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## Pictographs

A pictograph is a method of representing data using symbols or pictures where each symbol represents a fixed number of items. This visual representation helps in quickly understanding and comparing quantities without reading large numbers directly.

### Concept Explanation

In a pictograph, each symbol corresponds to a specific quantity. For example, one car symbol may represent 100 cars. Partial symbols can represent fractions of the quantity, such as half a symbol representing 50 cars.

### Formula Derivation

Let each symbol represent  $S$  units. If the number of full symbols is  $n_f$  and the number of partial symbols is  $n_p$  representing a fraction  $f$  of a full symbol, then the total quantity  $Q$  is:

$$Q = n_f \times S + n_p \times f \times S$$

## Worked Illustration

Given a pictograph where each car symbol represents 100 cars:

- July: 2 full symbols and 1 half symbol
- August: 3 full symbols
- September: 2 full symbols and 1 quarter symbol

Calculate the total cars for each month.

## Solved Examples

**Example:** Calculate the number of cars produced in July.

**Solution:**

Number of full symbols  $n_f = 2$

Number of partial symbols  $n_p = 1$ , fraction  $f = \frac{1}{2}$

Each symbol represents  $S = 100$  cars.

Total cars  $Q = 2 \times 100 + 1 \times \frac{1}{2} \times 100 = 200 + 50 = 250$  cars.

## Practice Set

- Calculate the number of cars produced in August and September using the pictograph.

- Interpret a pictograph where each symbol represents 50 items and partial symbols represent one-third.
- Draw a pictograph for the following data: Number of books read by students: 5, 8, 3, 10, 7.

## Answer Key

- August: 3 symbols  $\Rightarrow 3 \times 100 = 300$  cars.
- September: 2 full symbols and 1 quarter symbol  
 $\Rightarrow 2 \times 100 + \frac{1}{4} \times 100 = 200 + 25 = 225$  cars.
- Partial symbol representing one-third means multiply the symbol value by  $\frac{1}{3}$ .

## Quick Reference

- Each symbol represents a fixed quantity.
- Partial symbols represent fractions of the fixed quantity.
- Total quantity = (Number of full symbols)  $\times$  (quantity per symbol) + (Number of partial symbols)  $\times$  (fraction)  $\times$  (quantity per symbol).

## Glossary

- **Pictograph:** A graphical representation of data using pictures or symbols.
- **Symbol:** A picture or icon representing a fixed number of items.
- **Partial Symbol:** A fraction of a full symbol representing a fraction of the quantity.

## Bar Graphs

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A bar graph is a graphical display of data using bars of uniform width where the height of each bar is proportional to the value it represents. Bar graphs are useful for comparing quantities across different categories.

## Concept Explanation

In a bar graph, the horizontal axis (x-axis) represents categories, and the vertical axis (y-axis) represents numerical values. Each bar's height corresponds to the value of the category it represents.

## Formula Derivation

Height of bar  $h$  is proportional to the value  $v$  it represents. If the scale is  $s$  units per unit height, then:

$$h = \frac{v}{s}$$

## Worked Illustration

Given the number of students in Class VIII over academic years:

- 2003-04: 100 students
- 2004-05: 200 students
- 2005-06: 250 students
- 2006-07: 300 students
- 2007-08: 350 students

Draw a bar graph with a scale of 50 students per unit height.

## Solved Examples

**Example:** Calculate the height of the bar for the year 2005-06.

**Solution:**

Value  $v = 250$  students, scale  $s = 50$  students/unit height.

Height  $h = \frac{250}{50} = 5$  units.

## Practice Set

- Find the height of bars for all years using the scale 50 students/unit.
- Interpret the trend shown by the bar graph.
- Draw a bar graph for the following data: Number of books sold in months Jan to May: 120, 150, 100, 180, 200.

## Answer Key

- Heights: 2003-04: 2 units, 2004-05: 4 units, 2005-06: 5 units, 2006-07: 6 units, 2007-08: 7 units.
- The number of students increases steadily over the years.

## Quick Reference

- Bar height is proportional to the value represented.
- Bars have uniform width and are spaced equally.
- Axes must be labeled with categories and values.

## Glossary

- **Bar Graph:** A chart with rectangular bars representing data values.
- **Scale:** The ratio of units on the graph to actual values.
- **Category:** A group or label on the x-axis.

## Double Bar Graphs

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A double bar graph displays two sets of data simultaneously using pairs of bars for each category. It is useful for comparing two related data sets across categories.

## Concept Explanation

Each category on the x-axis has two bars side by side, each representing a different data set. The height of each bar is proportional to the value it represents.

## Formula Derivation

For each category  $c$ , the heights of the two bars  $h_1, h_2$  correspond to values  $v_1, v_2$  with scale  $s$ :

$$h_1 = \frac{v_1}{s}, \quad h_2 = \frac{v_2}{s}$$

## Worked Illustration

Marks obtained by a student in different subjects for two academic years:

- Maths: 30 (2005-06), 60 (2006-07)
- Social Science: 50, 55
- Science: 45, 50
- English: 50, 45
- Hindi: 60, 60

## Solved Examples

**Example:** Calculate the height of the bars for Maths if scale is 10 marks/unit.

## Solution:

For 2005-06:  $h_1 = \frac{30}{10} = 3$  units.

For 2006-07:  $h_2 = \frac{60}{10} = 6$  units.

## Practice Set

- Calculate bar heights for all subjects using scale 10 marks/unit.
- Identify the subject with the most improvement.
- Identify the subject with decreased performance.
- Draw a double bar graph for the data.

## Answer Key

- Maths: 3 and 6 units; Social Science: 5 and 5.5 units; Science: 4.5 and 5 units; English: 5 and 4.5 units; Hindi: 6 and 6 units.
- Most improvement in Maths.
- Performance decreased in English.

## Quick Reference

- Two bars per category represent two data sets.
- Bars are placed side by side for comparison.
- Height proportional to values with a common scale.

## Glossary

- **Double Bar Graph:** A bar graph with two bars per category for comparison.
- **Category:** The group or label on the x-axis.

- **Scale:** Ratio of graph units to actual values.

## Pie Charts

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A pie chart, or circle graph, represents data as sectors of a circle where each sector's angle is proportional to the quantity it represents. It shows the relationship between parts and the whole.

### Concept Explanation

The entire circle represents the total quantity (100%). Each sector corresponds to a category, and its central angle is proportional to the fraction of the total.

### Formula Derivation

Given a category with fraction  $f$  of the total, the central angle  $\theta$  in degrees is:

$$\theta = f \times 360^\circ$$

Where  $f = \frac{\text{category quantity}}{\text{total quantity}}$ .

### Worked Illustration

Ice cream flavor preferences:

- Chocolate: 50%
- Vanilla: 25%
- Other flavors: 25%

Calculate central angles for each sector.

## Solved Examples

**Example:** Find the central angle for Chocolate flavor.

**Solution:**

$$\text{Fraction } f = \frac{50}{100} = \frac{1}{2}$$

$$\text{Central angle } \theta = \frac{1}{2} \times 360^\circ = 180^\circ$$

## Practice Set

- Calculate central angles for Vanilla and Other flavors.
- Draw a pie chart for the given data.
- Given a pie chart with sectors of  $90^\circ$ ,  $120^\circ$ , and  $150^\circ$ , find the percentage each sector represents.
- Interpret a pie chart showing expenditure distribution.

## Answer Key

- Vanilla:  $\frac{1}{4} \times 360^\circ = 90^\circ$
- Other flavors:  $90^\circ$
- Percentages:  $\frac{90}{360} \times 100 = 25\%$ ,  $\frac{120}{360} \times 100 = 33.33\%$ ,  $\frac{150}{360} \times 100 = 41.67\%$

## Quick Reference

- Total angle in circle =  $360^\circ$ .

- Central angle for sector = fraction of total  $\times 360^\circ$ .
- Sum of all sector angles =  $360^\circ$ .

## Glossary

- **Pie Chart:** Circular graph representing parts of a whole.
- **Sector:** A slice of the pie chart representing a category.
- **Central Angle:** Angle at the center of the circle corresponding to a sector.

## Probability

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Probability is the measure of the likelihood of an event occurring, expressed as a number between 0 and 1. It is calculated as the ratio of favorable outcomes to the total number of equally likely outcomes.

### Concept Explanation

A random experiment is one whose outcome cannot be predicted with certainty. The set of all possible outcomes is called the sample space. An event is one or more outcomes of the experiment.

### Formula Derivation

For an event  $E$ , the probability  $P(E)$  is:

$$P(E) = \frac{\text{Number of favorable outcomes}}{\text{Total number of equally likely outcomes}}$$

### Worked Illustration

Tossing a fair coin:

- Sample space: {Head, Tail}
- Number of outcomes: 2
- Probability of Head:  $\frac{1}{2}$
- Probability of Tail:  $\frac{1}{2}$

## Solved Examples

**Example:** Probability of getting a 2 when a die is thrown.

**Solution:**

Sample space: {1, 2, 3, 4, 5, 6}

Number of outcomes: 6

Favorable outcomes for 2: 1

Probability  $P(2) = \frac{1}{6}$

## Practice Set

- Find the probability of getting an even number when a die is thrown.
- Calculate the probability of drawing a red ball from a bag containing 4 red and 2 yellow balls.
- List all possible outcomes when spinning a wheel divided into sectors A, B, and C.
- Calculate the probability of landing on sector G in a spinner divided into 8 equal sectors labeled R and G equally.

## Answer Key

- Even numbers on die: 2,4,6; Probability =  $\frac{3}{6} = \frac{1}{2}$
- Probability of red ball =  $\frac{4}{6} = \frac{2}{3}$
- Outcomes of wheel spin:  $\{A, B, C\}$
- Probability of sector G =  $\frac{4}{8} = \frac{1}{2}$

## Quick Reference

- Probability ranges from 0 (impossible event) to 1 (certain event).
- Sum of probabilities of all outcomes in sample space = 1.
- Equally likely outcomes have the same chance of occurring.

## Glossary

- **Random Experiment:** An experiment with uncertain outcomes.
- **Sample Space:** Set of all possible outcomes.
- **Event:** One or more outcomes of an experiment.
- **Favorable Outcomes:** Outcomes that satisfy the event.
- **Probability:** Measure of likelihood of an event.