Chapter 7: Statistics & Data Interpretation

Chapter 2 — Graphical Representation | Detailed Notes & Solved Examples

1. Introduction

A large collection of numbers is often difficult to understand when it is presented only as a table. Graphs and charts convert numerical data into a visual form, making comparisons, trends and patterns easier to see.

Graphical representation means presenting data through diagrams such as bar graphs, histograms, pie charts and line graphs.

2. Why Do We Use Graphs?

- They make large data easier to understand.
- They allow quick comparison between categories.
- They show increases and decreases clearly.
- They help identify the highest and lowest values.
- They make trends and patterns easier to recognise.
- They are useful for interpreting data quickly.

3. Important Parts of a Graph

- Title — tells what the graph represents.
- Axes — the horizontal axis is usually the x-axis and the vertical axis is the y-axis.
- Scale — tells how numerical values are represented.
- Labels — identify categories or quantities.
- Units — show whether values are in units, thousands, lakhs, percentages, etc.
- Legend or key — explains colours or symbols when more than one data series is shown.

4. Bar Graph

A bar graph represents categorical or discrete data using rectangular bars. The bars are separated by gaps.

The height or length of a bar represents the value of the category.

Bars may be drawn vertically or horizontally.

5. Reading a Bar Graph

To read a bar graph correctly, first identify the scale on the axis. Then locate the category and read the height of its bar.

Example 1

A bar graph shows sales of 40, 60, 50 and 80 units for four months. Which month has the highest sales?

Compare the four values: 40, 60, 50 and 80.

The largest value is 80.

Answer: The month with 80 units

6. Double Bar Graph

A double bar graph compares two related sets of data across the same categories. For example, it can compare the sales of two companies in the same years.

A legend is normally used to distinguish the two sets.

Example 2

Company A sold 50, 70 and 80 units in three years, while Company B sold 40, 90 and 60. In which year did Company B exceed Company A by the greatest amount?

Differences are 40−50 = −10, 90−70 = 20 and 60−80 = −20.

The greatest positive difference is 20.

Answer: The second year, by 20 units

7. Multiple Bar Graph

A multiple bar graph displays more than two data series for the same categories. It is useful for comparing several groups at once.

8. Histogram

A histogram is used mainly for continuous grouped data. It consists of adjacent rectangles, so there are normally no gaps between the bars.

The horizontal axis represents class intervals and the vertical axis represents frequency.

9. Bar Graph vs Histogram

Feature	Bar Graph	Histogram
Data	Categorical/discrete	Continuous grouped data
Bars	Usually separated by gaps	Usually touching
Horizontal axis	Categories	Class intervals
Main purpose	Compare categories	Show distribution

10. Frequency Polygon

A frequency polygon is a line graph formed by joining points representing class frequencies at their class marks.

It is useful for comparing distributions and seeing the overall shape of a frequency distribution.

11. Ogive

An ogive is a cumulative frequency curve. It can be drawn using less-than cumulative frequency or more-than cumulative frequency.

A less-than ogive uses upper class boundaries and cumulative frequencies. A more-than ogive uses lower class boundaries and cumulative frequencies.

12. Pie Chart

A pie chart represents the whole as a circle divided into sectors. Each sector represents a category's share of the total.

$$\text{Central Angle} = (\text{Category Value} / \text{Total Value}) \times 360^\circ$$

$$\text{Central Angle} = \text{Percentage} \times 3.6^\circ$$

Example 3

A survey of 200 students shows that 50 prefer cricket. Find the angle of the cricket sector in a pie chart.

Angle = 50/200 × 360°.

= 90°.

Answer: 90°

13. Percentage to Pie-Chart Angle

1% = 3.6°

25% = 90°

50% = 180°

75% = 270°

Example 4

A category represents 35% of the total. Find its sector angle.

Angle = 35 × 3.6°.

= 126°.

Answer: 126°

14. Finding Percentage from a Pie Chart

Percentage = Sector Angle / 360° × 100

Example 5

A sector in a pie chart has an angle of 72°. What percentage does it represent?

Percentage = 72/360 × 100.

= 20%.

Answer: 20%

15. Finding Actual Value from a Pie Chart

Example 6

A pie chart represents 600 students. A sector has an angle of 120°. Find the number of students represented by that sector.

Fraction represented = 120/360 = 1/3.

Students = 600 × 1/3 = 200.

Answer: 200 students

16. Line Graph

A line graph represents data using points joined by straight line segments. It is especially useful for showing change over time.

Examples include monthly rainfall, yearly population, daily temperature and stock prices.

17. Reading Trends from a Line Graph

- An upward movement indicates an increase.
- A downward movement indicates a decrease.
- A horizontal section indicates no change.
- The steepness of a line indicates how quickly the value changes between two points.

Example 7

A line graph shows temperatures of 20°C, 24°C, 27°C and 25°C from Monday to Thursday. On which day was the temperature highest?

Compare the four temperatures.

The maximum is 27°C.

Answer: Wednesday

18. Change Between Two Points

Absolute Change = Final Value − Initial Value

Example 8

A line graph shows production rising from 250 units to 325 units. Find the increase.

Increase = 325 − 250 = 75 units.

Answer: 75 units

19. Percentage Change from Graphical Data

Percentage Change = (Change / Original Value) × 100

Example 9

Production increases from 400 to 500 units. Find the percentage increase.

Increase = 500 − 400 = 100.

Percentage increase = 100/400 × 100 = 25%.

Answer: 25%

20. Scale of a Graph

The scale tells us how the markings on an axis correspond to actual values. A graph may use 1 cm = 10 units, 1 division = 5 students, or another suitable scale.

Never assume the scale is 1 unit per division. Read the scale before interpreting the graph.

Example 10

On a graph, 1 vertical division represents 20 units. A bar reaches the seventh division. What value does it represent?

One division = 20 units.

Seven divisions = 7 × 20 = 140 units.

Answer: 140 units

21. Choosing the Right Graph

Data / Purpose	Suitable Representation
Compare separate categories	Bar graph
Compare two or more groups	Double / multiple bar graph
Continuous grouped distribution	Histogram
Show change over time	Line graph
Show parts of a whole	Pie chart
Show cumulative frequency	Ogive
Show frequency distribution with class marks	Frequency polygon

22. Combined Data Interpretation

Many questions combine a table and a graph. In such questions, first identify exactly which source contains the required information. Then compare the relevant values.

Example 11

A graph shows values 120, 150, 180 and 210 for four quarters. What is the total value?

Add all four values.

120 + 150 + 180 + 210 = 660.

Answer: 660

23. Average from Graphical Data

Example 12

Four bars represent values 20, 30, 40 and 50. Find their average.

Average = (20 + 30 + 40 + 50)/4.

= 140/4 = 35.

Answer: 35

24. Ratio from Graphical Data

Example 13

Two bars represent 90 and 150 units. Find their ratio in simplest form.

Ratio = 90 : 150.

Divide both by 30.

= 3 : 5.

Answer: 3 : 5

25. Missing Value in a Pie Chart

Example 14

Three sectors of a pie chart are 80°, 120° and 70°. Find the fourth sector angle.

Total angle = 360°.

Fourth angle = 360 − (80 + 120 + 70).

= 90°.

Answer: 90°

26. Missing Percentage

Example 15

Three categories represent 25%, 35% and 15% of a pie chart. Find the percentage of the remaining category.

Known total = 25 + 35 + 15 = 75%.

Remaining = 100 − 75 = 25%.

Answer: 25%

27. Pie Chart with Total Population

Example 16

A town has 20,000 people. A sector representing 18% belongs to a particular age group. Find the population of that group.

Population = 18/100 × 20,000.

= 3,600.

Answer: 3,600 people

28. Histogram and Class Frequency

In a histogram, the height of each rectangle represents frequency when class widths are equal. If class widths are unequal, frequency density may be required.

Frequency Density = Frequency / Class Width

For standard school-level questions with equal class widths, the rectangle heights can usually be read directly as frequencies.

Example 17

A class interval has frequency 24 and width 6. Find its frequency density.

Frequency density = 24/6.

= 4.

Answer: 4

29. Frequency Polygon Example

Example 18

Class marks are 5, 15, 25 and 35 with frequencies 3, 7, 5 and 2. What points are plotted for a frequency polygon?

Plot each class mark on the horizontal axis and its frequency on the vertical axis.

The points are (5,3), (15,7), (25,5) and (35,2).

Answer: (5,3), (15,7), (25,5), (35,2)

30. Ogive Example

Example 19

Less-than cumulative frequencies at upper class boundaries 10, 20, 30 and 40 are 4, 10, 17 and 20. Which points are plotted?

For a less-than ogive, plot upper class boundary against cumulative frequency.

Points are (10,4), (20,10), (30,17) and (40,20).

Answer: (10,4), (20,10), (30,17), (40,20)

31. Graph-Based Percentage Question

Example 20

A graph shows total sales of 800 units, of which one category accounts for 240 units. What percentage does the category represent?

Percentage = 240/800 × 100.

= 30%.

Answer: 30%

32. Graph-Based Comparison

Example 21

Four branches have sales of 500, 650, 600 and 750 units. Find the difference between the highest and lowest sales.

Highest = 750.

Lowest = 500.

Difference = 750 − 500 = 250.

Answer: 250 units

33. Graph-Based Percentage Increase

Example 22

A company's production was 1,200 units in one year and 1,500 units in the next year. Find the percentage increase.

Increase = 1,500 − 1,200 = 300.

Percentage increase = 300/1,200 × 100.

= 25%.

Answer: 25%

34. Important Checks While Reading Graphs

- Read the title before interpreting the graph.
- Check the units and scale.
- Check whether the axis begins at zero or another value.
- Do not compare bar heights without checking the numerical scale.
- For pie charts, all sector angles must add to 360°.
- For percentages, the categories of a complete whole should add to 100%.
- For a histogram, check whether class intervals are equal or unequal.

35. Common Mistakes

- Assuming every graph starts at zero.
- Ignoring the scale on an axis.
- Confusing a histogram with a bar graph.
- Using 360 instead of 100 when calculating percentage from a pie chart.
- Forgetting that 1% corresponds to 3.6° in a pie chart.
- Reading the wrong bar or category.
- Calculating percentage change using the final value instead of the original value as the denominator.

36. Quick Revision Table

Graph / Concept	Key Point
Bar graph	Compare categories; bars usually have gaps
Histogram	Continuous grouped data; bars touch
Line graph	Shows change or trend over time
Pie chart	Shows parts of a whole
Frequency polygon	Joins frequency points at class marks
Ogive	Cumulative frequency curve
Pie angle	Value/Total × 360°
Pie percentage	Angle/360° × 100
Percentage change	Change/Original × 100
Frequency density	Frequency/Class width

37. Final Formula Sheet

Pie Chart Angle = Value/Total × 360°

Pie Chart Percentage = Angle/360° × 100

Percentage Change = Change/Original × 100

Average = Sum of Values / Number of Values

Frequency Density = Frequency / Class Width

Range = Maximum − Minimum

The key to graphical data interpretation is not just reading the height of a bar or the size of a sector. Always read the title, units and scale first. Then identify the values required and apply the appropriate calculation.

38. Final Revision

Graphs convert numerical information into a visual form. A bar graph is mainly used for category comparison, a histogram for continuous grouped data, a line graph for trends, a pie chart for parts of a whole, a frequency polygon for distributions, and an ogive for cumulative frequency.

With practice, most graph questions can be solved quickly by following three steps: read the scale, identify the required values, and perform the simplest appropriate calculation.