



- Concept of Pie chart (circle graph) and representation.
- Central tendency of data and its type.
- Calculation of arithmetic mean (when the frequency is not given)
- Finding the arithmetic mean (when the frequency is given)

3.1 Introduction :

In previous class you have studied that the numerical facts which are collected for a specific purpose are called data/figures.

You have learnt to, organize data from dis-organized data, creating frequency table, graphical representation of unclassified data, making pictograph and bar graph. Now in this unit we will learn about concept and representation of pie chart of unclassified data, central tendencies, the arithmetic mean of ungrouped data, as well as arithmetic mean when frequency is known etc.

3.2 Concept and Representation of Pie Graph :

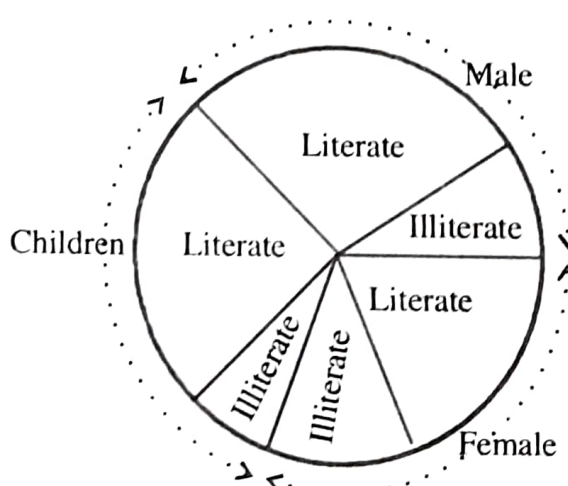
Representation of data by the pie graph is also a powerful medium. In this type of representation the data is presented by the sectors of circle.

You must have seen the figures as circularly describe in newspapers in the following manner.

Vote get by different parties
in the councilors election

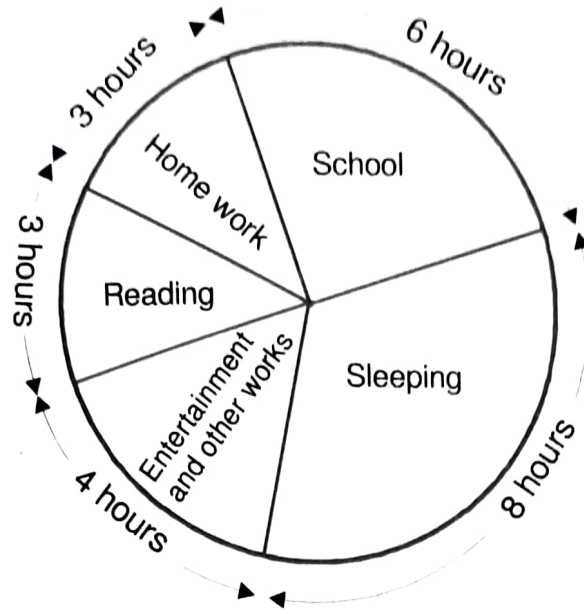


Total literacy in a town



This representation is called circle graph. The circle graph shows the relation between the whole and its parts. The entire circle is divided into sectors and the measurement of every sector is proportional to the information provided by it. Circle graph is also called the pie chart.

The time spent in various activities in one day by a child are shown in following figure by the circle graph.



In present diagram the proportional part of the sector of the time (in hours) spent by the child in the school

$$= \frac{\text{Number of Hours in School}}{\text{Whole day}}$$

$$= \frac{6 \text{ Hours}}{24 \text{ Hours}} = \frac{1}{4}$$

Therefore this sector has been drawn as $\frac{1}{4}$ part of the entire circle. Similarly the proportional part of the time spent in sleeping action.

$$= \frac{\text{Number of Hours spent sleeping}}{\text{Whole day}}$$

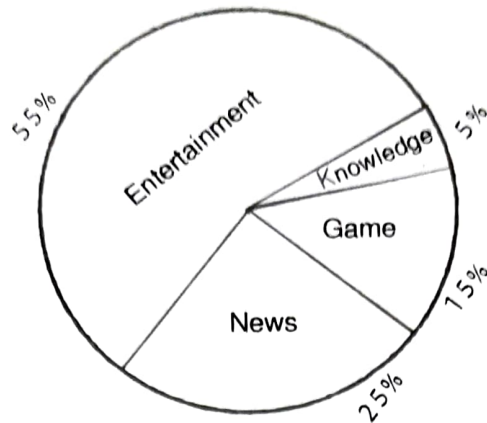
$$= \frac{8 \text{ Hours}}{24 \text{ Hours}} = \frac{1}{3}$$

This sector is shown as $\frac{1}{3}$ part of the entire circle. Similarly, the measurement of the other sectors can be found.

Adding the fractions of all activities, you see that the sum is 1.

Try it :

Answer the following questions on the basis of adjacent pie diagrams.



program shown on a TV channel

Fig. 3.4

1. Which type of programs are most viewed?
2. Which types of programs are least viewed?
3. What is the percentage of viewers seeing the news?
4. What is the total percentage of viewers watching the extra programs besides the entertainment program?

Activity 1 :

The marks obtained in Hindi, English Mathematics, Science and Social Science by Alka in the annual examination are shown by the following Pie Chart. If Alka had obtained a total of 540 marks then answer the following questions.

1. In which subjects Alka obtained 105 marks ?
2. How many more marks did Alka obtained in Mathematics than Hindi ?
3. Check it whether the sum of the marks obtained in English and Hindi is less or more than the sum of the marks obtained in science and social science.

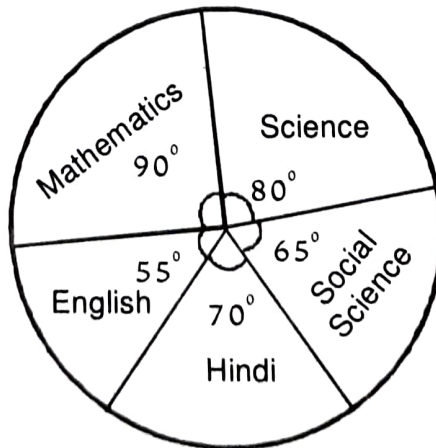


Fig. 3.5

Solution :

To solve these type of questions, convert the central angles into their corresponding marks obtained.

Central angle for the sum of 540 marks received = 360°

$$\text{Central angle for score } 105 = \frac{360^\circ}{540} \times 105 = 70^\circ$$

1. The central angle of the sector which denote for Hindi is 70° .

So Alka got 105 marks in Hindi.

2. Difference between the central angles of the sectors which denote mathematics and Hindi is :

$$= 90^\circ - 70^\circ = 20^\circ$$

$$\text{Difference of corresponding obtained marks} = \frac{20^\circ}{360^\circ} \times 540 = 30$$

Alka got 30 more marks in Mathematics than Hindi

3. The sum of the central angles of the sector which denote English and Hindi

$$= 55^\circ + 70^\circ = 125^\circ$$

The sum of the central angles of the sector which denote Science and Social Science.

$$= 80^\circ + 65^\circ = 145^\circ$$

Since $145^\circ > 125^\circ$

Hence, the sum of the marks obtained in Science and Social Science is more.

3.3 Draw a Pie Graph or Circle Graph

In the table given below details of the means used for coming to the school by the students of Class 6 in the school. Represent it by Pie graph.

Resources	Pedestrian	Cycle	Rickshaw	Motor cycle/Scooter	Bus	Sum
Number of Students	18	10	8	9	15	60

The entire angle at the center of the circle is 360° . The central angles of the sectors will be a part of 360° .

So, firstly find the measurement of the central angle of the sectors for the number of students who adopted various means of traffic in the entire angle created at the centre of the circle.

$$\text{Measure of Central angles of sector} = \frac{\text{Students who adopt different means}}{\text{Total Student}} \times 360^\circ$$

Therefore, the measurement of central angles for the instruments uses by all students can be calculated in the following manner :

Traffic Resources	Number of Students	Part of the Whole	Angle of Sector
Pedestrian	18	$\frac{18}{60} = \frac{3}{10}$	$360^\circ \times \frac{3}{10} = 108^\circ$
Cycle	10	$\frac{10}{60} = \frac{1}{6}$	$360^\circ \times \frac{1}{6} = 60^\circ$
Rickshaw	8	$\frac{8}{60} = \frac{2}{15}$	$360^\circ \times \frac{2}{15} = 48^\circ$
Motor cycle/Scooter	9	$\frac{9}{60} = \frac{3}{20}$	$360^\circ \times \frac{3}{20} = 48^\circ$
Bus	15	$\frac{15}{60} = \frac{1}{4}$	$360^\circ \times \frac{1}{4} = 90^\circ$
Sum	60		$= 360^\circ$

- Now take a suitable radius and draw a circle.
- Again draw a radius in the circle and with the help of a protactor draw a sector of the central angle 108° in the interior area of the circle.
- After this make the sector of the central angle of 60° , 48° , 54° and 90° respectively.
- Write the name of the instruments adopted in the corresponding sector segments.
- To make the figure attractive use different colours.

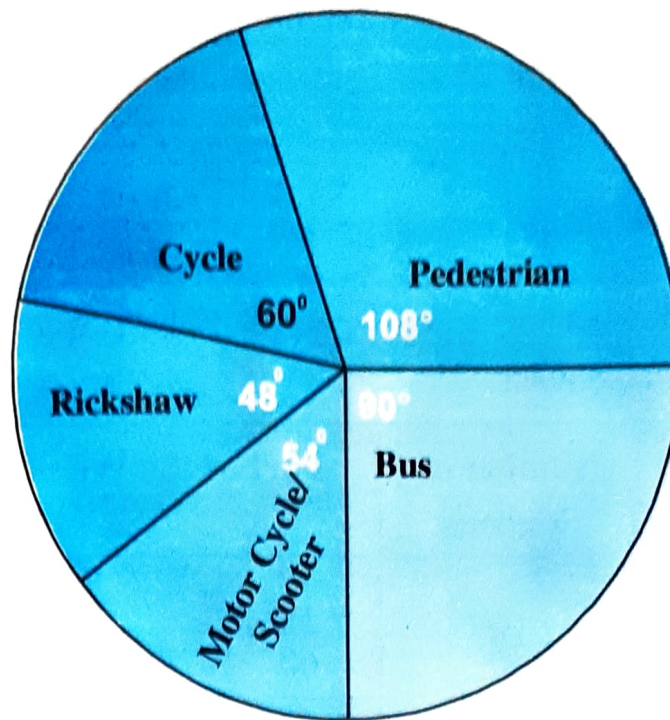


Fig. 3.6

Try it :

In the following table the monthly budget of a family has been presented. The percentage of expenditure on important items is given in it. Display data by Pie Chart.

Item	Expense percent	Part of the whole	Measure of the angle of the sectors (central angle)
House Rent	15	$\frac{15}{100}$	$360^\circ \times \frac{15}{100} = 54^\circ$
Food	45		
Clothing	15		
Education	10		
Mixed Expense	10		
Savings	5		
Sum	100		360°

Complete the pie graph from the given table and answer the following questions :

- What has been displayed by pie graph?
- The largest sector is for which item's expenditure?
- What is the total measurement of the central angles of education, mixed expense and savings?

- Which items expenditure are equal.
- What is the measurement of the whole angle?

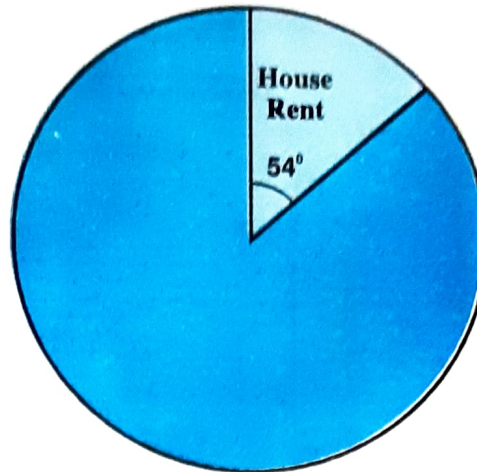
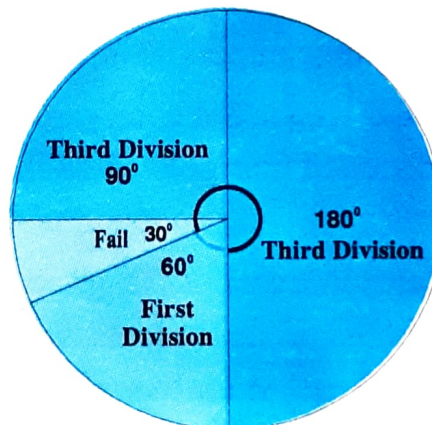


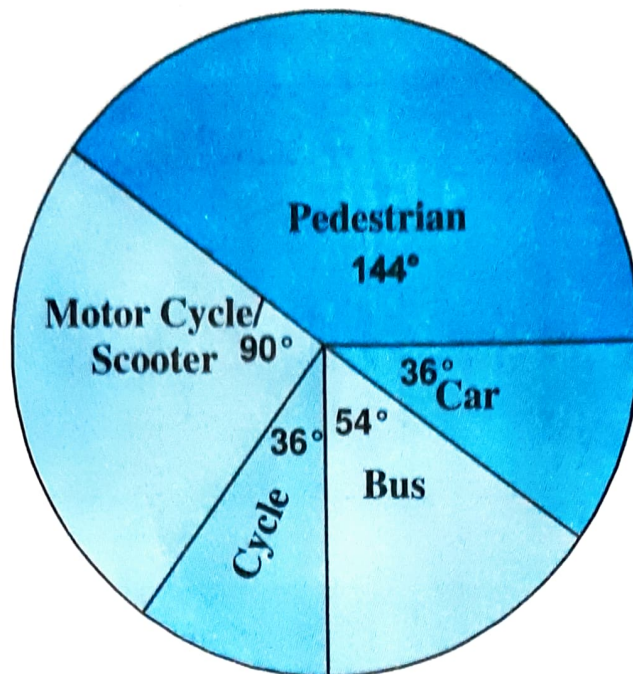
Fig. 3.7

Exercise – 3(a)

1. The result of 60 students of the annual examination of a class are denoted by the following pie graph. See picture and tell :

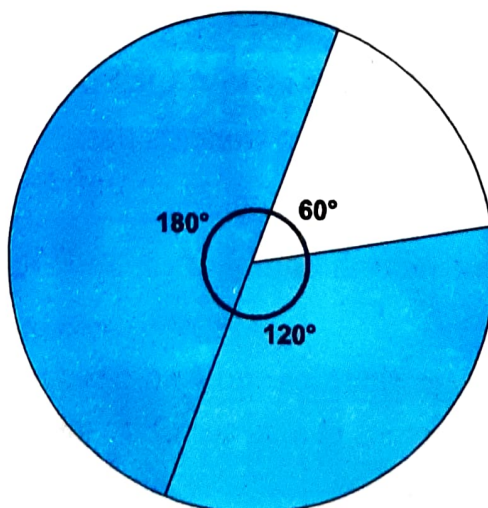


- (i) In which category did the more students pass?
 - (ii) In which category did the lowest students pass?
 - (iii) What is the number of failing students?
 - (iv) What is the ratio between the number of students passed in the first class and second class?
2. Due to non-compliance of traffic rules and fast speed in any city of India, pie graph of percentage rates of injured persons in road accidents travelling through different means is given below :



Answer the following questions by looking at the pie graph—

- (i) The most wounded person was travelling by which type of means?
 - (ii) What is the percentage of people injured travelling by bicycles ?
 - (iii) What percentage of the total number of people who were travelling by motorcycle were injured?
 - (iv) How many Percentage of injuries of pedestrains and car passengers.
 - (v) What is the total percentage of people injured in other travelling mean?
3. Flowers are planted in circular area in the courtyard of Panchayat Bhavan. In its half the area there is rose, one third area of marigold and dahlia plants in the rest. Represent this by pie graph.
 4. There are a total of 36 students in a group. Pie graph is drawn on the basis of the colours of their choice. Write the number of the students who like different colours by looking at pie graphs in the given table.



Colour	Pink	White	Yellow
Central Angle	180°	60°	120°
No. of Students			

5. Mathematical quiz was organized for teams of students of Class 7 of 4 schools of any Sankul. Make a pie graph based on the marks obtained by them :

School :	A	B	C	D
Obtained Marks :	20	25	30	15

6. The number of customers who bought different brands of television given as follows :

Brand	A	B	C	D	E
Number	40	20	15	15	10

Represent the data by Pie graph.

3.4 Central Tendency and type of data :

In daily life, we often hear and say the following types of things :

1. Average height of students in the class is 140 centimeters.
2. The average monthly income of factory workers is Rs. 4000.
3. Average of Runs is 50 in matches played by a player.

Infact, the height of each student of the class is 140 centimeters, the monthly income of every workers in the factory is Rs. 4000 and the run scored by the player in each match is 50 are not in real. In a match the player scored more than 50 runs and scored less than 50 in a match. These are all representative numbers, which are neither the lowest values of the nor the maximum value. Certainly such numbers are the number of middle or neighbourhood of the middle number.

Thus, we feel that the average is such a number that reflects the central tendency of a group of data, because the average is among the highest and lowest value figures. Therefore, average is the measure of central tendency of a group of data. To clarify the trend of different types of data various types of central values are required.

So, the meaning of the central tendency is that numerical measurement which represents most of the obtained data.

Measurements of central tendency are mainly of three types.

1. Arithmetic mean
2. Median
3. Mode.

Here we will study only the arithmetic mean.

3.5 Arithmetic Mean :

The representative value most used for a group of data is the arithmetic mean. It is also called arithmetic mean. In short it is called mean.

To understand this well. Let us come to look at the following examples.

Example 1. The three sacks have 40 kg, 60 kg and 80 kg wheat respectively. If there is equal wheat in 3 sacks, then how much wheat will be in each sack?

Solution : The quantity of wheat in each sack will be arithmetic mean or average.

$$\begin{aligned}\text{Arithmetic mean} &= \frac{\text{Total mass of wheat}}{\text{Number of sacks}} = \frac{40 + 60 + 80}{3} \text{ kg} \\ &= \frac{180}{3} \\ &= 60 \text{ kg}\end{aligned}$$

Thus, every sack will have 60 kg of wheat.

Example 2. The score of marks of the 6 students of Class 7 is 85, 73, 90, 64, 86, 70 out of 100 marks. Find the average of marks.

Solution : Here we see that the minimum marks is 64 and maximum marks is 90. In the above 6 scores, a representative number can be a number between the minimum and the maximum received marks.

To find it, all these numbers are added and divided by total number of terms. For example :

$$\frac{85 + 73 + 90 + 64 + 86 + 70}{6} = \frac{468}{6} = 78$$

So the representative number is 78. This is called average or arithmetic mean of numbers.

Arithmetic mean is the value which is obtained by dividing the number of terms in the sum of the given terms.

The arithmetic mean can be defined as in the following form

$$\text{Arithmetic mean} = \frac{\text{Sum of all terms}}{\text{Total number of terms}}$$

3.6 Calculation of arithmetic mean from unclassified data (when frequency is not given) :

To find the arithmetic mean from unclassified data dividing the sum of all the items by the number of items. If $x_1, x_2, x_3, \dots, x_n$ are the terms of the group of n values of a variable. Then

$$\text{Arithmetic mean} = \frac{x_1 + x_2 + x_3 + \dots + x_n}{n} = \frac{\Sigma x}{n}$$

Here, Σ (sigma) is a symbol of greek letter which is the sign of sum *i.e.*

$$\Sigma x = x_1 + x_2 + x_3 + \dots + x_n$$

Example 3. The weight (in kg) of 10 students of Class 7 are 56, 42, 40, 38, 52, 48, 45, 45, 44 and 40 kg respectively. Find the arithmetic mean of their weights.

Solution :

$$\begin{aligned}\text{Arithmetic mean} &= \frac{\text{Sum of all terms}}{\text{Number of terms}} = \frac{\Sigma x}{n} \\ &= \frac{56 + 42 + 40 + 38 + 52 + 48 + 45 + 45 + 44 + 40}{10} \text{ kg} \\ &= \frac{450}{10} \text{ kg} = 45 \text{ kg}\end{aligned}$$

Think, Discuss and Write :

In the above example—

1. Is the obtained arithmetic mean greater than the weight of each students?
2. Is the obtained arithmetic mean less than the weight of each students?

Discuss with your friends and give the answer by taking the examples of similar question.

Try :

1. Find the arithmetic mean of 5, 6, 11 and 22.
2. Find the arithmetic mean of natural numbers from 11 to 15.
3. If the arithmetic mean of 2, 3 and x is 3, then find the value of x .

3.7 Finding the arithmetic mean of unclassified data (when frequency of terms is given) :

The following steps are taken to calculate the arithmetic mean of this type of data.

(I). First of all, multiply each term with corresponding frequency.

(II). The sum of this $f \times x$ i.e. Σfx is obtained.

(III). The following formula is used $\bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{\Sigma fx}{N}$

This quotient is the desired arithmetic mean. If terms of the group are, $x_1, x_2, x_3, \dots, x_n$ and its frequency are $f_1, f_2, f_3, \dots, f_n$ respectively. Then,

$$\begin{aligned} \text{Arithmetic mean} &= \frac{f_1 \times x_1 + f_2 \times x_2 + f_3 \times x_3 + \dots + f_n \times x_n}{f_1 + f_2 + f_3 + \dots + f_n} \\ &= \frac{\Sigma fx}{\Sigma f} \end{aligned}$$

Example 4. The weight of 40 students of a class in kg are given the following :

Weight (kg) (x)	40	41	42	43	44	45
Frequency (f)	8	4	6	10	6	6

Find the arithmetic mean of weight of class learners.

Solution :

Weight (Kg) (x)	Frequencies (f)	Weight $\times$ Frequency $f \times x$
40	8	$8 \times 40 = 320$
41	4	$4 \times 41 = 164$
42	6	$6 \times 42 = 252$
43	10	$10 \times 43 = 430$
44	6	$6 \times 44 = 264$
45	6	$6 \times 45 = 270$
Sum	$\Sigma f = 40$	$\Sigma fx = 1700$

$$\text{Arithmetic Mean} = \frac{\Sigma fx}{\Sigma f}$$

$$= \frac{1700}{40} \text{ kg}$$

$$= 42.50 \text{ kg.}$$

Try it :

In the council election, the percentage of votes received for 50 candidates of different political parties has been given. Find the arithmetic mean :

Number of candidates	24	08	12	06
Percent of votes received	55	30	60	35

Exercise – 3(b)

- Five students of any class obtained 40, 50, 68, 70 and 72 marks in the mathematics examination respectively. Find the arithmetic mean of the obtained marks of the students.
- The daily wages of 15 workers of a factory Rs. 70, 110, 65, 80, 75, 85, 80, 76, 94, 100, 105, 110, 103, 81, 86, respectively. Find the arithmetic mean of the labour wages.
- Find the arithmetic mean of the data given below :

Term	4	6	8	10	12	14
Frequency	3	4	2	2	6	8

Height of Students in (cm.)	140	147	148	149	150	151	154	158	159	160
Frequency	3	4	5	6	10	7	5	4	4	2

Find the arithmetic mean of the above data.

Ability Exercise– 3

- In an examination, the score of 15 students of a class is 00, 30, 30, 20, 20, 40, 30, 50, 60, 50, 60, 80, 70, 30, 30, out of 100 marks. Find the arithmetic mean of obtained marks.
- The weight of 10 girls is 40, 42, 41, 38, 36, 35, 42, 37, 35, 35 kg respectively. Find the arithmetic mean of their weights.

3. The weight of 50 students in kilogram is given in the following table. Find the arithmetic mean of their weight.

Weight (in kilogram)	40	42	43	44	45
Frequency	4	12	18	10	6

4. Find the arithmetic mean of the following frequency distribution :

Height (in cm.)	142.5	143.5	144.5	145.5	146.5	147.5
Frequency	3	5	7	7	3	2

5. In the table given below, the figures of production of different food grains have been given in one year of any area. Represent the data in pie graph.

Grain/Pulses	Corn	Pea	Gram	Wheat	Paddy
Production (in tons)	4	4	6	10	12

6. The sale (in Rupees) of various items in a bakery shop is given below on Sunday.

Bread	320
Sweet Biscuit	120
Salty Biscuit	160
Pastry	80
Other	40

Make the table by finding the central angle of sector and using the table, draw a pie chart.

In this unit we learned :

1. Pie graph represent the group of statistical data in the representation of the circle, in which the different data is represented by the sector of the circle.

2. Measurement of central angle of sector = $\frac{\text{Corresponding figure}}{\text{Total figure}} \times 360^\circ$
3. Around one of the figures found that their tendency is called central tendency.
4. Arithmetic mean is the value that is obtained by the sum of all terms by dividing the total number of terms.
5. Finding the arithmetic mean from unclassified data, while the frequency is not given.

$$\text{Arithmetic mean} = \frac{\sum x}{n}$$

where

$\sum x$ = Sum of data

n = Number of given data.

6. Finding the arithmetic mean of unclassified data, while the frequency is given :

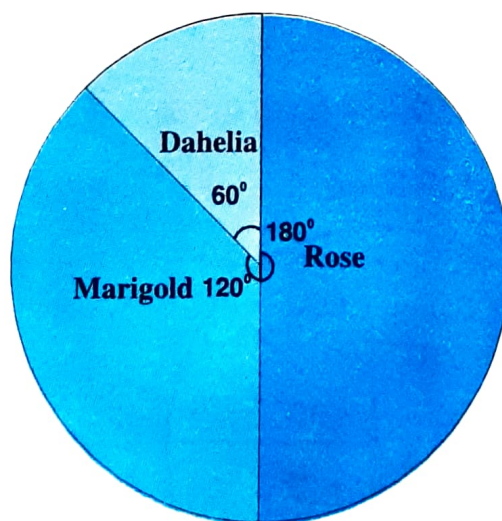
$$\text{Arithmetic mean} = \frac{\sum fx}{\sum f}, \quad \text{where } x = \text{data and } f = \text{frequency.}$$



ANSWERS

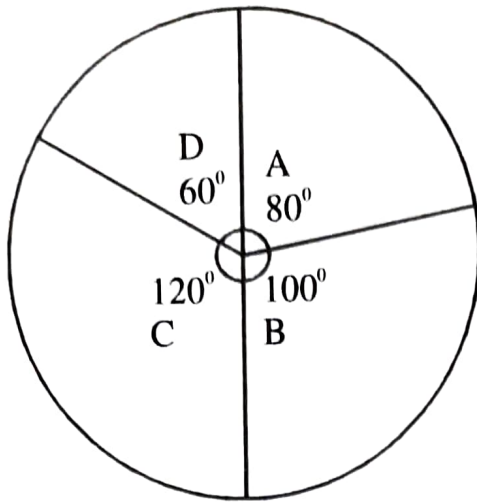
Exercise – 3(a)

1. (i) Second division, (ii) First division, (iii) 5, (iv) 1 : 3; 2. (i) Pedestrian, (ii) 10%, (iii) 25%, (iv) 50, (v) 60; 3.

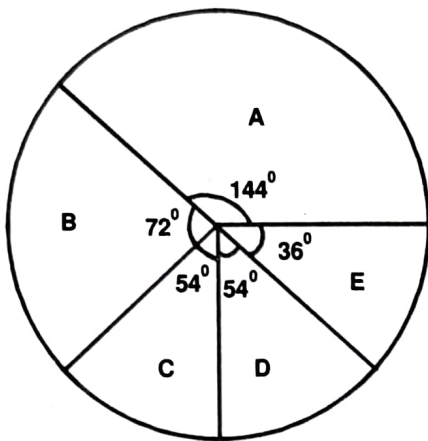


4. Pink Colour-18, White Colour-6, Black Colour-12

5.



6.



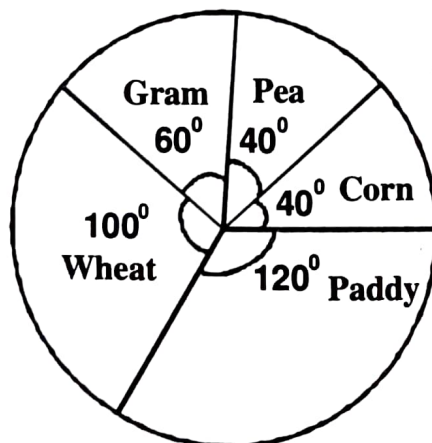
Exercise – 3(b)

1. 60; 2. Rs. 88; 3. 10.24; 4. 151.14 cm.

Ability Exercise

1. 40; 2. 38.1 kg; 3. 42.96 kg; 4. 144.8 cm

5.



6.

Items	Sale (in Rupees)	Part of the whole	Central angle
Bread	320	$\frac{320}{720}$	$\frac{4}{9} \times 360^\circ = 160^\circ$
Sweet Biscuit	120	$\frac{120}{720}$	$\frac{1}{6} \times 360^\circ = 60^\circ$
Salty Biscuit	160	$\frac{160}{720}$	$\frac{2}{9} \times 360^\circ = 80^\circ$
Pastry	80	$\frac{80}{720}$	$\frac{1}{9} \times 360^\circ = 40^\circ$
Other	40	$\frac{40}{720}$	$\frac{1}{18} \times 360^\circ = 20^\circ$
Sum	720		

