency used for?
Finding the median and drawing an ogive.

12 out of 48 people chose tea. Find the pie-chart angle.
(12/48) × 360° = 90°.

Find the mean of 3, 5, 7, 9, 11.

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35/5 = 7.

Find the median of 8, 3, 5, 9, 2.
Ordered 2, 3, 5, 8, 9 → 5.

Find the median of 4, 7, 9, 12.
(7 + 9)/2 = 8.

Find the mode of 2, 4, 4, 5, 7, 4.
4.

How does a histogram differ from a bar graph?
Histogram bars touch and are drawn on class boundaries.

Find the variance of 1, 2, 3, 4, 5.
55/5 – 9 = 2.

Find the standard deviation of 1, 2, 3, 4, 5.
$\sqrt{2} \approx 1.41$.

What is the variance of 5, 5, 5, 5?
0, since all values are equal.

Can standard deviation be negative?
No; it is a square root, so it is 0 or positive.

Long Questions and Answers

Explain types of data and frequency distributions.

Discrete vs continuous

Discrete data are counted and take separate values; continuous data are measured and can take any value in a range.

Grouped vs ungrouped

Ungrouped data list each value; grouped data place values in classes with frequencies.

Class limits, boundaries and class marks

For 30–39: limits 30 and 39, boundaries 29.5–39.5, class mark 34.5, class size 10.

Cumulative frequency

For frequencies 4, 6, 10, 7, 3 the c.f. are 4, 10, 20, 27, 30.

Draw a pie chart for the favourite subjects of 60 students.

Data

Maths 20, Science 15, English 10, Urdu 15.

Angles

Maths 120°, Science 90°, English 60°, Urdu 90° (total 360°).

Drawing

Draw a circle and a radius; measure each angle with a protractor in turn and label each sector.

Reading

The largest sector, Maths, is the most popular subject.

Find the mean of the grouped marks data.

Data

10–19 (4), 20–29 (6), 30–39 (10), 40–49 (7), 50–59 (3); n = 30.

Class marks

14.5, 24.5, 34.5, 44.5, 54.5.

fx values

58, 147, 345, 311.5, 163.5; $\Sigma fx = 1025$.

Mean

1025/30 ≈ 34.17 marks.

Find the median and mode of the grouped marks data.

Median class

n/2 = 15; c.f. 4, 10, 20 → median class 30–39.

Median

29.5 + (10/10)(15 – 10) = 34.5.

Modal class

30–39, with fm = 10, f1 = 6, f2 = 7.

Mode

29.5 + [4/(4 + 3)] × 10 ≈ 35.21.

Find the variance and standard deviation of 2, 4, 6, 8.

Σx and mean

$\Sigma x = 20$, n = 4, mean = 5.

Σx^2

4 + 16 + 36 + 64 = 120.

Variance

$120/4 - 5^2 = 30 - 25 = 5$.

Standard deviation

$\sqrt{5} \approx 2.24$.

Compare the spread of two data sets.

Set A: 6, 6, 6, 6

Mean 6, standard deviation 0 — no spread.

Set B: 3, 5, 7, 9

Mean 6; $\Sigma x^2 = 164$; variance $41 - 36 = 5$; SD ≈ 2.24.

Conclusion

Both have the same mean, but B is more spread out.

Why is spread useful?

An average alone does not show how consistent the data are; SD measures consistency.

Multiple Choice Questions (MCQs)

Heights of students are: (A) Discrete (B) Continuous (C) Qualitative (D) Ungrouped only
Correct answer: (B) Continuous. Measured.

Class boundaries of 10–19: (A) 10–19 (B) 9.5–19.5 (C) 9–20 (D) 10.5–19.5
Correct answer: (B) 9.5–19.5. ±0.5.

Class mark of 10–19: (A) 14 (B) 14.5 (C) 15 (D) 29
Correct answer: (B) 14.5. (10 + 19)/2.

Bars touch in a: (A) Bar graph (B) Pie chart (C) Histogram (D) Line graph
Correct answer: (C) Histogram. Continuous data.

A sector for 25% of the data has angle: (A) 25° (B) 45° (C) 90° (D) 180°
Correct answer: (C) 90°. ¼ × 360°.

Mean of 2, 4, 6, 8: (A) 4 (B) 5 (C) 6 (D) 20
Correct answer: (B) 5. 20/4.

Median of 1, 3, 3, 6, 7: (A) 3 (B) 4 (C) 6 (D) 3.5
Correct answer: (A) 3. Middle value.

Mode of 1, 2, 2, 3, 3, 3: (A) 1 (B) 2 (C) 3 (D) 2.5
Correct answer: (C) 3. Most frequent.

Mean of grouped data: (A) $\Sigma f/n$ (B) $\Sigma fx/\Sigma f$ (C) $\Sigma x/f$ (D) Σfx^2
Correct answer: (B) $\Sigma fx/\Sigma f$. Class marks used.

In the median formula, c is the: (A) Class size (B) c.f. before the median class (C) Frequency of median class (D) Lower limit
Correct answer: (B) c.f. before the median class. Preceding c.f.

In the mode formula, fm is the frequency of the: (A) First class (B) Median class (C) Modal class (D) Last class
Correct answer: (C) Modal class. Modal class.

Variance S^2 = (A) $\Sigma x/n$ (B) $\Sigma x^2/n - (\Sigma x/n)^2$ (C) $(\Sigma x)^2$ (D) $\sqrt{\Sigma x}$
Correct answer: (B) $\Sigma x^2/n - (\Sigma x/n)^2$. Formula.

SD of 7, 7, 7: (A) 7 (B) 0 (C) 1 (D) 49
Correct answer: (B) 0. No spread.

Standard deviation is the square root of: (A) Mean (B) Median (C) Variance (D) Mode
Correct answer: (C) Variance. $\sqrt{S^2}$.

An ogive is drawn using: (A) Frequency (B) Cumulative frequency (C) Class marks (D) Angles
Correct answer: (B) Cumulative frequency. c.f. vs boundary.

Quick Revision Summary

- Discrete (counted) vs continuous (measured); grouped vs ungrouped.
- Boundaries = limits $\mp$ 0.5; class mark = midpoint; c.f. = running total.
- Pie angle = (f/total) × 360°; histogram bars touch.
- Mean $\Sigma fx/\Sigma f$; median $l + (h/f)(n/2 - c)$; mode $l + (fm - f1)/((fm - f1) + (fm - f2)) \times h$.
- Variance $\Sigma x^2/n - (\Sigma x/n)^2$; SD = $\sqrt{\text{variance}} \geq 0$.

Exam Tips

- Make a full table (x, f, fx, c.f.) before using any grouped formula.
- Use class boundaries, not limits, for l in the median and mode formulas.
- Check that pie-chart angles add up to 360°.
- Arrange ungrouped data in order before finding the median.
- Round only the final answer, not intermediate steps.