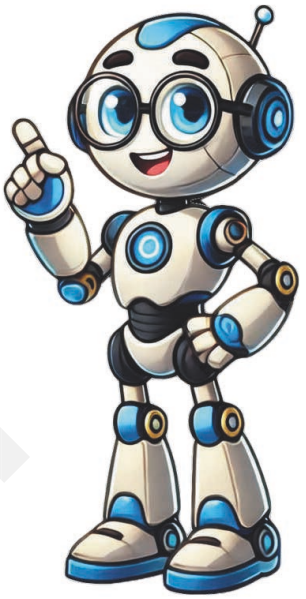
4
Chapter

Data Handling

We'll cover the following key points:

- → Grouped data
- → Construction of a grouped frequency distribution
- → Bar graphs
- → Construction of bar graphs
- → Histograms
- → Probability
- → Pie chart
- → Constructing a pie chart for a given data
- → Reading a pie chart



Hi, I'm EeeBee

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Do you Remember fundamental concept in previous class.
In class 7th we learnt

- → Bar Graph

Do you Remember fundamental concept in previous class.
In class 6th we learnt

- → Data
- → Organising data
- → Pictograph

Learning Outcomes

By the end of this chapter, students will be able to:

- Understand the concept of data and its representation in various forms such as tables, charts, and graphs.
- Organize and represent data using bar graphs, histograms, and pie charts.
- Calculate measures of central tendency, including mean, median, and mode, for a given data set.
- Understand and interpret the concept of probability as a measure of uncertainty.
- Solve problems involving simple probability using real-life scenarios.
- Draw inferences and conclusions from the given data sets and graphical representations.
- Compare and analyze data using frequency distribution tables.
- Identify and rectify errors or inconsistencies in data representation.
- Develop the ability to collect, classify, and interpret raw data for practical applications.
- Apply data handling techniques to solve problems in various fields, including science, economics, and daily life.

Mind Map

DATA HANDLING

Circle Graph or Pie Chart

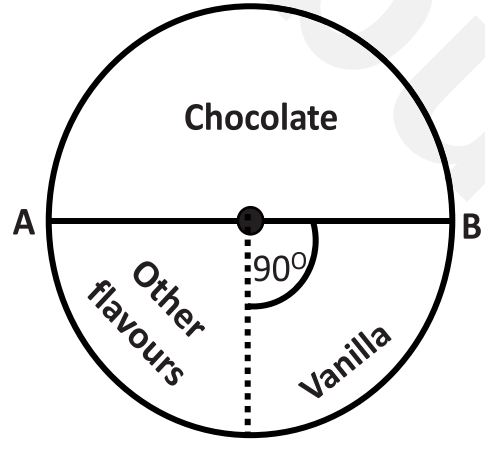
i. Shows the relationship between a whole and its part.

ii. Whole is divided into parts

iii. Central angle = $\frac{\text{Value of a particular made}}{\text{Sum of the value}} \times 360^{O}$

Drawing Pie charts

Flavours	Students in per cent preferring the flavours	In fractions	Fraction of 360°
Chocolate	50%	$\frac{50}{100} = \frac{1}{2}$	$\frac{1}{2}$ of $360^{O} = 180^{O}$
Vanilla	25%	$\frac{25}{100} = \frac{1}{4}$	$\frac{1}{4}$ of $360^{O} = 90^{O}$
Other flavours	25%	$\frac{25}{100} = \frac{1}{4}$	$\frac{1}{4}$ of $360^{O} = 90^{O}$



Chance and Probability

i. Random Experiment

Whose outcomes cannot be predicted exactly in advance.

e.g., Tossing a coin

ii. Equally like outcomes

Same chance of occuring

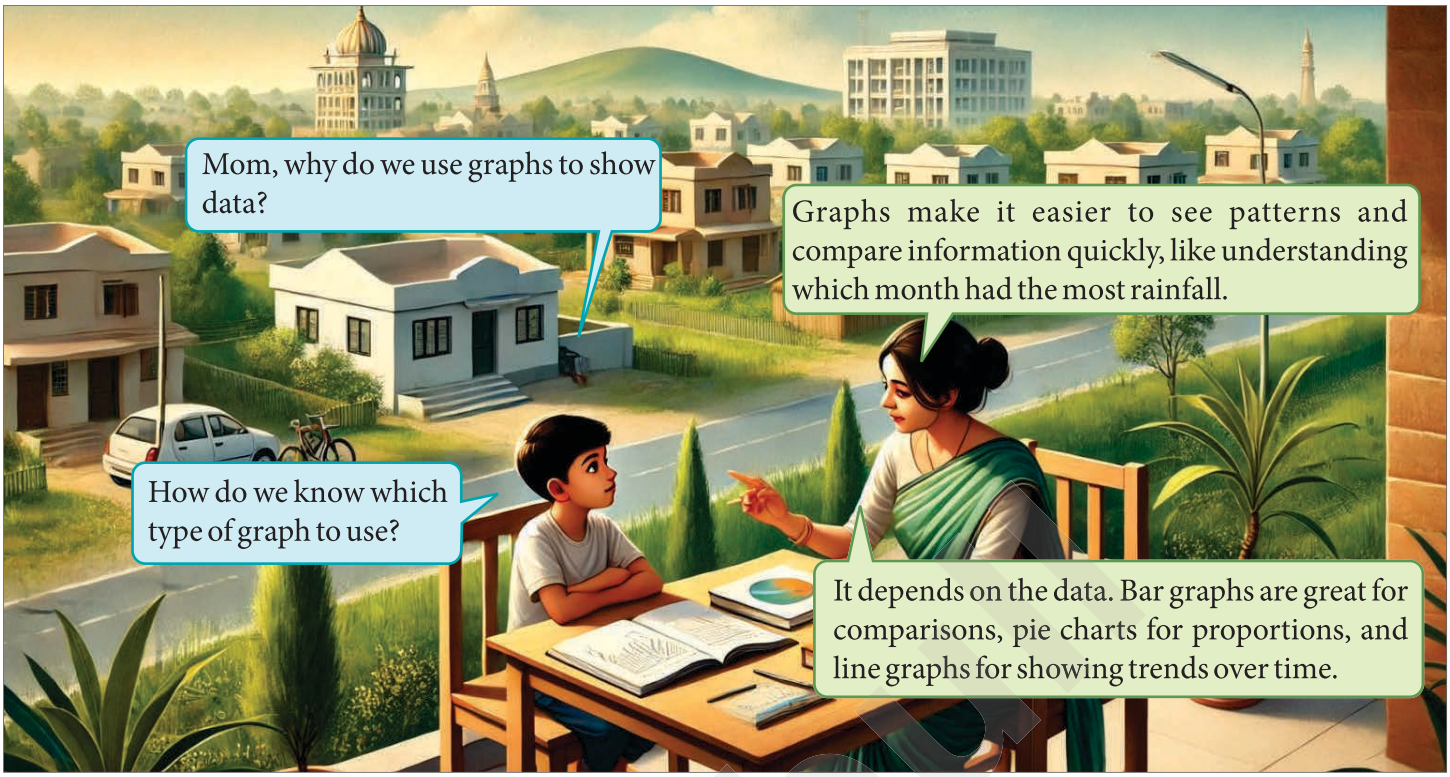
e.g., Tossing a coin

iii. Probability of an event

Probability = $\frac{\text{No.of outcomes that make an event}}{\text{Total no.of outcomes of the experiment}}$

Based on NCERT*

Introduction



Let us revise few definitions.

Data: A collection of numerical facts regarding a particular type of information is called *data*.

Observation: Each numerical fact of this information is called *observation*.

Raw data: A collection of observations gathered initially is called *raw data*.

Range: The difference between the highest and the lowest values of the observation in a data is called *range*.

Frequency: A particular observation which occurs a number of times is called *frequency*.

Example 1 : **In a maths test, following marks (*out of 20*) were obtained by 32 students of Class VIII. Arrange these marks in a table using tally marks and answer the following questions:**

17 12 16 18 15 19 15 11 15 12 14 14 19 13 16 15 17
18 16 16 13 17 15 14 11 19 14 16 17 13 14 16

(*i*) What is the lowest marks obtained?

(*ii*) What is the highest marks obtained?

(*iii*) How many students obtained 16 or more marks?

(*iv*) What is the range of the given data?

Solution: Arranging the data in ascending order, we have:

11 11 12 12 13 13 13 14 14 14 14 14 15 15 15 15
15 16 16 16 16 16 16 17 17 17 17 18 18 19 19 19

Now, frequency table is shown below :

Numbers of marks obtained by students of class VIII	Tally Marks	Frequency
11	|	2
12	||	2
13	|||	3
14	𝍸	5
15	𝍸	5
16	𝍸 |	6
17	||||	4
18	||	2
19	|||	3
	Total	**32**

(*i*) 11 marks (*ii*) 19 marks

(*iii*) 15 students (*iv*) Range = 19 – 11 = 8

Exercise 4.1

1. Define the following terms :

   (*i*) Frequency of an observation (*ii*) Data (*iii*) Observation

   (*iv*) Raw data (*v*) Range (*vi*) Frequency

2. The number of children in 20 families of a city are 4, 3, 2, 3, 4, 2, 1, 4, 4, 3, 3, 1, 0, 3, 5, 3, 3, 6, 4 and 3. Prepare a frequency distribution table for the data and answer the questions given below :

   (*i*) How many families have more than 3 children?

   (*ii*) How many families have no children?

   (*iii*) How many families are there in all?

3. Following figures are related to the daily wages (in ₹) of 15 employees in an office :

   300, 250, 300, 250, 200, 200, 200, 250, 150, 350, 250, 300, 150, 200, 250.

   Prepare a frequency table and answer the following :

   (*i*) How many employees are getting ₹250?

   (*ii*) What is the range in wages (in ₹)?

4. A dice was thrown 20 times and the following outcomes were noted:

4	6	2	2	4	2	3	3	5	3
4	6	5	6	1	1	6	6	2	3

Prepare a frequency table for the above data.

5. A data of height (in cm) of 20 students in a class were taken:

104	116	125	105	104	116	103	103	125	125
113	114	114	116	127	113	115	115	117	103

Represent a frequency distribution of the data.

6. The following data represents the rainfall (in cm) in 30 days of a month :

17	15	20	12	10	16	8	23	12	14
14	10	16	26	18	23	15	16	8	23
16	25	19	23	18	17	16	14	23	15

Represent the data in the form of frequency table and answer the following questions :

(*i*) What is the range of the given data?

(*ii*) How many days have less than 20 cm rain?

(*iii*) How many days have rainfall between 12 cm to 23 cm?

(*iv*) Which data is recorded the maximum number of times?

Skills covered: Evaluation skills, analytical skills, problem solving skills, numeracy skills

Grouped Data

When the number of observations is large, we condense the data into several groups or classes. Then, we record the frequency of observations falling into each group.

Observe the following discussion :

The marks obtained by 30 students of a class in a monthly English test out of 50 are as follows :

21	6	40	41	13	21	42	12	39	14
25	19	19	39	17	20	11	27	17	8
6	25	9	30	19	18	23	19	6	2

We can arrange the given data in a frequency distribution table as shown below :

Marks (*class intervals*)	**Tally Marks**	**Number of students (*frequency*)**
0 – 10	𝍸 |	6
10 – 20	𝍸 𝍸 |	11
20 – 30	𝍸 ||	7
30 – 40	|||	3
40 – 50	|||	3

The above representation of data as shown in the table is known as the *grouped frequency distribution*.

In the above example, 30 observations have been divided into 5 groups. These groups are called *classes*. The class 0–10 means the marks should lie between 0 and 10 with the inclusion of 0 and exclusion of 10. The number of observations falling in a particular class is called the *frequency* of that class or *class frequency*.

The class 0–10 has frequency of 6 and the class 10–20 has frequency 11. In the class 10 –20, 10 is called the *lower limit* and 20 is called the *upper limit* of the class. The difference between the upper limit and lower limit of any class is known as *class interval*.

For example, in the class 10 –20, the class interval is (20 – 10) = 10.

The mid-point of a class is called its *class mark* and is the sum of its upper and lower class limits divided by 2.

Class mark of the class interval 10–20 is $\frac{10 + 20}{2} = 15$.

Note

We can choose the number and size of class intervals in a grouped frequency distribution according to our suitability. The size of each group and the number of groups are decided, keeping in view the range of the data.

Construction of a Grouped Frequency Distribution

Example 2 : The runs scored by 40 batsmen in a practice session for the selection of players for the school team are given below:

67 84 90 78 25 27 40 45 65 58 60 77 5 45 7 28 21
47 48 55 31 47 34 69 71 75 59 77 41 30 52 78 14 20
80 82 63 76 82 42

Form a frequency table taking a class interval of 10.

Solution:

Class intervals	Tally Marks	Frequency
0 – 10	||	2
10 – 20	|	1
20 – 30	𝍸	5
30 – 40	|||	3
40 – 50	𝍸 |||	8
50 – 60	||||	4

60 – 70	𝍸	5
70 – 80	𝍸 ||	7
80 – 90	||||	4
90 – 100	|	1
Total		**40**

Example 3 : **The following data represents the high blood pressure level of 30 people observed in a clinic:**

119 112 124 116 110 101 107 113 122 128 114 113 108 109 114
106 125 121 119 114 117 122 112 108 104 102 103 114 110 121

(*i*) Form a frequency distribution table taking one of the classes as 0 – 5.

(*ii*) What is the frequency corresponding to the class 120 – 125?

(*iii*) What is the class mark of the class 120 – 125?

(*iv*) What is the upper limit of the class 115 – 120?

Solution: (*i*) Required frequency distribution table is as shown below:

Class Intervals	Tally Marks	Frequency
100 – 105	||||	4
105 – 110	𝍸	5
110 – 115	𝍸 𝍸	10
115 – 120	||||	4
120 – 125	𝍸	5
125 – 130	||	2
Total		**30**

(*ii*) Frequency corresponding to the class 120 – 125 is 5.

(*iii*) Class mark of 120 – 125 $= \frac{120 + 125}{2} = \frac{245}{2} = 122.5$

(*iv*) Upper limit of the class interval 115 – 120 is 120.

Exercise 4.2

1. Represent the following data in the frequency distribution table with one of the class intervals as 0 – 10.

12	15	10	5	24	24	35	3	6	14	10	19	27
7	10	17	29	41	28	11	32	41	20	30	8	11
15	25	49	7	16	46	5	37	9	14	25	11	25
8	46	38	25	29	17	33	26	19	16	38		

Answer the following questions :

(*i*) What is the class size? (*ii*) What is the range?

(*iii*) What is the class mark of 30 – 40 ? (*iv*) What is the upper class limit of 40 – 50 ?

2. The number of times head falling while tossing a coin by 20 people are given below :

6	6	8	2	3	2	5	8	5	5
6	8	7	7	5	6	7	7	6	6

Prepare a frequency distribution table for the data and answer the following :

(*i*) What is the least number of times head fallen ?

(*ii*) What is the most number of times head fallen ?

3. Construct a frequency table with class-interval 0–10 (10 not included) of the following marks obtained by a group of 30 students in a mathematics test :

0	5	8	10	12	15	20	23	25	21	8	12	18	4	6
9	18	19	21	29	31	35	38	40	43	45	49	45	0	17

4. The temperatures (°C) of a town for the month of December are given below :

9.2	10.5	9.4	10.4	9.0	5.2	11.2	10.5	7.1	8.3	10.0
11.0	12.5	12.2	12.0	11.9	7.7	8.8	9.3	9.0	5.7	7.9
6.9	7.6	8.5	8.7	6.4	7.0	8.0	7.1	5.7		

Prepare grouped frequency table using equal class size taking one of the classes as 6 –7 :

(*i*) What was the minimum temperature in December ?

(*ii*) What was the maximum temperature in December ?

(*iii*) Which temperature occurred in a maximum number of days ?

5. The frequency distribution of heights (in cm) of 40 students of a locality is given below:

Height (in cm)	100–110	110–120	120–130	130–140	140–150
Frequency	4	11	10	8	7

(*i*) What is the class size of each class interval?

(*ii*) Which class interval has the highest frequency?

(*iii*) What is the upper limit of the second class interval?

(*iv*) Find the class mark of 120–130.

Skills covered: Evaluation skills, analytical skills, problem solving skills, numeracy skills

Bar Graphs

A bar graph is a pictorial representation of the numerical data by a number of bars (rectangles) of uniform width erected horizontally or vertically with equal spacing between them.

In a bar graph, each bar (rectangle) represents a value of the numerical data. The height or length of a bar indicates, the corresponding value of the numerical data. If the bars are drawn vertically on the X-axis (horizontal), then the scale of heights of the bars or rectangles is shown along the Y-axis (vertical). If the bars are drawn horizontally on the Y-axis, then the scale of heights of bars is shown along the X-axis.

Construction of Bar Graphs

In order to construct a bar graph for the given data, follow the procedure given below:

Working Rules

Step 1. Take a graph paper and draw a horizontal line XX' and a vertical line YY'. These lines intersect at O. The XX' line is called X-axis and YY' line is called Y-axis.

Step 2. Both X-axis and Y-axis must have equal parts. Mark these parts and name the information given.

Step 3. Along X-axis mark the information given in the data like weekdays, months, places, etc. at uniform gap.

Step 4. Choose a suitable scale to determine the heights of the rectangles or bars and then mark the heights on the Y-axis.

Step 5. Draw bars or rectangles of equal width and of heights marked in step 3 on the X-axis with equal spacing between them.

Step 6. Give the graph a suitable title.

The figure so obtained will be the bar graph representing the given numerical data.

Study the following examples to understand the construction of bar graphs of given data :

Example 4 : **The area cultivated under different crops in the year 2011 were as follows :**

Crop	Wheat	Rice	Pulses	Oil seeds	Sugarcane	Cotton	Other cereals
Area (in ten lakh hectares)	22	36	24	17	6	8	38

Represent the above data with the help of a bar graph. Explain through the bar graph, which crop was cultivated in the largest area.

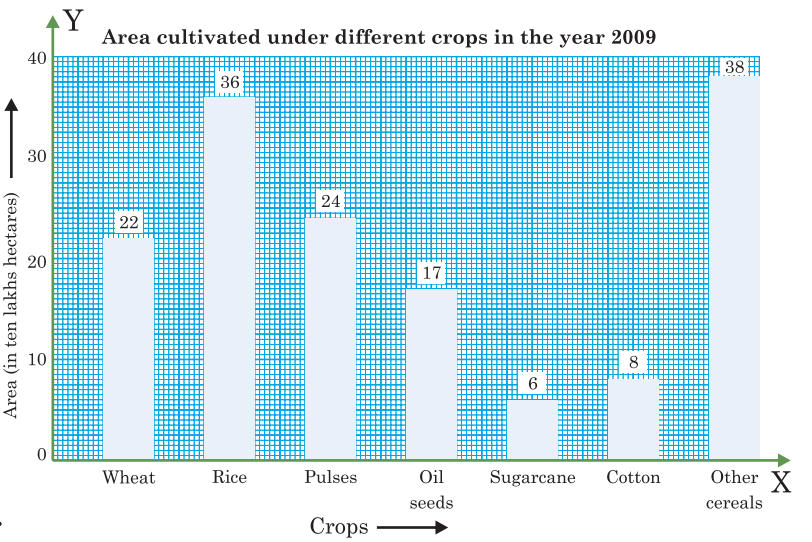
Solution: We take the following steps to construct the required bar graph :

Step 1. Draw two lines perpendicular to each other on a graph paper and represent them as X-axis and Y-axis.

Step 2. Along X-axis, mark 'crops' and along the Y-axis, mark. 'Area (in ten lakh hectares)'.

Step 3. Here, we choose the scale to determine the heights of the bars. Ten lakh hectares = 10 small divisions.

The required bar graph is as shown on the right.



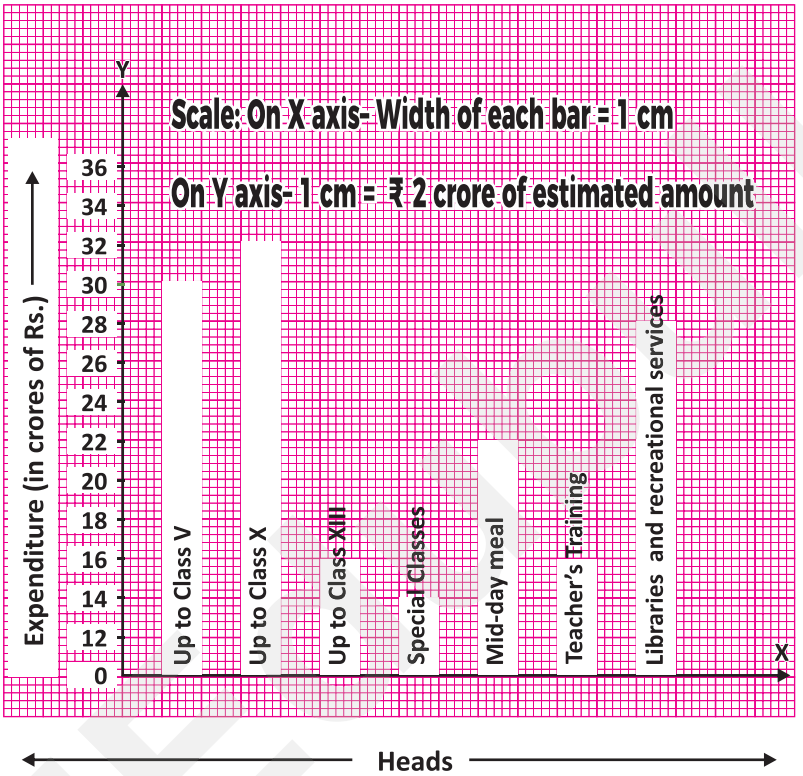
Example 5 : **Read the graph given below representing the expenditure on the educational system of a country in a particular financial year and answer the following questions:**

(*i*) In which system was the minimum provision made?

(*ii*) What was the total amount of money estimated for smooth functioning on the educational system of the country?

(*iii*) What percentage of total estimated amount was kept for libraries and recreational activities ?

(*iv*) Under which head the maximum provision of estimated amount was made ?



Solution: (*i*) Special classes

(*ii*) $30 + 32 + 16 + 14 + 22 + 16 + 28 = 158$ crores.

(*iii*) Estimated amount provided for libraries and recreational activities

$= 28$ crores

Total estimated amount = 158 crores

Required percentage $= \frac{28}{158} \times 100\% = \frac{1400}{79}\% = 17\frac{57}{79}\%$.

(*iv*) Up to class X

Example 6 : **The bar graph given below represents the average weight of boys and girls of different sections of a class. Read the graph and answer the following :**

(*i*) Which section has the maximum average weight?

(*ii*) In which class the average weight of boys and girls are the same?

(*iii*) Find the ratio of the average weight of boys and girls in section C.

(*iv*) What is the difference between the average weight of boys and girls in section E?

Solution: (*I*) Section A

(*ii*) Section D

(*iii*) Boys : girl = 40 : 42 = 20 : 21.

(*iv*) Average weight of boys = 44 kg.

Average weight of girls = 38 kg.

Difference = (44 – 38) kg = 6 kg.

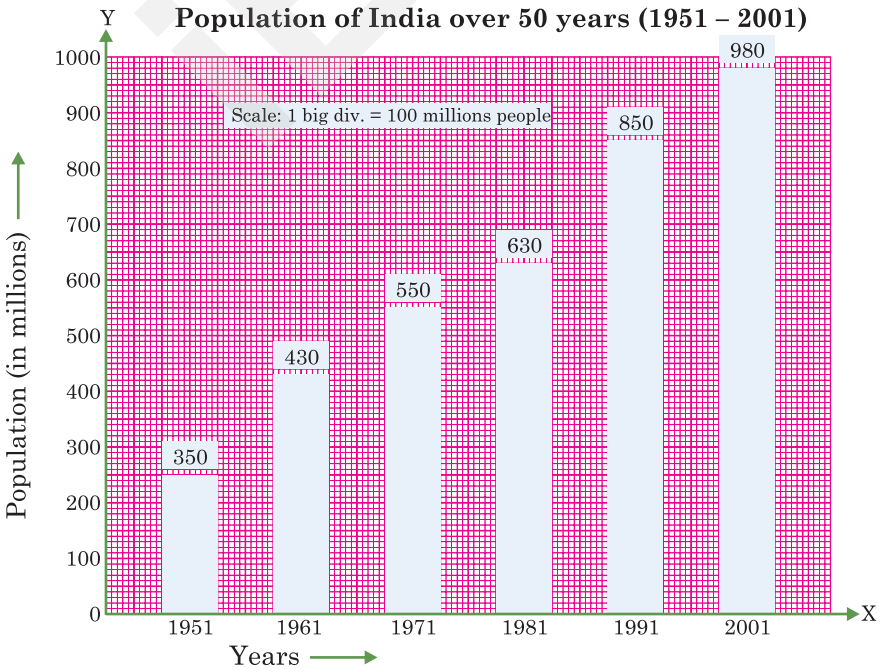
Example 7 : Read the bar graph and answer the following questions :

(*i*) What is represented by the bar graph?

(*ii*) What was the approximate population of India in 2001?

(*iii*) What is the increase in population over 50 years?

(*iv*) Does the bar graph indicate increase in population with the passage of time?



Solution : (*i*) The population of India over 50 years (1951-2001)

(*ii*) 980 millions

(*iii*) The increase in population over 50 years = (980 – 350) = 630 millions

(*iv*) Yes

Histograms

In this section, let us learn how to draw and interpret the bar graphs of a grouped data. The bar graphs of grouped data are graphs with no spacing between the bars. Bar graphs of grouped data are also called histograms. In order to draw histograms, we use the following steps:

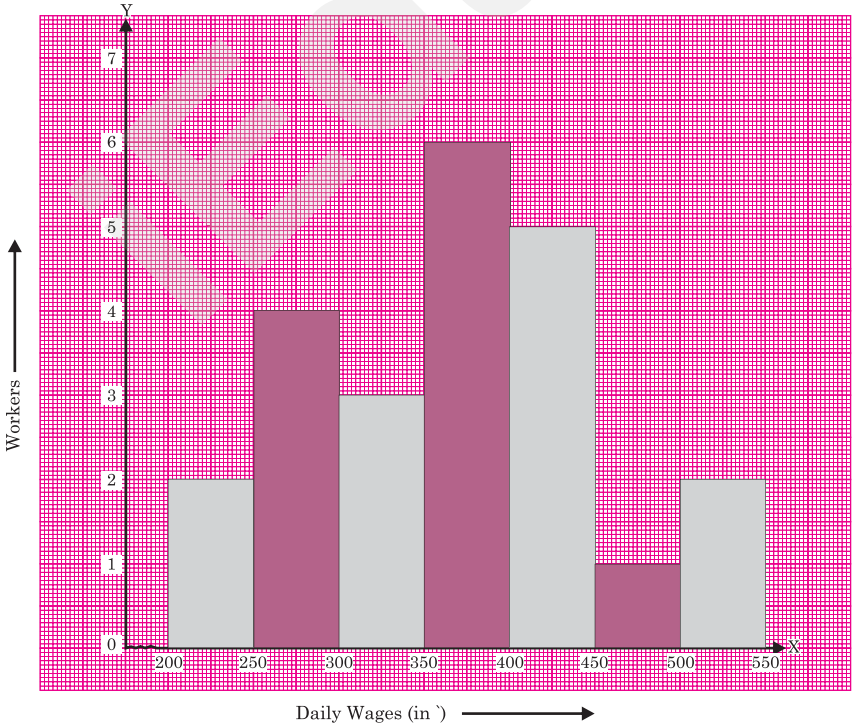
1. Draw two perpendicular axes.
2. Mark class boundaries on the horizontal axis.
3. Mark frequencies on the vertical axis.
4. Construct rectangles with the respective class intervals as the bases and the corresponding frequencies as the heights. The areas of rectangles must be proportional to the frequencies of their classes.

REMEMBER

(*i*) Choose a suitable scale on both the axes.

(*ii*) Draw slanting line segments in each rectangle or colour each rectangle with a distinct colour. so, that the bars look beautiful.

Example 8 : The histogram given below shows the frequency distribution of daily wages of 22 workers in a factory. Using the histogram answer the following questions :



(*i*) What is class size?

(*ii*) Which wage group of workers are least in the factory?

(*iii*) What is the wages of highest paid and lowest paid workers in the factory?

(*iv*) What are the class marks of the 300–350 group and 500–550?

Solution: (*i*) Size of the classes = 50.

(*ii*) Workers in the wage group of ₹ (450 – 500), i.e., 1.

(*iii*) Number of highest paid workers = 2, number of lowest paid workers = 2.

(*iv*) Class mark of $300 - 350 = \frac{300 + 350}{2} = \frac{650}{2} = ₹\ 325$

Class mark of $500 - 550 = \frac{500 + 550}{2} = \frac{1050}{2} = ₹\ 525$

Example 9 : Read the histogram given below and answer the following questions :

(*i*) What information is depicted by this histogram?

(*ii*) Name the class which contains the minimum number of students. Explain significance of this.

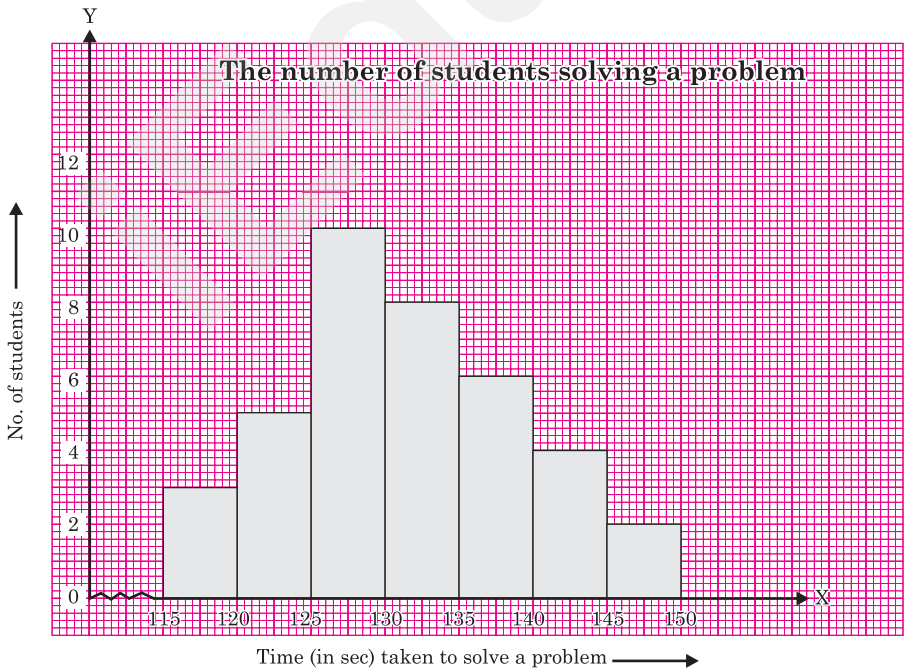
(*iii*) Name the class which contains the maximum number of students. Explain significance of this.

(*iv*) How many students can solve the problem in 135 s to 140 s?

(*v*) Write the approximate number of students who can solve the problem in time interval, 120 s to 125 s.

(*vi*) Write the approximate number of students who can solve the problem in maximum time interval, i.e., in 145 s to 150 s.

(*vii*) What is the approximate total number of students solving the problem?



Solution: (*i*) The histogram gives us the information about different times in seconds taken by a number of students to solve a problem.

(*ii*) The class 145 – 150 contains the minimum number of students. This means that

minimum number of students take time ranging from 145 s to 150 s to solve the problem.

(*iii*) The class 125 – 130 contains the maximum number of students. This means that maximum number of students take time ranging from 125 s to 130 s to solve the problem.

(*iv*) We see that the height of the rectangle corresponding to the class 135 – 140 is 6. Hence, 6 students can solve the problem in time ranging from 135 s to 140 s.

(*v*) We see that the height of the rectangle corresponding to the class 120 – 125 is approximately 5. Hence, the required approximate number of students who can solve the problem in this time interval is 5.

(*vi*) We see that the height of the rectangle corresponding to the class 145 – 150 is approximately 2. Hence, the required approximate number of students who can solve the problem in maximum time is 2.

(*vii*) We see that the sum of the heights of all the rectangles in different classes is nearly $3 + 5 + 10 + 8 + 6 + 4 + 2 = 38$.

Hence, the approximate total number of students solving the problem is 38.

Note

Since the scale on the X-axis starts at 115 and not from the origin O, a kink, i.e., a break (⌇) is indicated in above histogram near the origin to signify that the graph is drawn to a scale beginning at 115 and not at the origin.

Exercise 4.3

1. The results of pass percentage of class VII and VIII in annual examination of a school of five students are given in the following table :

Students	Rakesh	Rajesh	Vinay	Rajni	Aparna
VII	80	90	75	95	96
VIII	85	80	80	90	95

Draw a bar graph to represent the above data.

2. Number of students in five different classes are given below:

Classes	I	II	III	IV	V
No. of students	25	40	30	45	25

Construct a bar graph to represent the above data.

3. The marks obtained (out of 100) by a student are given below :

Subjects	Hindi	English	Maths	Science	S. St	Arts
Marks obtained	66	80	95	88	75	65

Represent the data by a bar graph.

4. The production of crops (in tonnes) cultivated in the present year is as follows :

Crops	Wheat	Rice	Grams	Oil seeds	Cereals	Jute	Cotton
Area	23	38	23	17	40	4	8

Represent the above data with the help of a bar graph. Explain through the bar graph, which crop was cultivated in the largest area.

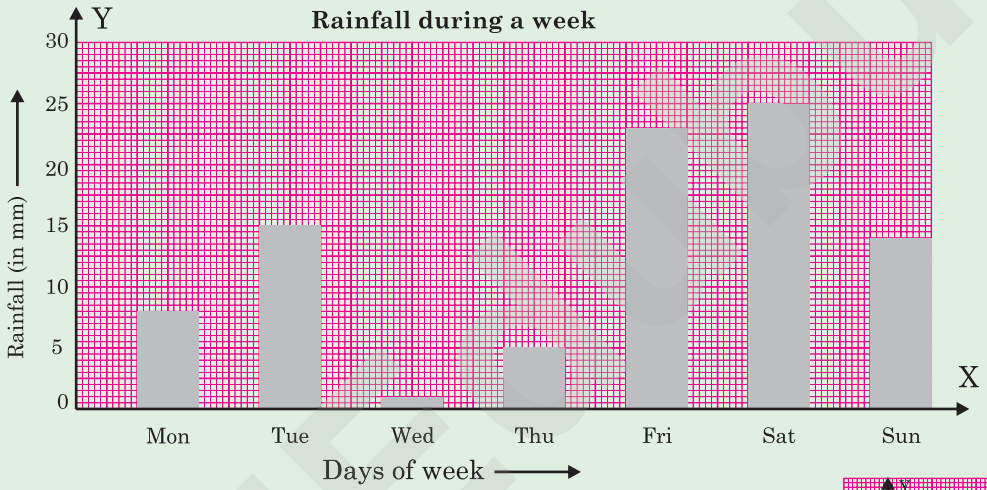
5. Draw a graph for the following :

Age group (in years)	25–30	30–35	35–40	40–45	45–50
No. of children	2	3	3	4	1

6. The following data shows number of toys produced by a company during seven consecutive years. Represent the given data by a bar graph :

Year	2004	2005	2006	2007	2008	2009	2010
No. of toys	1800	1200	2500	1725	1800	2050	2200

7. Read the bar graph shown (Fig.) and answer the questions that follow:



(*i*) What does the vertical scale (Y-axis) represent?

(*ii*) What information does the bar graph represent?

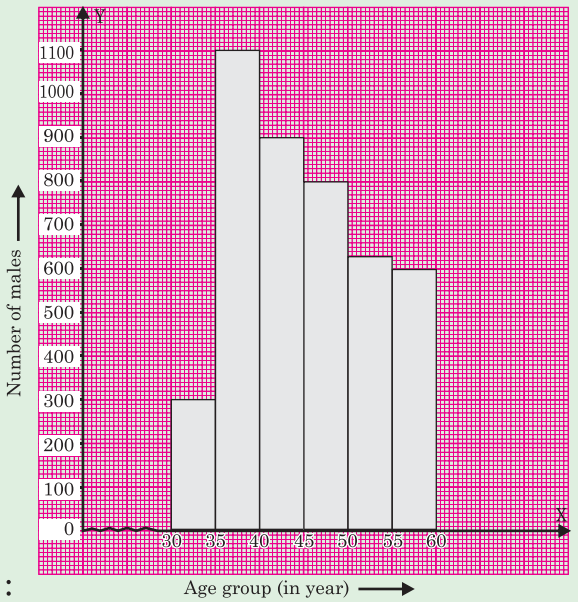
(*iii*) On which day was there minimum rainfall?

(*iv*) On which days were there the same rainfall?

(*v*) On which day was there maximum rainfall?

(*vi*) Is it an example of a vertical graph?

8. The following histogram shows the number of educated males in the age group 30 to 60 years in a village:



Read the histogram and answer the following questions :

(*i*) What is the class size?

(*ii*) Write the age group in which the number of educated males is highest.

(*iii*) In which age group educated males are least?

(*iv*) What is the lowest frequency?

(*v*) What are the class marks of the classes?

9. A maths teacher checked whether the new technique of teaching he applied after quarterly test was effective or not. He took the scores of the 5 weakest children in the quarterly test (out of 25) and in the half yearly test (out of 25) as follows :

Student	Reshma	Anubhav	Rohini	Amita	Karim
Quarterly	15	12	12	23	15
Half yearly	13	17	12	24	16

Construct a bar graph to represent the above data.

10. Draw a histogram for the following data :

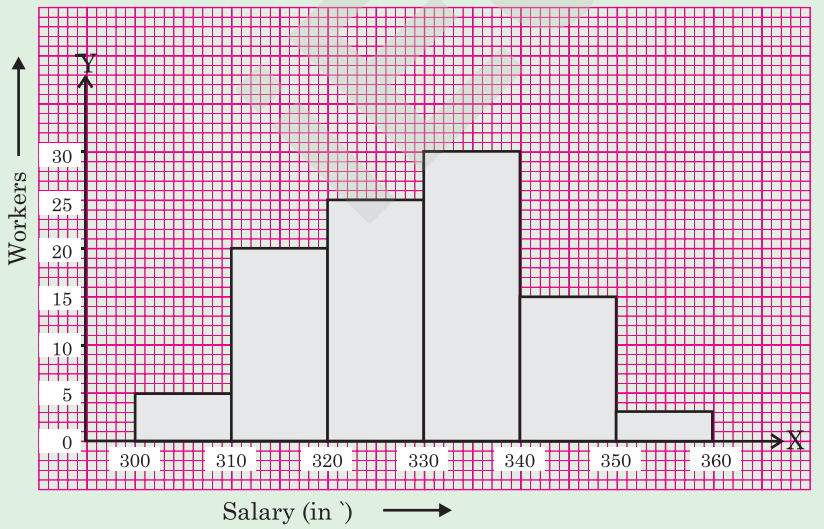
Monthly income (in `)	2500-3000	3000-3500	3500-4000	4000-4500	4500-5000
No. of workers	10	8	15	20	10

11. The number of cars produced in a factory during five consecutive months is given below :

Months	1st	2nd	3rd	4th	5th
No. of cars produced	840	1,280	920	1,100	1,500

Draw a bar graph representing the above information.

12. Study the histogram and answer the following questions.



(*i*) How many workers are in the maximum salary group?

(*ii*) In which salary group are the maximum workers?

(*iii*) What is the size of each class?

(*iv*) How many workers get less than ₹330?

(*v*) How many get ₹ 330 or more?

(*vi*) What is the total number of workers?

Skills covered: Evaluation skills, analytical skills, problem solving skills, numeracy skills

Probability

We often hear phrases like "Most probably India will win the match" or "Probably I will get a new bicycle this birthday". These show a certain degree of uncertainty or probability of occurrence of an event. Probability is used to analyse these events, which can be repeated and predictions are made on the basis of expected average value of outcomes.

Let's go through preliminary terms used in the study of probability :

1. **Experiment:** A situation involving chance or probability that leads to an outcome is called an *experiment*. For example, drawing an ace from a pack of cards.
2. **Outcomes:** After a single trial of an experiment the result we get is called an *outcome*. For example, when we throw a coin and let it fall flat on the ground, its upper face show either head or tail.

   (i) Whichever the face comes out, is called an outcome.

   (ii) All possible outcomes are either head or tail.
3. **Events:** An event is one or more outcomes of an experiment. Getting 4, when a dice is tossed is an *event*.
4. **Random Experiment:** An experiment in which outcomes may differ each time when the experiment is performed is called *random experiment*. For example, tossing a coin may result in getting a head or a tail.

Probability: *Probability is a fractional number that measures the chance of an outcome happening. All probabilities have a value between 0 and 1.*

The probability of an uncertainly is 0 and that of a certain happening is 1.

Empirical Probability: Let n be the total number of trials of a random experiment, then the empirical probability P (E) of happening of an event E is given by the formula:

$$P(E) = \frac{\text{Number of trials in which the event happened}}{\text{Total number of trials}}$$

Example 10 : **A coin is tossed 40 times in which head is obtained 20 times. On tossing a coin at random, find the probability of getting (*i*) a head (*ii*) a tail.**

Solution: We have total number of trials = 40

Number of times a head come up = 20

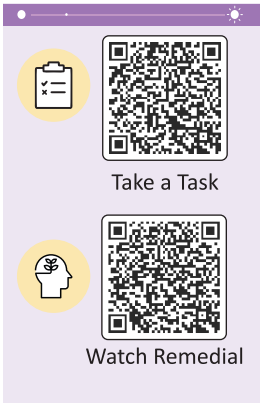
Number of times a tail come up $= (40 - 20) = 20$

$\therefore$ Probability of getting a head $= \dfrac{\text{Number of heads}}{\text{Total number of trials}}$

$= \dfrac{20}{40} = 0.5$

Probability of getting a tail $= \dfrac{\text{Number of tails}}{\text{Total number of trials}}$

$= \dfrac{20}{40} = 0.5$



Example 11 : **Two coins are tossed simultaneously (at a time) 450 times and the outcomes of the trials are given below :**

Two tails 200 ; One tail 150 ; No tail 100

Find the probability of the occurrence of each of these events.

Solution: Total number of trials $= 450$

$\therefore$ P (getting two tails) $= \dfrac{200}{450} = \dfrac{4}{9}$

P (getting one tail) $= \dfrac{150}{450} = \dfrac{1}{3}$

P (getting no tail) $= \dfrac{100}{450} = \dfrac{2}{9}$.

Example 12 : **In a survey of 200 adolescents, it was found that 75 like pepsi while 125 like coke. Out of these adolescents, an adolescent is chosen at random. What is the probability that the chosen adolescent.**

(i) likes pepsi? (ii) likes coke?

Solution: We have, total number of adolescents $= 200$

Number of adolescents who like pepsi $= 75$

Number of adolescents who like coke $= 125$

$\therefore$ Probability that a chosen adolescent likes pepsi

$= \dfrac{75}{200} = \dfrac{3}{8}$

Probability that a chosen adolescent likes coke

$= \dfrac{125}{200} = \dfrac{5}{8}$.

Exercise 4.4

1. Which of the following is an example of a random experiment ?
   (*i*) Measuring the height of a person.
   (*ii*) Selecting a card from a pack of playing cards.

(*iii*) Selecting a vowel from the letters of the English alphabet.

(*iv*) Throwing two coins together.

(*v*) Finding the length of your pencil box.

2. A coin is tossed 200 times and head is obtained 85 times. What is the probability of getting a tail?
3. A bag has 5 red balls and 7 white balls in it. What is the probability of drawing:

   (*i*) a white ball? (*ii*) a red ball?
4. A dice is thrown 100 times and the outcomes are noted as shown below:

Outcome	1	2	3	4	5	6
Frequency	20	16	11	13	15	25

   If a dice is thrown at random. What is the probability that the number comes up is even?
5. There are 6 marbles in a bag with numbers 1 to 6 marked on each of them. What is the probability of drawing a marble with number:

   (*i*) 6 (*ii*) 5 (*iii*) 3
6. If two coins are tossed together, what are the chances of getting "head head" or two heads?
7. A bag contains 8 green, 2 blue, 3 red and 2 yellow marbles. If a marble is drawn at random. What is the probability of getting:

   (*i*) a yellow marble (*ii*) a red marble (*iii*) a green marble
8. In a deck of 52 cards, the number of red and black cards are same. If one card is drawn at random. What is the probability of getting black card?
9. In 40 throws of a dice, 1 is obtained 7 times and 2 is obtained 4 times. If dice is thrown at random, what is the probability of getting a number greater than 2?
10. Six cards with numbers 10, 9, 8, 7, 6 and 5 are randomly placed face-down on a table. Ankita removed two cards number10 and 7. What is the probability that the next one turned up is 6?

Skills covered: Evaluation skills, analytical skills, problem solving skills, numeracy skills

Pie Chart

A pie chart is a circle graph divided into sectors, which displays the sizes of parts (components) that make up some whole.

The central angle for a component is calculated as:

$$\text{Central angle for a component} = \left(\frac{\text{Value of the component}}{\text{Sum of the values of all components}} \times 360^\circ\right)$$

Constructing a Pie Chart for a given Data

To construct a pie chart for a given data, we proceed as per the following steps:

Working Rules

Step 1. The central angle for each component is calculated by using the formula:

$$\text{Central angle of a component} = \left(\frac{\text{Value of the component}}{\text{Total value}} \times 360^\circ\right)$$

Step 2. Draw a circle of convenient radius and in it draw a horizontal radius.

Step 3. Starting with the horizontal radius, draw radii making central angles corresponding to the values of the respective components, till all the components are completed. These radii divide the whole circle into various sectors.

Step 4. Shade each sector with different design.

Example 13 : **The time (in hours) spent by different students on home work on a working day is given below:**

Name of students	No. of hours spent on home work
Arati	6
Binny	5
Ramesh	3
Stefy	8
Bela	2
Total	24

Represent the above information in the form of a pie chart.

Solution : Given data may be written in the tabular form as shown below:

Name of students	No. of hours	Measure of central angle
Arati	6	$\frac{6}{24} \times 360^\circ = 90^\circ$
Binny	5	$\frac{5}{24} \times 360^\circ = 75^\circ$
Ramesh	3	$\frac{3}{24} \times 360^\circ = 45^\circ$
Stefy	8	$\frac{8}{24} \times 360^\circ = 120^\circ$
Bela	2	$\frac{2}{24} \times 360^\circ = 30^\circ$
Total	24	360°

Construction of pie chart :

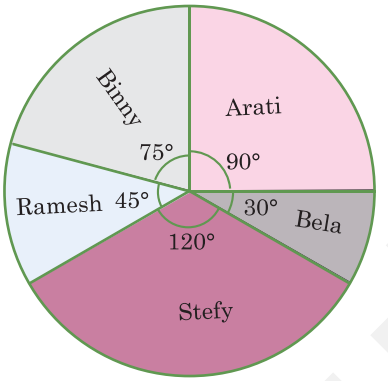
Step 1. Draw a circle of any convenient radius.

Step 2. Draw a horizontal radius of this circle.

Step 3. Starting with the horizontal radius, draw sectors whose central angles are calculated above.

Step 4. Shade the sectors so obtained differently and label each one of them (Fig.).

Thus, we obtain the required pie chart, as shown in figure below :



Example 14 : There are 900 literature books in a library as per the list given in the table below :

Fiction	Non-fiction	Poetry	Classic	Novel
175	125	150	50	400

Represent the above data by a pie chart.

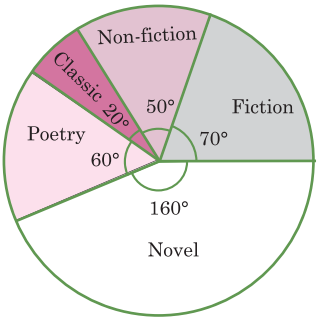
Solution : We have total books = (175 + 125 + 50 + 150 + 400) = 900.

Central angle for a component = $\left(\frac{\text{Value of the component}}{\text{Sum of the values of all components}} \times 360^\circ\right)$

Calculation of Central Angles :

Name of the books	No. of books	Central angle
Fiction	175	$\left(\frac{175}{900} \times 360^\circ\right) = 70^\circ$
Non-fiction	125	$\left(\frac{125}{900} \times 360^\circ\right) = 50^\circ$
Poetry	150	$\left(\frac{150}{900} \times 360^\circ\right) = 60^\circ$
Classic	50	$\left(\frac{50}{900} \times 360^\circ\right) = 20^\circ$
Novel	400	$\left(\frac{400}{900} \times 360^\circ\right) = 160^\circ$

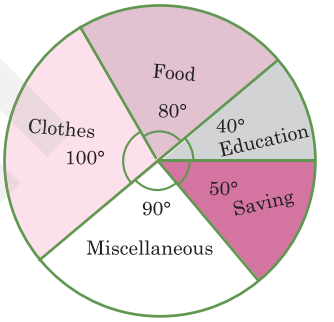
The required pie chart is shown in figure below :



Reading a Pie Chart

The process of making inferences from the pie chart is said to be reading of pie chart.

Observe the following example :



Example 15 : Monthly income of a family is ₹ 9,000. The following pie chart shows how the family used the money in a month. Study the pie-chart and answer the following questions :

(*i*) How much was spent on food?

(*ii*) How much was spent on education?

(*iii*) How much was spent on clothes?

(*iv*) How much does the family save?

(*v*) Find the ratio of the amount spent on miscellaneous items to that spent on food ?

Solution: Total income of the family = ₹ 9,000

$$\text{Value of a component} = \frac{\text{Central angle for the component}}{360} \times \text{Total value}$$

(*i*) Amount spent on food = $\frac{80}{360} \times 9000 =$ ₹ 2,000

(*ii*) Amount spent on education = $\frac{40}{360} \times 9000 =$ ₹ 1,000

(*iii*) Amount spent on clothes = $\frac{100}{360} \times 9000 =$ ₹ 2,500

(*iv*) Savings of the family = $\frac{50}{360} \times 9000 =$ ₹ 1,250

(*v*) Amount spent on miscellaneous items = $\frac{90}{360} \times 9000 =$ ₹ 2,250

From (*I*), amount spent on food = ₹ 2,000

∴ Required ratio ₹ = 2250 : 2000 = 9 : 8.

Exercise 4.5

1. The following table shows the mode of transport used by 300 students to come to school:

Mode of transport	scooter	car	bus	on foot
No. of students	50	25	150	75

Illustrate the above data by means of a pie chart.

2. The marks obtained by Ritika in an examination are given below:

Subjects	Mathematics	Hindi	English	Science	GK
Marks obtained	90	105	75	120	150

Represent the above data by a pie chart.

[Hint. Total marks obtained = (90 + 105 + 75 + 120 + 150) = 540]

3. A weekly periodical made a survey about the reading habits of a group of persons living in a particular locality. Percentage of those reading different types of books is given below:

Type of books	Stories	Novels	Drama	Adventure	Others
Percentage	20%	15%	30%	10%	25%

Represent the above data by a pie chart.

4. The number of players of class VII are selected for sports team in the last five years is given below:

Year	2005	2006	2007	2008	2009
No. of players	25	35	30	40	20

Express the above data in pie chart.

5. Rohit's with a monthly salary of ₹ 14400 plans his budget for a month as given below:

Item	Food	Clothing	Rent	Education	Miscellaneous
Amount (in ₹)	5,400	4,000	2,800	1,800	400

Represent the above data by a pie chart.

6. The following table shows the percentages of consumers of four different brands of tea:

Brand	Tata tea	Lipton	Broke band	AVC
Percentage of consumers	35%	20%	30%	15%

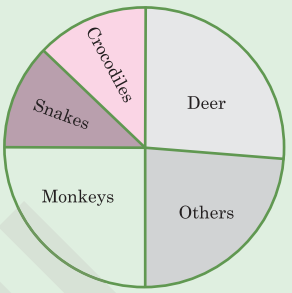
Represent the above data by a pie chart.

7. The number of students in a hostel, speaking different languages is given below:

Languages	Hindi	English	Gujrati	Bengali	Marathi	Total
No. of students	40	12	9	4	7	72

Display the data in a pie chart.

8. The adjoining pie chart shows the animals kept in a zoo. Read the pie chart and answer the following questions:



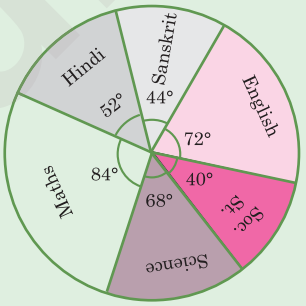
(*i*) Which animal is the most popular?

(*ii*) Which two animals are equally popular?

(*iii*) What percentage of people like crocodiles?

9. The given pie chart depicts the marks obtained by a student in different subjects out of a total of 450 marks.

Answer the following questions:



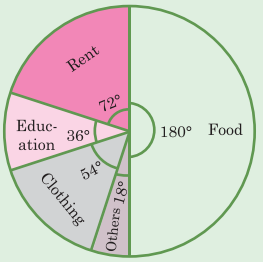
(i) Find the marks obtained in each subject.

(ii) In which subject the marks is highest ?

(iii) In which subject the marks is the lowest?

(iv) Which subject has the greatest sector angle?

10. The expenditure of a hostel spending amount on different items is represented by a pie chart given in Fig. Read the pie chart and answer the following questions:



(*i*) On which item the expenditure is the most?

(*ii*) On which item the expenditure is least ?

(*iii*) If the expenditure on food is ₹ 18,000. What will be the cost on clothing ?

Skills covered: Evaluation skills, analytical skills, problem solving skills, numeracy skills

Revision Exercise

Conceptual Learning

A. Tick (✓) the correct option:

(*i*) The number of times a particular entry occurs in an observation is known as _____

(*a*) range (*b*) class size (*c*) frequency (*d*) none

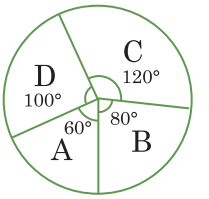
(*ii*) The difference between the highest and the lowest value of observation is called its ____

(*a*) frequency (*b*) range (*c*) class interval (*d*) none

(*iii*) The difference between upper and lower class limits of a group is called _____

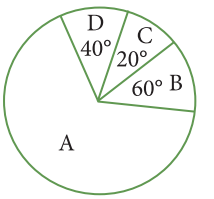
(*a*) class limit (*b*) class mark (*c*) class width (*d*) none

(*iv*) In the adjacent figure. What per cent of the circle is occupied by sector C?



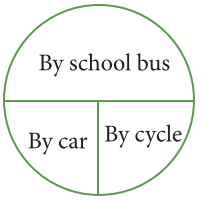
(*a*) $33\frac{1}{3}\%$ (*b*) $22\frac{2}{9}\%$ (*c*) $16\frac{2}{3}\%$ (*d*) $27\frac{7}{9}\%$

(*v*) In the adjacent figure. What fraction of the circle is occupied by sector A?



(*a*) $\frac{1}{2}$ (*b*) $\frac{1}{3}$ (*c*) $\frac{2}{3}$ (*d*) $\frac{3}{5}$

(*vi*) In the adjacent figure. If 215 students come by car, then the number of students in the school are :



(*a*) 920 (*b*) 900 (*c*) 840 (*d*) 860

B. Fill in the blanks :

(*i*) When data is an unorganised set of observations, it is called _____.

(*ii*) Number of times an _____ occurs in the data is called frequency of that observation.

(*iii*) The range of the data 32, 46, 80, 56, 78, 21 is _____.

(*iv*) The difference between the upper limit and lower limit is called _____ .

(*v*) The mid-point of the class is called the _____ of the class.

(*vi*) The data organised into a frequency distribution is called _____data.

(*vii*) Sum of central angles in pie-chart is _____ .

(*viii*) Histogram is a bar graph with no _____ between the bars.

(*ix*) The _____ is the number of observations in a particular group or class.

(*x*) The upper limit of the class 60-70 is _____ .

Assertion and Reason

Critical Thinking

In each of the following questions, an Assertion (A) and a corresponding Reason (R) supporting it is given.

Study both the statements and state which of the following is correct :

(*a*) Both A and R are true and R is the correct explanation of A.

(*b*) Both A and R are true but R is not the correct explanation of A.

(*c*) A is true but R is false. (*d*) A is false but R is true.

Custom Learning Path

1. **Assertion (A) :** If a die thrown, getting a number 7 has only one chance.

   Reason (R) : If a die thrown, getting a number less than 7 is a sure chance.

2. **Assertion (A) :** The probability of getting on add number when a die is thrown, is $\frac{3}{6}$.

   Reason (R) : Sum of all central angles in a pie chart is 180^0.

3. **Assertion (A) :** Bar graphs may be horizontal or vertical.

   Reason (R) : Information in the form of numerical figure is called data.

4. **Assertion (A) :** Difference between upper limit and lower limit of a class is called class width.

   Reason (R) : Data after arranging in ascending or descending order is called raw data.

5. **Assertion (A) :** If a data is arranged in descending order, it is called an array.

   Reason (R) : The probability of selecting a vowel from the English alphabet is $\frac{4}{13}$.

Thinking Skills

A survey was conducted in a school to find out the favorite fruits of 120 students. The results are summarized in the table below:

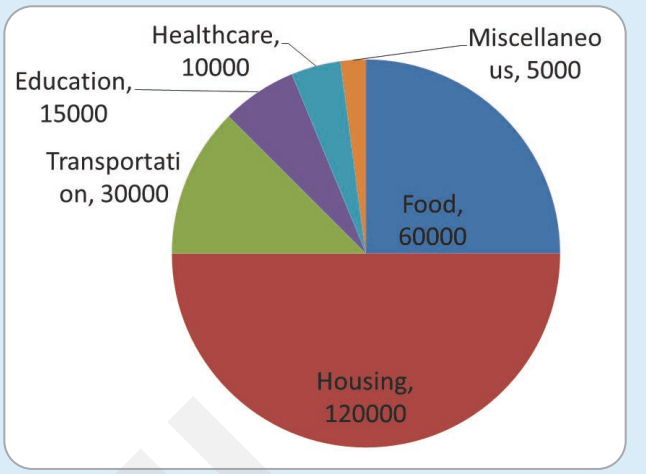
Fruit	Number of Students
Apple	40
Banana	30
Mango	20
Orange	15
Grapes	15

1. What is the total number of students who participated in the survey?
2. What is the percentage of students who prefer Apple as their favorite fruit?
3. How many more students prefer Banana over Mango?
4. If one student is selected at random, what is the probability that the student prefers Mango?
5. If two students are chosen at random, what is the probability that both students prefer Apple?

Skills Developed: Creativity, Observation, Critical Thinking, Logical Reasoning, Reflective Thinking

Competency based Questions

The following pie chart shows the distribution of the annual expenses of a family:



The total annual expense of the family is ₹2,40,000.

1. What is the angle of the sector representing Housing?
2. What percentage of the total annual expense is spent on Food?
3. Find the difference of expenses between housing and Education?
4. Calculate the difference in percentage between the expenses on Transportation and Healthcare.
5. What are total expenses of Transportation, Education and Miscellaneous?

Skills Developed: Interpersonal skills, Observation, Application and Decision making skills

Case Study

The following data shows the average number of hours spent on four different activities by a group of 20 students each month. The data is recorded over the last 6 months:

Month	Studying (hrs)	Playing (hrs)	Watching TV (hrs)	Other (hrs)
January	80	30	40	50
February	85	28	42	55
March	75	32	35	45
April	78	30	38	48
May	90	27	45	50
June	88	35	40	48

1. Find the total number of hours spent on others activities over the 6 months.
2. Calculate the mean number of hours spent on watching TV activity across the 6months.
3. Identify the month with the highest total hours spent on all activities combined.
4. Calculate the mode of the number of hours spent on "Watching TV."
5. Find the probability that a student selected at random attended Playing in May?

Skills Developed: Research, Logical Reasoning, Problem-Solving, Practical Application