

6

Statistics

... INDEX ...

Pr. S 6.1 - 1 Pg 143	Pr. S 6.2 - 3 Pg 149	Pr. S 6.4 - 3 Pg 154	Pr. S 6.6 - 4 Pg 166	PS 6 - 6 Pg 148	PS 6 - 14 Pg 169
Pr. S 6.1 - 2 Pg 144	Pr. S 6.2 - 4 Pg 148	Pr. S 6.4 - 4 Pg 155	Pr. S 6.6 - 5 Pg 168	PS 6 - 7 Pg 149	PS 6 - 15 Pg 166
Pr. S 6.1 - 3 Pg 143	Pr. S 6.3 - 1 Pg 150	Pr. S 6.5 - 1 Pg 158	Pr. S 6.6 - 6 Pg 168	PS 6 - 8 Pg 151	PS 6 - 16 Pg 169
Pr. S 6.1 - 4 Pg 144	Pr. S 6.3 - 2 Pg 150	Pr. S 6.5 - 2 Pg 158	PS 6 - 1 Pg 170	PS 6 - 9 Pg 156	PS 6 - 17 Pg 167
Pr. S 6.1 - 5 Pg 146	Pr. S 6.3 - 3 Pg 151	Pr. S 6.5 - 3 Pg 159	PS 6 - 2 Pg 143	PS 6 - 10 Pg 161	PS 6 - 18 Pg 167
Pr. S 6.1 - 6 Pg 146	Pr. S 6.3 - 4 Pg 151	Pr. S 6.6 - 1 Pg 165	PS 6 - 3 Pg 145	PS 6 - 11 Pg 161	ASS. - Pg 174
Pr. S 6.2 - 1 Pg 147	Pr. S 6.4 - 1 Pg 152	Pr. S 6.6 - 2 Pg 165	PS 6 - 4 Pg 146	PS 6 - 12 Pg 162	
Pr. S 6.2 - 2 Pg 148	Pr. S 6.4 - 2 Pg 153	Pr. S 6.6 - 3 Pg 166	PS 6 - 5 Pg 145	PS 6 - 13 Pg 163	

**Points to Remember:**

- Introduction:**

Statistics is something that surrounds us every day - we are constantly bombarded with statistics, in the form of polls, tests, ratings etc. It is a branch of Mathematics which deals with the collection, presentation and analysis of numerical data and drawing the conclusions on the basis of the same.

Statistics is used to study the problems in Biology, Psychology, Economics, Education, Sociology, Trade etc. It is widely used in industries to control the quality of products.

In our Xth standard syllabus, we have four things to learn :

- (A) Measures of Central Tendency of Grouped Data.
- (B) Pie-Diagram.
- (C) Histogram.
- (D) Frequency Polygon or Frequency Curve

- Measures of Central Tendency of Grouped data:**

The most basic concept in statistics is the idea of an **average (arithmetic mean)**. An **average** is a single number which represents the idea of a typical value. There are three different numbers which can represent the idea of an average value. The three values are the mean, the median and the mode.

Mean : Given a set of values, the mean is sum of all the values, divided by the total number of values. Mean summarizes the properties of entire data.

There are three different methods to find Mean for the given data.

Mean by Direct Method:

- Classes need not be continuous.
- Classmark (x_i) has to be found for every class of the given data.

- Method 1 : Direct Method**

In this method, table will have four columns.

Step 1 : In 1st column, write the given Classes.

Step 2 : In 2nd column, write the Classmark/Mid-values (x_i) for each of the class.

Find the class mark of the first class, the remaining class marks could be found by adding class width (h) to the previous class mark.

Step 3 : In 3rd column, write the Frequency (f_i) of all the classes. Find the sum of all frequencies i.e. Σf_i .

Step 4: In 4th column, find the product of Classmark/Mid values (x_i) and frequency (f_i), i.e. $f_i x_i$ for each of the classes. Find the sum of all ($f_i x_i$) values i.e. $\Sigma f_i x_i$

Step 5 : Calculate, Mean ($\bar{x}$) = $\frac{\Sigma f_i x_i}{\Sigma f_i}$

MASTER KEY QUESTION SET - 6

Practice Set - 6.1 (Textbook Page No. 138)

- (1) The following table shows the number of students and the time they utilized daily for their studies. Find the mean time spent by students for their studies by direct method. (3 marks)

Time (hrs.)	0 - 2	2 - 4	4 - 6	6 - 8	8 - 10
No. of students	7	18	12	10	3

Solution:

Time (in hrs.)	Class Mark (x_i)	No. of students (f_i)	$f_i x_i$
0 - 2	1	7	7
2 - 4	3	18	54
4 - 6	5	12	60
6 - 8	7	10	70
8 - 10	9	3	27
Total		$N = \sum f_i = 50$	$\sum f_i x_i = 218$

$$\begin{aligned}\text{Mean } (\bar{x}) &= \frac{\sum f_i x_i}{\sum f_i} \\ &= \frac{218}{50} \\ &= 4.36\end{aligned}$$

∴ Mean of the time spent by students for studies is 4.36 hrs.

- (3) A milk centre sold milk to 50 customers. The table below gives the number of customers and the milk they purchased. Find the mean of the milk sold by direct method. (3 marks)

Milk sold (Litre)	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6
No. of customers	17	13	10	7	3

Solution:

Milk sold (in litres)	Class Mark (x_i)	No. of families (f_i)	$f_i x_i$
1 - 2	1.5	17	25.5
2 - 3	2.5	13	32.5
3 - 4	3.5	10	35
4 - 5	4.5	7	31.5
5 - 6	5.5	3	16.5
Total		$N = \sum f_i = 50$	$\sum f_i x_i = 141$

$$\begin{aligned}\text{Mean } (\bar{x}) &= \frac{\sum f_i x_i}{\sum f_i} \\ &= \frac{141}{50} \\ &= 2.82\end{aligned}$$

∴ Mean quantity of milk sold is 2.82 litres

Problem Set - 6 (Textbook Page No. 165)

- (2) The following table shows the income of farmers in a grape season. Find the mean of their income. (3 marks)

Income (Thousand ₹)	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80
Farmers	10	11	15	16	18	14

Solution:

Production (in thousand rupees)	Class Mark (x_i)	No. of families (f_i)	$f_i x_i$
20 - 30	25	10	250
30 - 40	35	11	385
40 - 50	45	15	675
50 - 60	55	16	880
60 - 70	65	18	1170
70 - 80	75	14	1050
Total		$N = \sum f_i = 84$	$\sum f_i x_i = 4410$

$$\begin{aligned}\text{Mean } (\bar{x}) &= \frac{\sum f_i x_i}{\sum f_i} \\ &= \frac{4410}{84} \\ &= 52.5\end{aligned}$$

$$\begin{aligned}\text{Mean of production} &= 52.5 \times 1000 \\ &= 52,500\end{aligned}$$

∴ Mean of production in rupees is ₹ 52,500.



Points to Remember:

• Method II:

Assumed Mean Method or shift of origin method:

In this method, table will have five columns.

Step 1 : In 1st column, write the given classes.

Step 2 : In 2nd column, write the Classmark/Mid

values (x_i) for each of the class.

Step 3 : Select any value in the Classmark (x_i) column as Assumed mean. It is denoted by A. Generally, middle value of the column is selected.

Step 4 : In 3rd column, find deviations using formula $d_i = x_i - A$ for first class and the remaining d_i could be found by adding class width to the previous d_i .

Step 5 : In 4th column, write the Frequency (f_i) of all the classes. Also, find the sum of all frequencies, i.e. Σf_i

Step 6 : In 5th column, find the product of deviations (d_i) and frequency (f_i), i.e. $f_i d_i$ for each of the classes. Find the sum of all ($f_i d_i$) values i.e. $\Sigma f_i d_i$

Step 7 : Calculate $\bar{d} = \frac{\Sigma f_i d_i}{\Sigma f_i}$

Step 8 : Calculate Mean $\bar{x} = A + \bar{d}$

Practice Set - 6.1 (Textbook Page No. 138)

- (2) In the following table, the toll paid by drivers and the number of vehicles is shown. Find the mean of the toll by 'assumed mean' method.

Toll (₹)	300 - 400	400 - 500	500 - 600	600 - 700	700 - 800
No. of Vehicles	80	110	120	70	40

(4 marks)

Solution:

Assumed Mean (A) = 550

Toll collected (in rupees)	Class Mark (x_i)	$d_i = x_i - A = x_i - 550$	No. of vehicles (f_i)	$f_i d_i$
300 - 400	350	-200	80	-16000
400 - 500	450	-100	110	-11000
500 - 600	550 → A	0	120	0
600 - 700	650	100	70	7000
700 - 800	750	200	40	8000
Total			$N = \Sigma f_i = 420$	$\Sigma f_i d_i = -12000$

$$\bar{d} = \frac{\Sigma f_i d_i}{\Sigma f_i}$$

$$= \frac{-12000}{420}$$

$$= -28.57$$

$$\text{Mean } (\bar{x}) = A + \bar{d}$$

$$= [550 + (-28.57)]$$

$$= 521.43$$

∴

Mean of the money collected is ₹ 521.43.

- (4) A frequency distribution table for the production of oranges of some farm owners is given below. Find the mean production of oranges by 'assumed mean' method. (4 marks)

Production (Thousand ₹)	25 - 30	30 - 35	35 - 40	40 - 45	45 - 50
No. of farm owners	20	25	15	10	10

Solution:

Assumed Mean (A) = 37.5

Production (in thousand rupees)	Class Mark (x_i)	$d_i = x_i - A = x_i - 37.5$	frequency (f_i)	$f_i d_i$
25 - 30	27.5	-10	20	-200
30 - 35	32.5	-5	25	-125
35 - 40	37.5 → A	0	15	0
40 - 45	42.5	5	10	50
45 - 50	47.5	10	10	100
Total			$\Sigma f_i = 80$	$\Sigma f_i d_i = -175$

$$\bar{d} = \frac{\Sigma f_i d_i}{\Sigma f_i}$$

$$= \frac{-175}{80}$$

$$= -2.19$$

$$\text{Mean } (\bar{x}) = A + \bar{d}$$

$$= [37.5 + (-2.19)]$$

$$= 35.31$$

$$\therefore \text{Mean of production Amount} = 35.31 \times 1000 = ₹ 35,310$$

∴

Mean of production is ₹ 35,310.

Problem Set - 6 (Textbook Page No. 165)

- (3) The loans sanctioned by a bank for construction of farm ponds are shown in the following table. Find the mean of the loans. (4 marks)

Loan (Thousand ₹)	40 - 50	50 - 60	60 - 70	70 - 80	80 - 90
No. of farm ponds	13	20	24	36	7

Solution:

Assumed Mean (A) = 65

Loan (in thousand rupees)	Class Mark (x_i)	$d_i = x_i - A$ $= x_i - 65$	Number of farm pond (f_i)	$f_i d_i$
40 - 50	45	-20	13	-260
50 - 60	55	-10	20	-200
60 - 70	65 → A	0	24	0
70 - 80	75	10	36	360
80 - 90	85	20	7	140
Total			$\Sigma f_i = 100$	$\Sigma f_i d_i = 40$

$$\begin{aligned}\bar{d} &= \frac{\Sigma f_i d_i}{\Sigma f_i} \\ &= \frac{40}{100} \\ &= 0.4\end{aligned}$$

$$\begin{aligned}\text{Mean } (\bar{x}) &= A + \bar{d} \\ &= 65 + 0.4 \\ &= 65.4\end{aligned}$$

$$\begin{aligned}\text{Total amount} &= 65.4 \times 1000 \\ &= 65,400\end{aligned}$$

∴ Mean of loan given by bank is ₹ 65,400.

- (5) The following frequency distribution table shows the amount of aid given to 50 flood affected families. Find the mean of the amount of aid. (4 marks)

Amount of aid (Thousand ₹)	50 - 60	60 - 70	70 - 80	80 - 90	90 - 100
No. of families	7	13	20	6	4

Solution:

Assumed Mean (A) = 75

Money (in thousand rupees)	Class Mark (x_i)	$d_i = x_i - A$ $= x_i - 75$	frequency (f_i)	$f_i d_i$
50 - 60	55	-20	7	-140
60 - 70	65	-10	13	-130
70 - 80	75 → A	0	20	0
80 - 90	85	10	6	60
90 - 100	95	20	4	80
Total			$\Sigma f_i = 50$	$\Sigma f_i d_i = -130$

$$\begin{aligned}\bar{d} &= \frac{\Sigma f_i d_i}{\Sigma f_i} \\ &= \frac{-130}{50} \\ &= -2.6\end{aligned}$$

$$\begin{aligned}\text{Mean } (\bar{x}) &= A + \bar{d} \\ &= 75 + (-2.6) = 72.4\end{aligned}$$

$$\text{Total amount} = 72.4 \times 1000 = ₹ 72,400$$

∴

Mean of money given is ₹ 72,400.

**Points to Remember:**

Method III : Step Deviation Method or shift of origin and scale method.

Width of class (g) = Difference between any two consecutive upper limits or lower limits. In this method, table will have 6 columns.

Step 1 : In 1st column, write the given classes.

Step 2 : In 2nd column, write the Classmark/ Mid-values (x_i) for each of the class.

Step 3 : In 3rd column, write the values of the d_i where $d_i = x_i - A$

Step 4 : In 4th column, write the value of the

$$u_i \text{ where } u_i = \frac{x_i - A}{g} = \frac{d_i}{g}$$

Step 5 : In 5th column, write the frequencies f_i and find its sum.

Step 6 : In 6th column, find the product of u_i and frequency, f_i i.e. $f_i u_i$ for each of the classes. Find the sum of all ($f_i u_i$) values. i.e. $\Sigma f_i u_i$

Step 7 : Find mean of u_i using the formula

$$\bar{u}_i = \frac{\sum f_i u_i}{\sum f_i}$$

Step 8 : Calculate, Mean ($\bar{x}$) = $A + \bar{u} \cdot g$

Practice set - 6.1 (Textbook Page No. 138)

- (5) A frequency distribution of funds collected by 120 workers in a company for the drought affected people are given in the following table. Find the mean of the funds by 'step deviation' method. (4 marks)

Fund (₹)	0 - 500	500 - 1000	1000 - 1500	1500 - 2000	2000 - 2500
No. of workers	35	28	32	15	10

Solution:

$g = 500$, Assumed Mean (A) = 1250

Fund (in rupees)	Class Mark (x_i)	$d_i = x_i - A = x_i - 1250$	$u_i = \frac{d_i}{g}$	No. of workers (f_i)	$f_i u_i$
0 - 500	250	-1000	-2	35	-70
500 - 1000	750	-500	-1	28	-28
1000 - 1500	1250 → A	0	0	32	0
1500 - 2000	1750	500	1	15	15
2000 - 2500	2250	1000	2	10	20
Total				$\sum f_i = 120$	$\sum f_i u_i = -63$

$$\begin{aligned}\bar{u} &= \frac{\sum f_i u_i}{\sum f_i} \\ &= \frac{-63}{120} \\ &= -0.525\end{aligned}$$

$$\begin{aligned}\text{Mean } (\bar{x}) &= A + \bar{u} \cdot g \\ &= 1250 + 500(-0.525) \\ &= 1250 - 262.5 \\ &= 987.50\end{aligned}$$

∴

Mean of the Fund collected is ₹ 987.50.

- (6) The following table gives the information of frequency distribution of weekly wages of 150 workers of a company. Find the mean of the weekly wages by 'step deviation' method. (4 marks)

Weekly wages (₹)	1000 - 2000	2000 - 3000	3000 - 4000	4000 - 5000
No. of workers	25	45	50	30

Solution:

$g = 1000$, Assumed Mean (A) = 2500

Weekly salary (in rupees)	Class Mark (x_i)	$d_i = x_i - A = x_i - 2500$	$u_i = \frac{d_i}{h}$	No. of workers (f_i)	$f_i u_i$
1000 - 2000	1500	-1000	-1	25	-25
2000 - 3000	2500 → A	0	0	45	0
3000 - 4000	3500	1000	1	50	50
4000 - 5000	4500	2000	2	30	60
Total				$N = \sum f_i = 150$	$\sum f_i u_i = 85$

$$\begin{aligned}\bar{u} &= \frac{\sum f_i u_i}{\sum f_i} \\ &= \frac{85}{150} \\ &= 0.567\end{aligned}$$

$$\begin{aligned}\text{Mean } (\bar{x}) &= A + \bar{u} \cdot g \\ &= 2500 + 0.567 \times 1000 \\ &= 2500 + 567 \\ &= 3067\end{aligned}$$

∴

Mean of salary is ₹ 3067.

Problem Set - 6 (Textbook Page No. 166)

- (4) The weekly wages of 120 workers in a factory are shown in the following frequency distribution table. Find the mean of the weekly wages. (4 marks)

Weekly wages (₹)	0 - 2000	2000 - 4000	4000 - 6000	6000 - 8000
No. of workers	15	35	50	20

Solution:

$g = 2000$, Assumed Mean (A) = 3000

Weekly salary (in rupees)	Class Mark (x_i)	$d_i = x_i - A = x_i - 2500$	$u_i = \frac{d_i}{g}$	No. of employee (f_i)	$f_i u_i$
0 - 2000	1000	-2000	-1	15	-15
2000 - 4000	3000 → A	0	0	35	0
4000 - 6000	5000	2000	1	50	50
6000 - 8000	7000	4000	2	20	40
Total				$N = \sum f_i = 120$	$\sum f_i u_i = 75$

$$\begin{aligned}\bar{u} &= \frac{\sum f_i u_i}{\sum f_i} \\ &= \frac{75}{120} \\ &= 0.625\end{aligned}$$

$$\begin{aligned}\text{Mean } (\bar{x}) &= A + \bar{u} \cdot g \\ &= 3000 + 2000 \times 0.625 \\ &= 3000 + 1250 \\ &= 4250\end{aligned}$$

Mean of weekly salary is ₹ 4250.



Points to Remember:

Median:

To find Median for the given data.

Median is a measure of the 'Middle' value of the given data. When it is arranged. Median is often a better representative of a typical member of a group. If we take all values in a list and arrange them in increasing order, the number at the centre will be the median. Median gives you the central number of the group. Median is a number which divides data into two equal parts.

Steps to calculate Median

Step 1 : Make classes continuous if they are not.

Step 2 : In next column, write the frequencies.

Step 3 : In next column, calculate the 'Cumulative frequency less than type'.

Step 4 : Determine the median class, frequency of median class (f) and cumulative frequency of the class preceding the median class ($c.f.$)

Step 5 : Calculate $\text{Median} = L + \left[\frac{\frac{N}{2} - c.f.}{f} \right] h$

L = Lower limit of median class.

N = Total frequency.

$c.f.$ = Cumulative frequency of class preceding the median class.

f = Frequency of median class.

h = class interval of the median class

Steps to determine Median class

Step 1 : Find the value of $\frac{N}{2}$, where N = Total frequency.

Step 2 : Find the cumulative frequency less than type which is just greater than or equal to $\frac{N}{2}$. The corresponding class is a median class.

For Median,

- Classes have to be continuous.
- Cumulative frequency less than type has to be found for every sum.

Practice set - 6.2 (Textbook Page No. 145)

- (1) The following table shows classification of number of workers and the number of hours they work in a software company. Find the median of the number of hours they work.

(4 marks)

Daily No. of hours	8 - 10	10 - 12	12 - 14	14 - 16
No. of workers	150	500	300	50

Solution:

Class width (h) = 2

Class intervals (Daily working hours)	Frequency (No. of employees)	Cumulative frequency (less than type)
8 - 10	150	150 $\rightarrow$ c.f.
10 - 12	500 $\rightarrow f$	150 + 500 = 650
12 - 14	300	650 + 300 = 950
14 - 16	50	950 + 50 = 1000
Total	1000 $\rightarrow N$	

Here, total frequency (N) = 1000.

$$\therefore \frac{N}{2} = \frac{1000}{2} = 500$$

Cumulative frequency (less than type) which is just greater than 500 is 650.

$\therefore$ Corresponding class 10 - 12 is the median class.

$\therefore f = 500, c.f. = 150, L = 10$ and $h = 2$

$$\begin{aligned}\text{Median} &= L + \left[\frac{\frac{N}{2} - c.f.}{f} \right] \times h \\ &= 10 + \left[\frac{500 - 150}{500} \right] \times 2 \\ &= 10 + 1.4 \\ &= 11.4\end{aligned}$$

$\therefore$ Median of no. of hours worked is 11.4

- (2) The frequency distribution table shows the number of mango trees in a grove and their yield of mangoes. Find the median of data. (4 marks)

No. of mangoes	50 - 100	100 - 150	150 - 200	200 - 250	250 - 300
No. of trees	33	30	90	80	17

Solution:

Class intervals (No. of mangoes)	Frequency (No. of trees)	Cumulative frequency (less than type)
50-100	33	33
100-150	30	$33 + 30 = 63 \rightarrow c.f.$
150 - 200	$90 \rightarrow f$	$63 + 90 = 153$
200 - 250	80	$153 + 80 = 233$
250 - 300	17	$233 + 17 = 250$
Total	250 $\rightarrow$ N	

Here, total frequency (N) = 250.

$$\therefore \frac{N}{2} = \frac{250}{2} = 125$$

Cumulative frequency (less than type) which is just greater than 125 is 153.

$\therefore$ Corresponding class 150 - 200 is the median class.

$\therefore f = 90, c.f. = 63, L = 150$ and $h = 50$

$$\begin{aligned} \text{Median} &= L + \left[\frac{\frac{N}{2} - c.f.}{f} \right] \times h \\ &= 150 + \left[\frac{125 - 63}{90} \right] \times 50 \end{aligned}$$

$$= 150 + \frac{62}{90} \times 50$$

$$= 150 + 34.44$$

$$= 184.44 \approx 184$$

$\therefore$ **Median of no. of mangoes is 184 (approx.)**

- (4) The production of electric bulbs in different factories is shown in the following table. Find the median of the productions. (4 marks)

No. of bulbs produced (Thousands)	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80	80 - 90	90 - 100
No. of factories	12	35	20	15	8	7	8

Solution:

Class intervals (No. of bulbs) (in Thousands)	Frequency (No. of factories)	Cumulative frequency (less than type)
30 - 40	12	12
40 - 50	35	$35 + 12 = 47 \rightarrow c.f.$
50 - 60	$20 \rightarrow f$	$47 + 20 = 67$
60 - 70	15	$67 + 15 = 82$
70 - 80	8	$82 + 8 = 90$
80 - 90	7	$90 + 7 = 97$
90 - 100	8	$97 + 8 = 105$
Total	105 $\rightarrow$ N	

Here, total frequency (N) = 105.

$$\therefore \frac{N}{2} = \frac{105}{2} = 52.5 \text{ and } h = 10$$

Cumulative frequency (less than type) which is just greater than 52.5 is 67.

$\therefore$ Corresponding class 50 - 60 is the median class.

$\therefore f = 20, c.f. = 47, L = 50$

$$\text{Median} = L + \left[\frac{\frac{N}{2} - c.f.}{f} \right] \times h$$

$$= 50 + \left[\frac{52.5 - 47}{20} \right] \times 10$$

$$= 50 + \frac{5.5}{20} \times 10$$

$$= 50 + 2.75$$

$$= 52.75$$

Median production = $52.75 \times 1000 = 52750$

$\therefore$ **Median of production of bulbs is 52750**

Problem Set - 6 (Textbook Page No. 166)

- (6) The distances covered by 250 public transport buses in a day is shown in the following frequency distribution table. Find the median of the distances. (4 marks)

Distance (km)	200 - 210	210 - 220	220 - 230	230 - 240	240 - 250
No. of buses	40	60	80	50	20

Solution:

Class (Distance km)	Frequency (No. of buses)	Cumulative frequency (less than type)
200 - 210	40	40
210 - 220	60	40 + 60 = 100 $\rightarrow$ c.f.
220 - 230	80 $\rightarrow$ f	100 + 80 = 180
230 - 240	50	180 + 50 = 230
240 - 250	20	230 + 20 = 250
Total	250 $\rightarrow$ N	

Here, total frequency = $\sum f_i = N = 250$ and $h = 10$

$$\therefore \frac{N}{2} = \frac{250}{2} = 125$$

Cumulative frequency (less than type) which is just greater than 125 is 180.

$\therefore$ Corresponding class 220 - 230 is the median class.

$\therefore f = 80, c.f. = 100, L = 220$

$$\begin{aligned} \text{Median} &= L + \left[\frac{\frac{N}{2} - c.f.}{f} \right] \times h \\ &= 220 + \left(\frac{125 - 100}{80} \right) \times 10 \\ &= 220 + \left(\frac{25}{80} \right) \times 10 \\ &= 220 + 3.125 \\ &= 223.13 \end{aligned}$$

$\therefore$ **Median distance covered is 223.13 km.**

- (7) The prices of different articles and demand for them is shown in the following frequency distribution table. Find the median of the prices.

Price (₹)	less than 20	20 - 40	40 - 60	60 - 80	80 - 100
No. of articles	140	100	80	60	20

(4 marks)

Solution:

Class intervals (Price in Rs.)	Frequency (No. of articles)	Cumulative frequency (less than type)
less than 20	140	140 $\rightarrow$ c.f.
20 - 40	100 $\rightarrow$ f	140 + 100 = 240
40 - 60	80	240 + 80 = 320
60 - 80	60	320 + 60 = 380
80 - 100	20	380 + 20 = 400
Total	400 $\rightarrow$ N	

Here, total frequency = $\sum f_i = N = 400$.

$$\therefore \frac{N}{2} = 200 \text{ and } h = 20$$

Cumulative frequency (less than type) which is just greater than 200 is 240.

$\therefore$ Corresponding class 20 - 40 is the median class.

$\therefore f = 100, c.f. = 140, L = 20$

$$\begin{aligned} \text{Median} &= L + \left[\frac{\frac{N}{2} - c.f.}{f} \right] \times h \\ &= 20 + \left(\frac{200 - 140}{100} \right) \times 20 \\ &= 20 + \frac{60}{100} \times 20 \\ &= 20 + 12 = 32 \end{aligned}$$

$\therefore$ **Median of Amount is ₹ 32.**

Practice set - 6.2 (Textbook Page No. 145)

- (3) The following table shows the classification of number of vehicles and their speeds on Mumbai-Pune express way. Find the median of the data. (4 marks)

Average Speed of Vehicles (Km/hr)	60-64	65-69	70-74	75-79	80-84	85-89
No. of Vehicles	10	34	55	85	10	6

Solution: First make continuous classes

Class intervals (vehicle speed)	Continuous class intervals	Frequency (No. of vehicles)	Cumulative frequency (less than type)
60 - 64	59.5 - 64.5	10	10
65 - 69	64.5 - 69.5	34	44
70 - 74	69.5 - 74.5	55	99 $\rightarrow$ c.f.
75 - 79	74.5 - 79.5	85 $\rightarrow$ f	184
80 - 84	79.5 - 84.5	10	194
85 - 89	84.5 - 89.5	6	200
Total		200 $\rightarrow$ N	

Here, total frequency (N) = 200.

$$\therefore \frac{N}{2} = \frac{200}{2} = 100 \text{ and } h = 5$$

Cumulative frequency (less than type) which is just greater than 100 is 184.

$\therefore$ Corresponding class 74.5 - 79.5 is the median class.

$$\therefore f = 85, c.f. = 99, L = 74.5$$

$$\begin{aligned}\text{Median} &= L + \left[\frac{\frac{N}{2} - c.f.}{f} \right] \times h \\ &= 74.5 + \left[\frac{100 - 99}{85} \right] \times 5 \\ &= 74.5 + \frac{1}{85} \times 5 \\ &= 74.5 + 0.058 \\ &= 74.559 \approx 75 \text{ (approx)}\end{aligned}$$

$\therefore$ Median of speed of the vehicles is 75 km/h (approx)



Points to Remember:

Mode :

Mode is the observation which occurs most frequently. The observation having maximum frequency is called **mode**. A data set has no mode when all the observations appearing in the data have the frequency 1. A data set has multiple modes when two or more values appear with the same highest frequency.

To find mode for the given data,

- Classes have to be continuous.
- If maximum frequency occurs twice in the data, then data will have two Modal classes.

Hence, Mode has to be found for both modal class.

Steps to calculate Mode :

Step 1 : Make the classes continuous if they are not.

Step 2 : Determine Modal class, Maximum frequency (f_1), frequency of class preceding modal class (f_0), frequency of class succeeding the modal class (f_2)

Step 3 : Calculate,

$$\text{Mode} = L + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right] \times h$$

L = Lower limit of modal class.

N = Total frequency.

f_1 = Maximum frequency.

f_0 = Frequency of class preceding modal class.

f_2 = Frequency of class succeeding the modal class.

h = class interval of the modal class.

Steps to determine Modal class :

Step 1 : The class having maximum frequency is termed as Modal class.

Practice Set - 6.3 (Textbook Page No. 149)

- (1) The following table shows the information regarding the milk collected from farmers on a milk collection centre and the content of fat in the milk, measured by a lactometer. Find the mode of fat content. (4 marks)

Content of fat (%)	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7
Milk collected (Litre)	30	70	80	60	20

Solution:

Class interval (fat content in milk)	Frequency (milk in litres)
2 - 3	30
3 - 4	70 $\rightarrow f_0$
4 - 5	80 $\rightarrow f_1$
5 - 6	60 $\rightarrow f_2$
6 - 7	20

f_1 = Maximum frequency = 80.

The corresponding class 4 - 5 is modal class.

$f_0 = 70, f_2 = 60, L = 4$ and $h = 1$

$$\begin{aligned}\text{Mode} &= L + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right] \times h \\ &= 4 + \left[\frac{80 - 70}{2 \times 80 - 70 - 60} \right] \times 1 \\ &= 4 + \left[\frac{10}{160 - 130} \right] \\ &= 4 + \frac{10}{30} \\ &= 4 + 0.33 \\ &= 4.33\end{aligned}$$

$\therefore$ Mode of weight of fat in milk is 4.33 %

- (2) Electricity used by some families is shown in the following table. Find the mode for use of electricity. (4 marks)

Use of electricity (Unit)	0 - 20	20 - 40	40 - 60	60 - 80	80 - 100	100 - 120
No. of families	13	50	70	100	80	17

Solution:

Class interval (Units of electricity)	Frequency (No. of families)
0 - 20	13
20 - 40	50
40 - 60	$70 \rightarrow f_0$
60 - 80	$100 \rightarrow f_1$
80 - 100	$80 \rightarrow f_2$
100 - 120	17

 f_1 = Maximum frequency = 100.

The corresponding class 60 - 80 is modal class.

 $f_0 = 70, f_2 = 80, L = 60$ and $h = 20$

$$\begin{aligned}
 \text{Mode} &= L + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right] \times h \\
 &= 60 + \left[\frac{100 - 70}{2 \times 100 - 70 - 80} \right] \times 20 \\
 &= 60 + \frac{30}{50} \times 20 \\
 &= 60 + 12 \\
 &= 72
 \end{aligned}$$

 $\therefore$ **Mode of no. of units consumed is 72**

- (3) Grouped frequency distribution of supply of milk to hotels and the number of hotels is given in the following table. Find the mode of the supply of milk. (4 marks)

Milk (litre)	1-3	3-5	5-7	7-9	9-11	11-13
No. of hotels	7	5	15	20	35	18

Solution:

Class interval (Milk in litres)	Frequency (No. of Hotels)
1 - 3	7
3 - 5	5
5 - 7	15
7 - 9	$20 \rightarrow f_0$
9 - 11	$35 \rightarrow f_1$
11 - 13	$18 \rightarrow f_2$

 f_1 = Maximum frequency = 35.

The corresponding class 9 - 11 is the modal class.

 $f_0 = 20, f_2 = 18, L = 9$ and $h = 2$

$$\begin{aligned}
 \text{Mode} &= L + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right] \times h \\
 &= 9 + \left[\frac{35 - 20}{2 \times 35 - 20 - 18} \right] \times 2
 \end{aligned}$$

$$\begin{aligned}
 &= 9 + \frac{15}{32} \times 2 \\
 &= 9 + 0.94 = 9.94
 \end{aligned}$$

 $\therefore$ **Modal of quantity of milk consumed by hotels is 9.94 litres.**

- (4) The following frequency distribution table gives the ages of 200 patients treated in a hospital in a week. Find the mode of ages of the patients. (4 marks)

Age (years)	Less than 5	5 - 9	10 - 14	15 - 19	20 - 24	25 - 29
No. of patients	38	32	50	36	24	20

Solution:

Age	Contribution class Interval	No. of patients
less than 5	0.5 - 4.5	38
5 - 9	4.5 - 9.5	$32 \rightarrow f_0$
10 - 14	9.5 - 14.5	$50 \rightarrow f_1$
15 - 19	14.5 - 19.5	$36 \rightarrow f_2$
20 - 24	19.5 - 24.5	24
25 - 29	24.5 - 29.5	20

 f_1 = Maximum frequency = 50.

The corresponding class 9.5 - 14.5 is the modal class.

 $f_0 = 32, f_2 = 36, L = 9.5$ and $h = 5$

$$\begin{aligned}
 \text{Mode} &= L + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right] \times h \\
 &= 9.5 + \left[\frac{50 - 32}{2 \times 50 - 32 - 36} \right] \times 5 \\
 &= 9.5 + \frac{18}{32} \times 5 \\
 &= 9.5 + 2.81 \\
 &= 12.31 \text{ years.}
 \end{aligned}$$

 $\therefore$ **Mode of age of patients is 12.31 years****Problem Set - 6 (Textbook Page No. 166)**

- (8) The following frequency table shows the demand for a sweet and the number of customers. Find the mode of demand of sweet.

Weight of sweet (gram)	0 - 250	250 - 500	500 - 750	750 - 1000	1000 - 1250
No. of customers	10	60	25	20	15

(4 marks)

Solution:

Class interval (Weight of sweets in gms)	Frequency (No. of customers)
0 - 250	10 $\rightarrow f_0$
250 - 500	60 $\rightarrow f_1$
500 - 750	25 $\rightarrow f_2$
750 - 1000	20
1000 - 1250	15

Here, the maximum frequency $f_1 = 60$.

$\therefore$ The corresponding class 250 - 500 is the Modal class.

$f_1 = 60, f_0 = 10, f_2 = 25, L = 250$ and $h = 250$

$$\begin{aligned}
 \text{Mode} &= L + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right] \times h \\
 &= 250 + \left[\frac{60 - 10}{2 \times 60 - 10 - 25} \right] \times 250 \\
 &= 250 + \left(\frac{50}{85} \right) \times 250 \\
 &= 250 + 147.06 \\
 &= 397.06
 \end{aligned}$$

Mode of weight of sweets is 397.06 gm.



Points to Remember:

- Pictorial Representation of Statistical Data:**

It is difficult to arrive at a conclusion with a raw data. So, it needs to be processed. Processing involves arranging data in order, classification, tabulation. Such a compact or condensed form of data are easy to understand. Further if it is graphically or diagrammatically represented, it becomes simple to understand and interpret.

The specific graphs associated with frequency distribution are as follows :

(i) Histogram (ii) Frequency polygon or Frequency curve (iii) Pie diagram

- (i) Histogram :**

Steps to draw histogram :

Step 1 : Make the classes continuous if they are not continuous.

Step 2 : Take continuous classes on X-axis with suitable scale. For writing the classes, we can either use 1 cm or 2 cm for each class.

Step 3 : Take frequency on Y-axis with suitable scale.

Step 4 : Draw rectangles on the X-axis for each class. The height of the rectangles is equal to the frequency of the respective class.

Note: Thus, the histogram is series of joint rectangles:

If there is a difference in the gap between the origin and lower limit of the first class and class width, then a ' $\sim$ ' kink mark is drawn near the origin on the X-axis. The mark can be used on Y-axis to draw a graph of optimum site

Practice Set - 6.4 (Textbook Page No. 153)

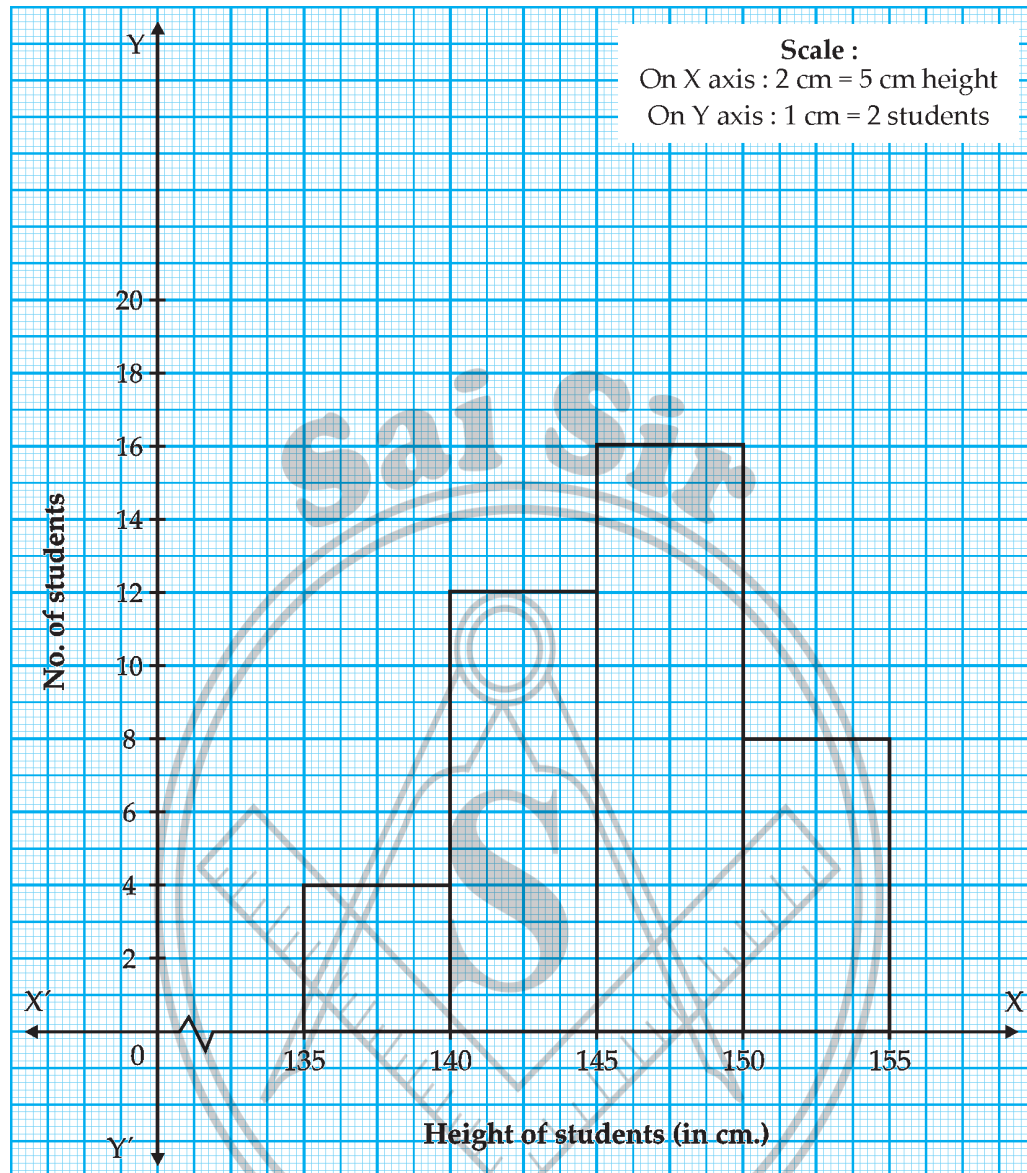
(1) Draw a histogram of the following data.

Height of student (cm)	135 - 140	140 - 145	145 - 150	150 - 155
No. of students	4	12	16	8

(3 marks)

Solution:

Height (in cms.)	No. of Students
135 - 140	4
140 - 145	12
145 - 150	16
150 - 155	8



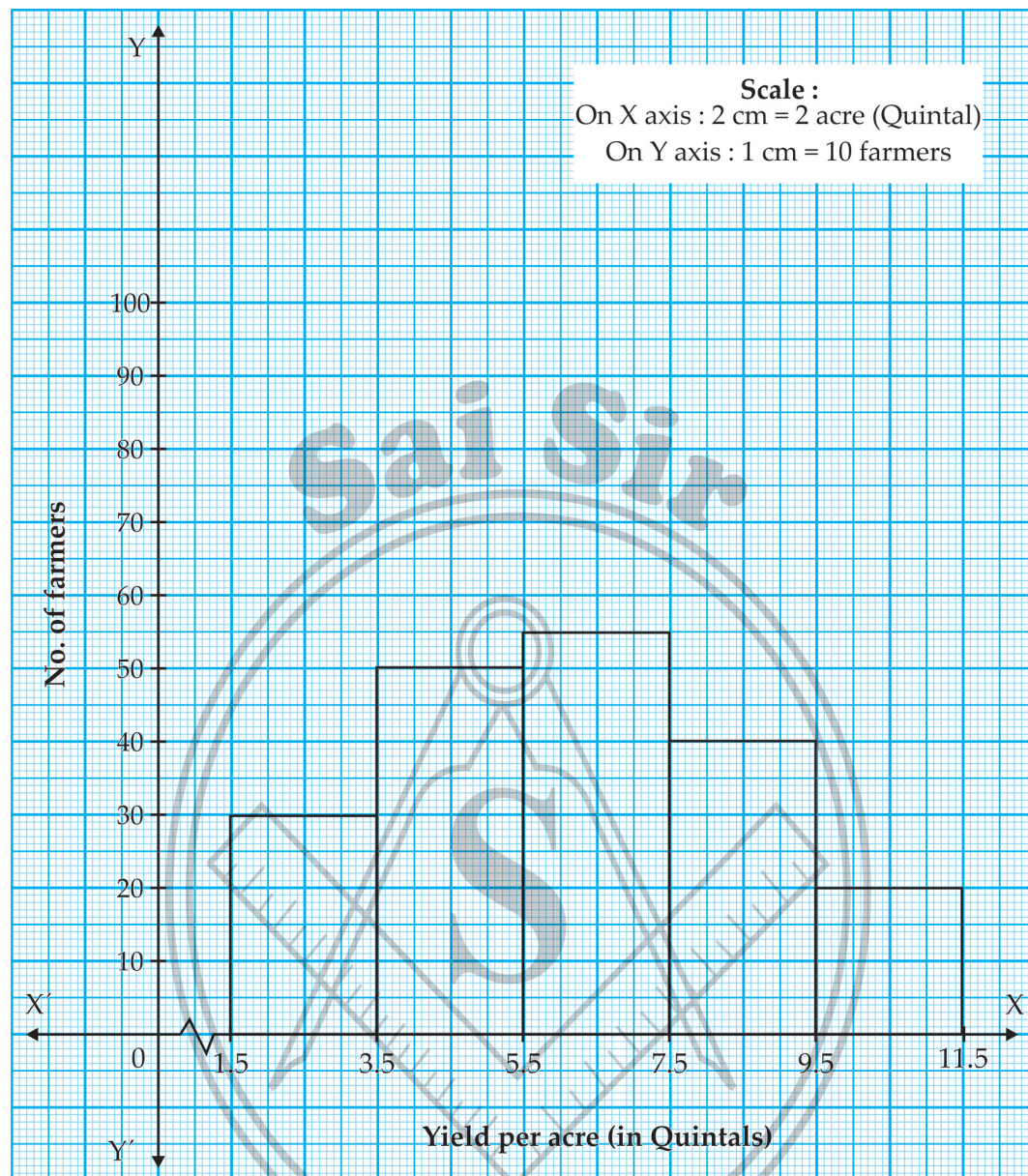
- (2) The table below shows the yield of jowar per acre. Show the data by histogram.

Yield per acre (quintal)	2 - 3	4 - 5	6 - 7	8 - 9	10 - 11
No. of farmers	30	50	55	40	20

(4 marks)

Solution:

Class	Continuous class	Frequency
2 - 3	1.5 - 3.5	30
4 - 5	3.5 - 5.5	50
6 - 7	5.5 - 7.5	55
8 - 9	7.5 - 9.5	40
10 - 11	9.5 - 11.5	20



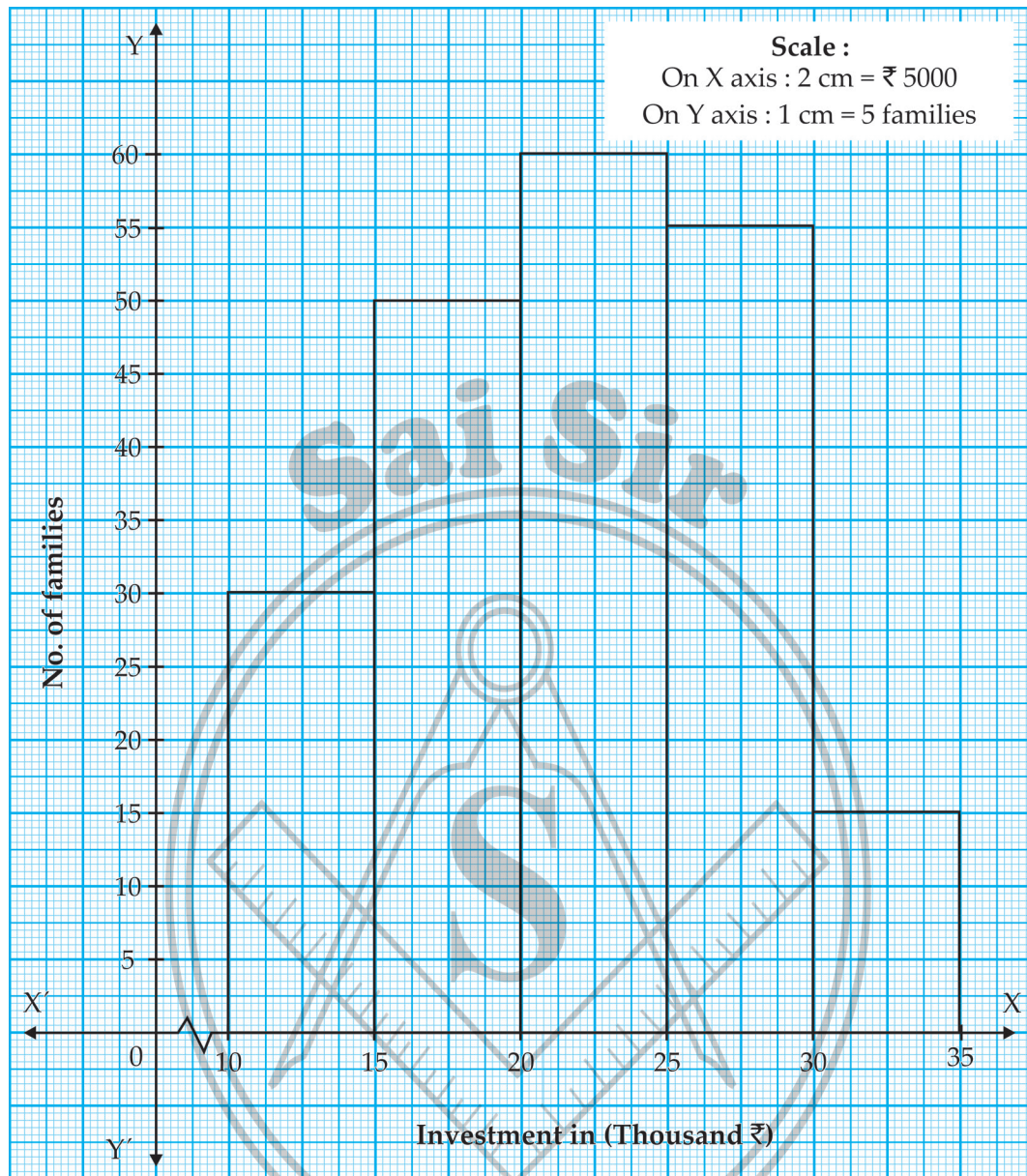
- (3) In the following table, the investment made by 210 families is shown. Present it in the form of a histogram.

Investment (Thousand ₹)	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35
No. of families	30	50	60	55	15

(3 marks)

Solution:

Investment (Thousand ₹)	No. of families
10 - 15	30
15 - 20	50
20 - 25	60
25 - 30	55
30 - 35	15



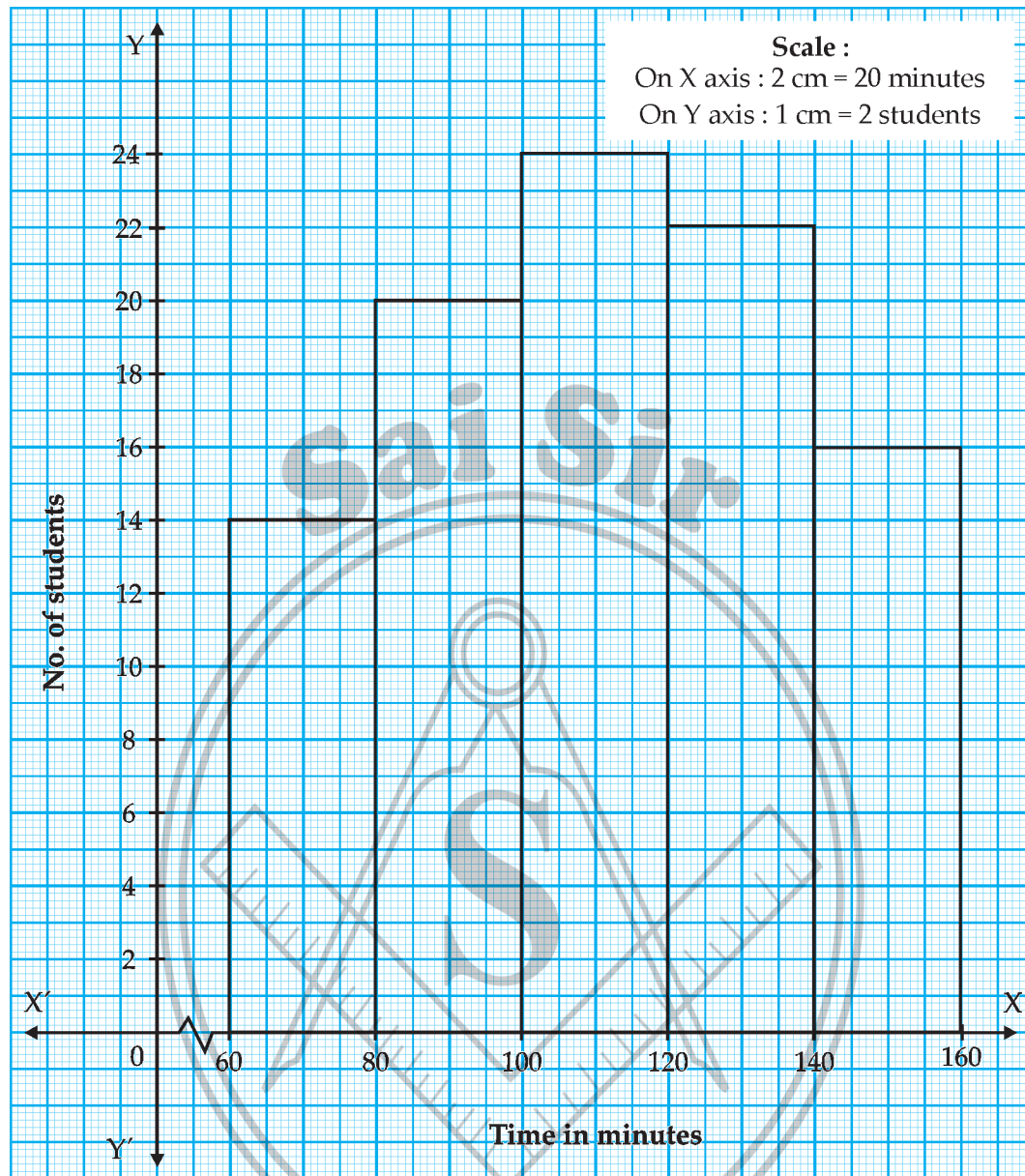
- (4) Time allotted for the preparation of an examination by some students is shown in the table. Draw a histogram to show the information.

Time (minutes)	60 - 80	80 - 100	100 - 120	120 - 140	140 - 160
No. of students	14	20	24	22	16

(3 marks)

Solution:

Time (in minutes)	No. of students
60 - 80	14
80 - 100	20
100 - 120	24
120 - 140	22
140 - 160	16



Problem Set - 6 (Textbook Page No. 166)

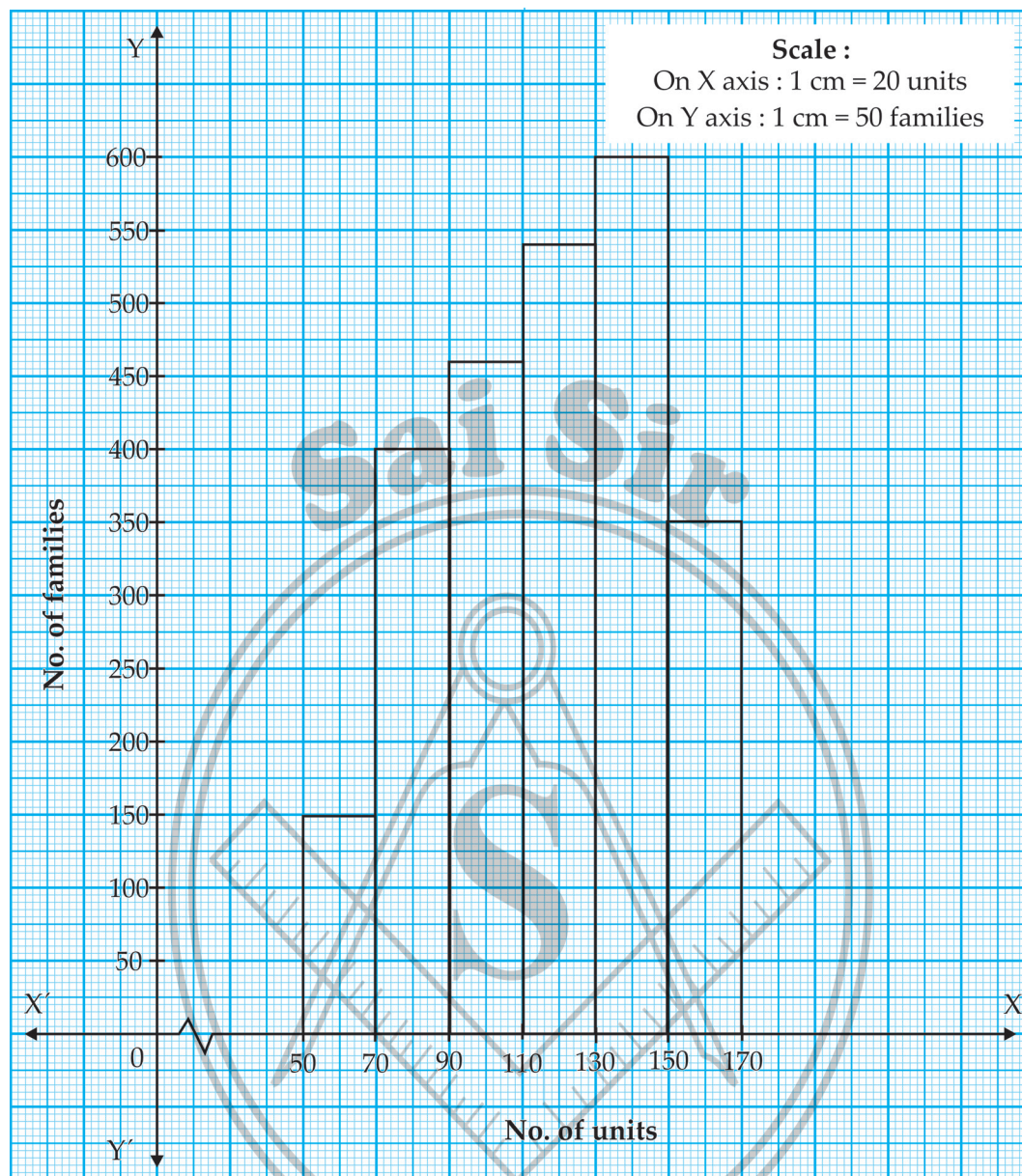
- (9) Draw a histogram for the following frequency distribution.

Use of electricity (Unit)	50 - 70	70 - 90	90 - 110	110 - 130	130 - 150	150 - 170
No. of families	150	400	460	540	600	350

(3 marks)

Solution:

Electricity electricity (Units)	No. of families
50 - 70	150
70 - 90	400
90 - 110	460
110 - 130	540
130 - 150	600
150 - 170	350



Points to Remember:

(ii) Frequency Polygon:

There are two methods to draw frequency polygon or curve:

- Using histogram
- Plotting the points.

In the first method, we have to draw histogram and then mark all the mid-points on the upper side of the rectangles and then we join all the points with scale. To close the polygon or curve, we have to join the midpoint of the class before the first class and the mid point of the class after the last class.

In the second method, we plot the points on the graph paper with midpoint of class as x co-ordinate and frequency as y co-ordinate

(midpoint, frequency) and then join all the points in order with scale and then close the polygon or curve as mentioned in the previous method.

Steps to draw frequency polygon or frequency curve :

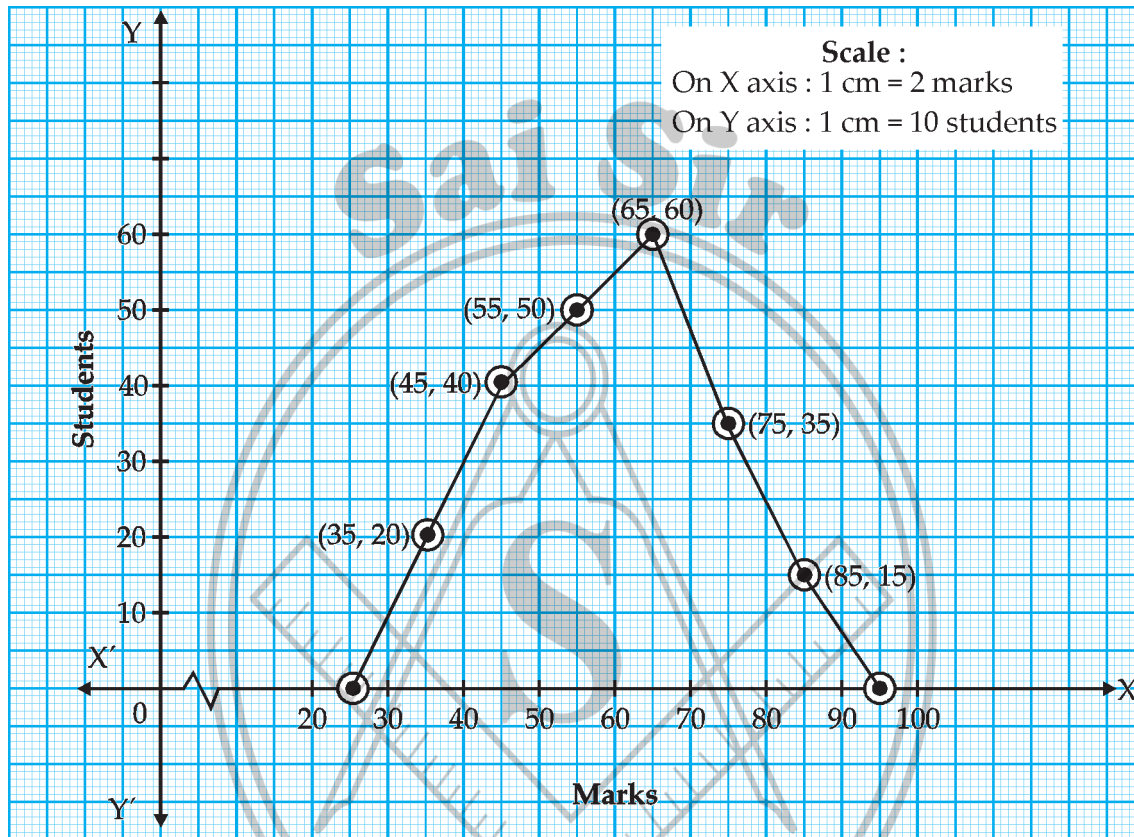
- Step 1 : Prepare frequency distribution table with class marks.
- Step 2 : Draw X-axis, Y-axis, choose proper scale.
- Step 3 : Take class marks on X-axis.
- Step 4 : Take frequencies (f_i) on Y-axis
- Step 5 : Plot the points (x_i, f_i).
- Step 6 : Plot two additional points with two additional classes one preceding the first class with frequency zero (0) and the other succeeding the last class with frequency zero (0).

Step 7 : Join all the successive points including the two additional extreme points by straight lines.
Eventually, the closed figure so obtained is frequency polygon.

Practice Set - 6.5 (Textbook Page No. 157)

(1) Observe the following frequency polygon and write the answers of the questions below it.

(3 marks)



(1) Which class has the maximum number of students?

Ans. Maximum number of students are present in the group 60 - 70.

(2) Write the classes having zero frequency.

Ans. Zero students are present in 20 - 30 and 90 - 100 groups.

(3) What is the class-mark of the class, having frequency of 50 students?

Ans. 50 students are present in the group 50 - 60 whose class mark is 55.

(4) Write the lower and upper class limits of the class whose class mark is 85.

Ans. 85 is the class mark of the group 80 - 90.

(5) How many students are in the class 80-90?

Ans. There are 15 students in the group 80 - 90.

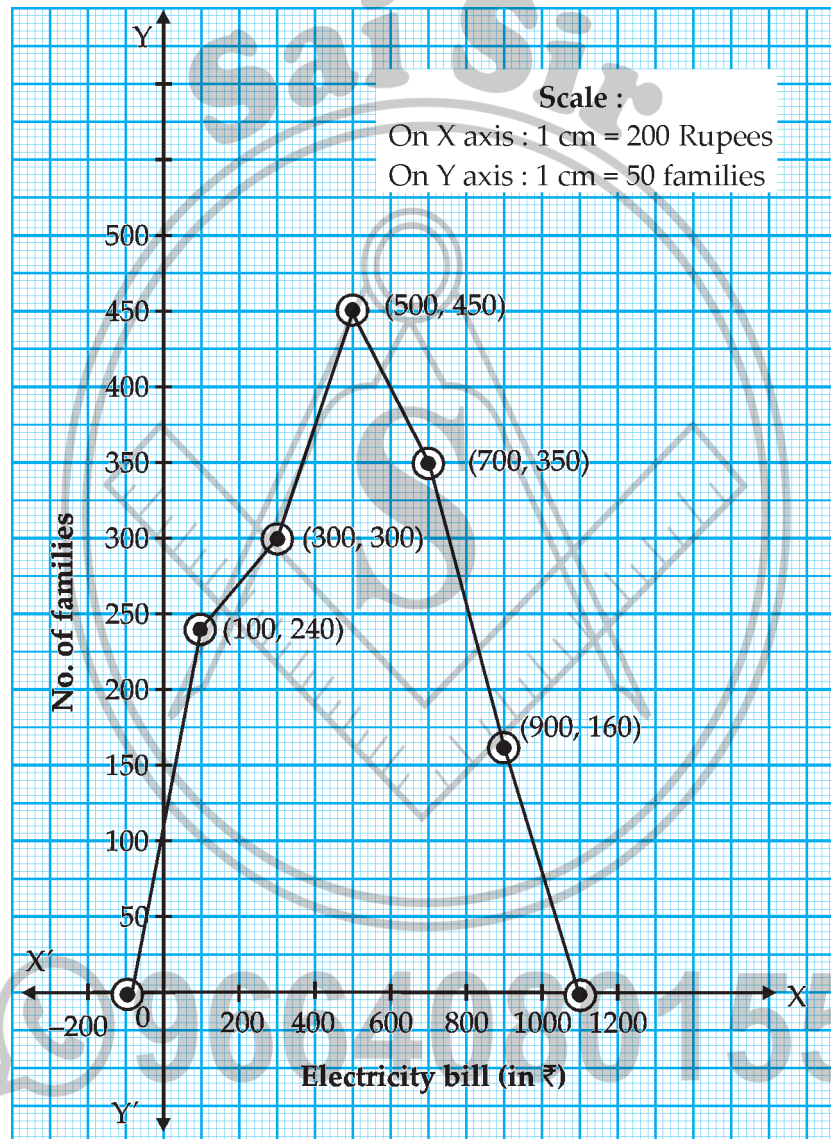
(2) Show the following data by a frequency polygon.

(4 marks)

Electricity bill (₹)	0 - 200	200 - 400	400 - 600	600 - 800	800 - 1000
No. of families	240	300	450	350	160

Solution:

Class	Class mark	Frequency	Coordinate of points
-200 - 0	-100	0	(-100, 0)
0 - 200	100	240	(100, 240)
200 - 400	300	300	(300, 300)
400 - 600	500	450	(500, 450)
600 - 800	700	350	(700, 350)
800 - 1000	900	160	(900, 160)
1000 - 1200	1100	0	(1100, 0)



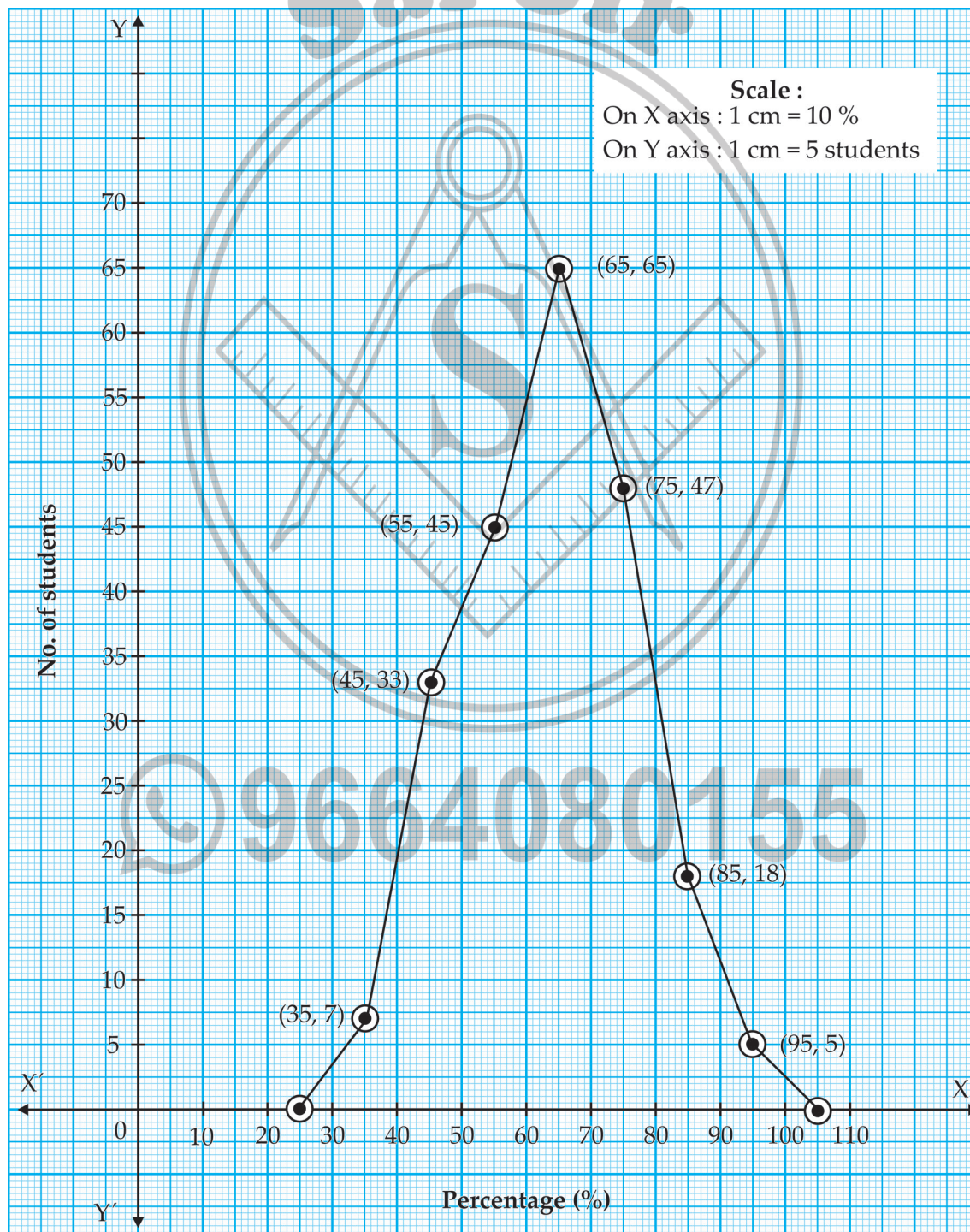
- (3) The following table shows the classification of percentages of marks of students and the number of students. Draw a frequency polygon from the table.

Result (Percentage)	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80	80 - 90	90 - 100
No. of students	7	33	45	65	47	18	5

(4 marks)

Solution:

Class	Class mark	Frequency	Coordinate of points
20 - 30	25	0	(25, 0)
30 - 40	35	7	(35, 7)
40 - 50	45	33	(45, 33)
50 - 60	55	45	(55, 45)
60 - 70	65	65	(65, 65)
70 - 80	75	47	(75, 47)
80 - 90	85	18	(85, 18)
90 - 100	95	5	(95, 5)
100 - 110	105	0	(105, 0)



Problem Set - 6 (Textbook Page No. 167)

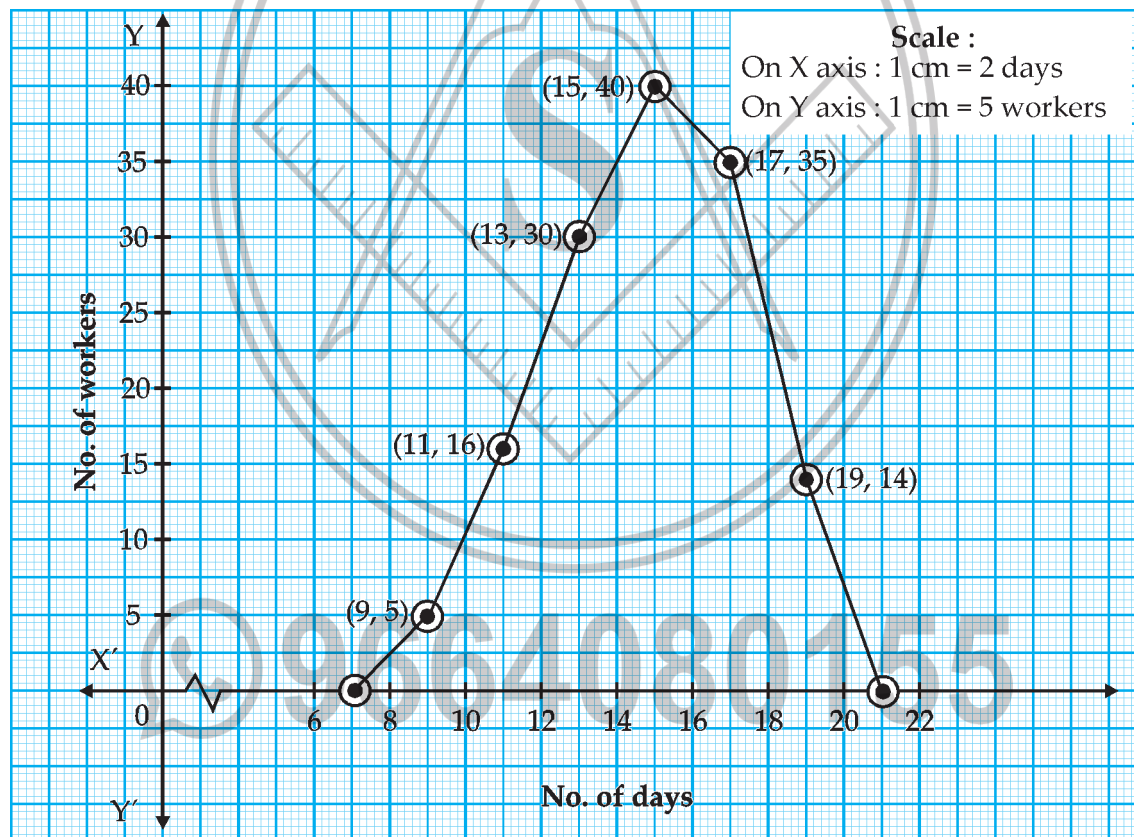
- (10) In a handloom factory different workers take different periods of time to weave a saree. The number of workers and their required periods are given below. Present the information by a frequency polygon.

No. of days	8 - 10	10 - 12	12 - 14	14 - 16	16 - 18	18 - 20
No. of workers	5	16	30	40	35	14

(4 marks)

Solution:

Class	Class mark	Frequency	Coordinate of points
6 - 8	7	0	(7, 0)
8 - 10	9	5	(9, 5)
10 - 12	11	16	(11, 16)
12 - 14	13	30	(13, 30)
14 - 16	15	40	(15, 40)
16 - 18	17	35	(17, 35)
18 - 20	19	14	(19, 14)
20 - 22	21	0	(21, 0)



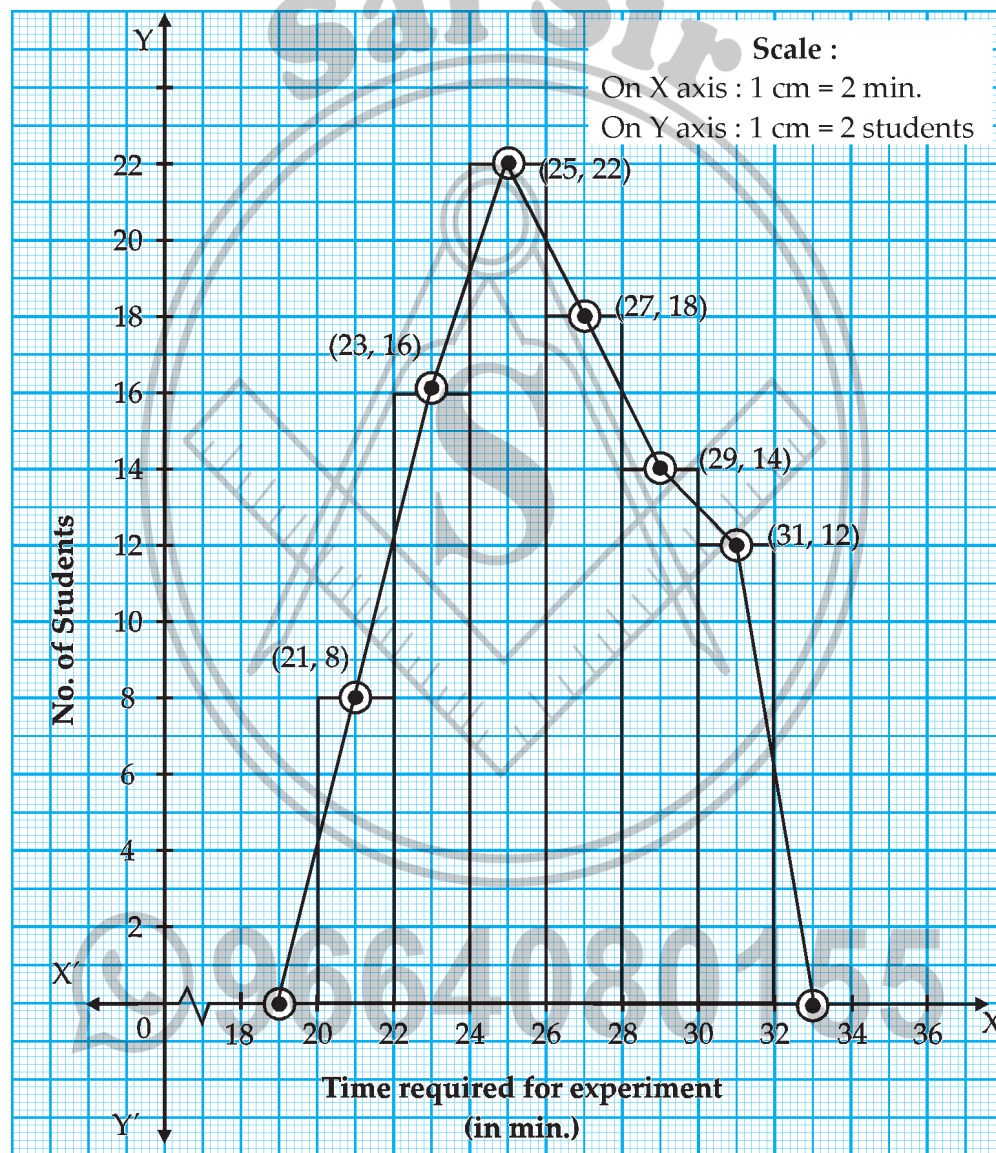
- (11) The time required for students to do a science experiment and the number of students is shown in the following grouped frequency distribution table. Show the information by a histogram and also by a frequency polygon.

(4 marks)

Time required for experiment (minutes)	20 - 22	22 - 24	24 - 26	26 - 28	28 - 30	30 - 32
No. of students	8	16	22	18	14	12

Solution:

Class	Class mark	Frequency	Coordinate of points
18 - 20	19	0	(19, 0)
20 - 22	21	8	(21, 8)
22 - 24	23	16	(23, 16)
24 - 26	25	22	(25, 22)
26 - 28	27	18	(27, 18)
28 - 30	29	14	(29, 14)
30 - 32	31	12	(31, 12)
32 - 34	33	0	(33, 0)

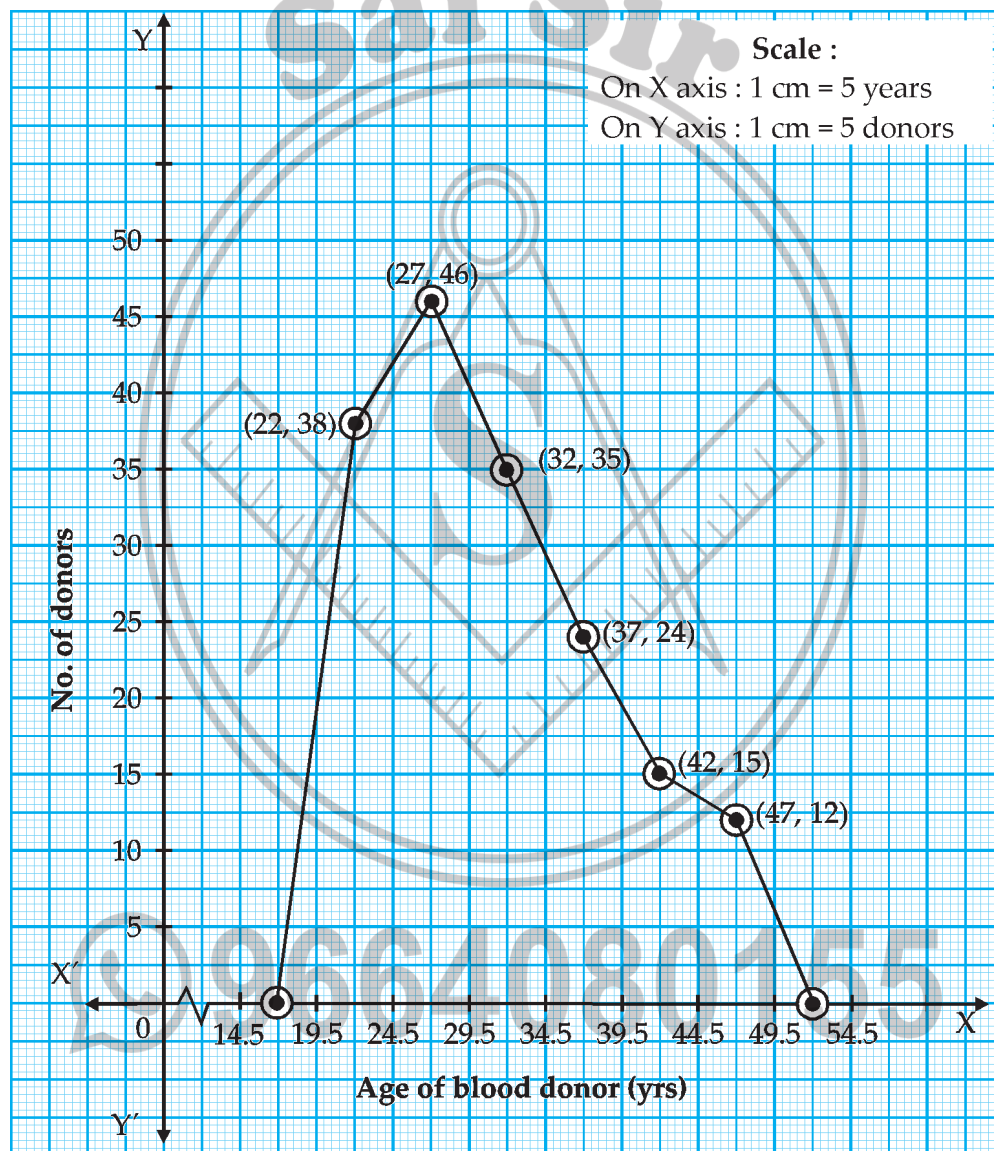
**(12)** Draw a frequency polygon for the following grouped frequency distribution table.

Age of the donor (Yrs.)	20 - 24	25 - 29	30 - 34	35 - 39	40 - 44	45 - 49
No. of blood donors	38	46	35	24	15	12

(4 marks)

Solution:

Class	Continuous class	Class mark	Frequency	Coordinate of points
15 - 19	14.5 - 19.5	17	0	(17, 0)
20 - 24	19.5 - 24.5	22	38	(22, 38)
25 - 29	24.5 - 29.5	27	46	(27, 46)
30 - 34	29.5 - 34.5	32	35	(32, 35)
35 - 39	34.5 - 39.5	37	24	(37, 24)
40 - 44	39.5 - 44.5	42	15	(42, 15)
45 - 49	44.5 - 49.5	47	12	(47, 12)
50 - 54	49.5 - 54.5	52	0	(52, 0)

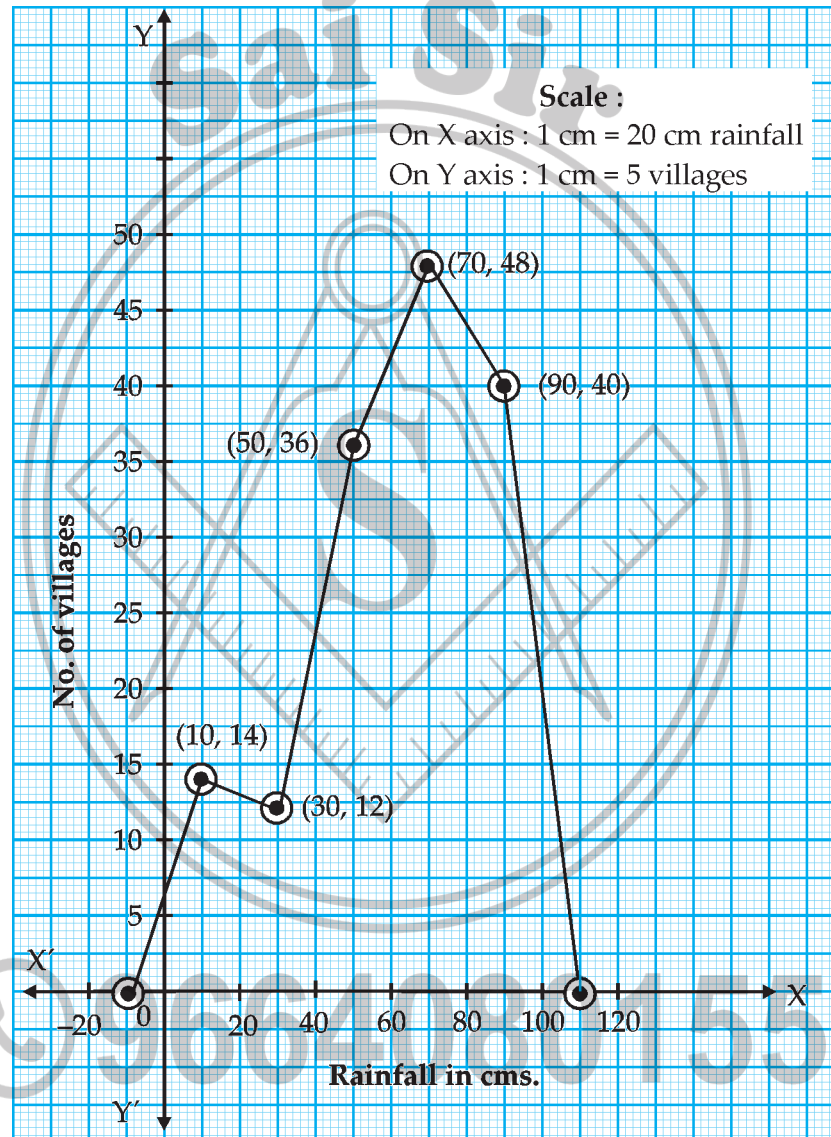


- (13) The following table shows the average rainfall in 150 towns. Show the information by a frequency polygon. (4 marks)

Average rainfall (cm)	0 - 20	20 - 40	40 - 60	60 - 80	80 - 100
No. of towns	14	12	36	48	40

Solution:

Class	Class mark	Frequency	Coordinate of points
-20 - 0	-10	0	(-10, 0)
0 - 20	10	14	(10, 14)
20 - 40	30	12	(30, 12)
40 - 60	50	36	(50, 36)
60 - 80	70	48	(70, 48)
80 - 100	90	40	(90, 40)
100 - 120	110	0	(110, 0)

**Points to Remember:****(iii) Pie diagram:**

The relative values of items are represented by a sector of circle. Since the sectors resembles the slices of pie, therefore it is called a **pie diagram**.

The main terms related to pie diagrams are sector and central angle.

Steps to draw a pie diagram:

Step 1: Find the total of all values of items or that of components corresponds to 360° . Hence, find the measure of central angle (θ) for each given information.

Step 2: Draw a circle of convenient radius (usually within 4 - 5 cm range preferred.)

Step 3: Divide the circle into number of sectors using the value of central angle (θ)

to represent the various items or components.

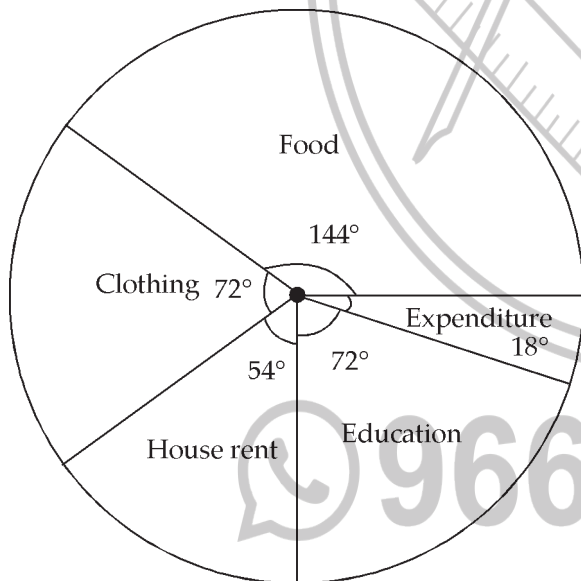
$$\text{Central angle } (\theta) = \frac{\text{value of the component}}{\text{Total value}} \times 360^\circ$$

Activity :

The monthly expenditure of a family of different items is shown in the following table. Calculate the related central angles and draw a pie chart.

Different Items	% of Expenditure	Measure of Central angle
Food	40	$\frac{40}{100} \times 360 = 144^\circ$
Clothing	20	$\frac{20}{100} \times 360 = 72^\circ$
House rent	15	$\frac{15}{100} \times 360 = 54^\circ$
Education	20	$\frac{20}{100} \times 360 = 72^\circ$
Expenditure	05	$\frac{05}{100} \times 360 = 18^\circ$
Total	100	360°

Pie Diagram:



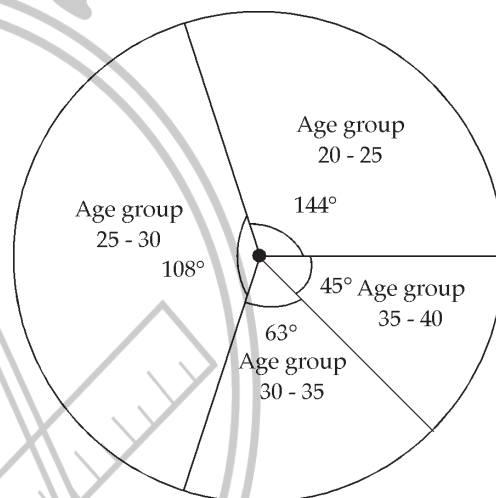
Practice Set - 6.6 (Textbook Page No. 163)

- (1) The age group and number of persons, who donated blood in a blood donation camp is given below. Draw a pie diagram from it. (4 marks)

Age group (Yrs.)	20 - 25	25 - 30	30 - 35	35 - 40
No. of persons	80	60	35	25

Solution:

Age group (Years)	No. of persons	Measure of Central angle
20 - 25	80	$\frac{80}{200} \times 360 = 144^\circ$
25 - 30	60	$\frac{60}{200} \times 360 = 108^\circ$
30 - 35	35	$\frac{35}{200} \times 360 = 63^\circ$
35 - 40	25	$\frac{25}{200} \times 360 = 45^\circ$
Total	200	360°

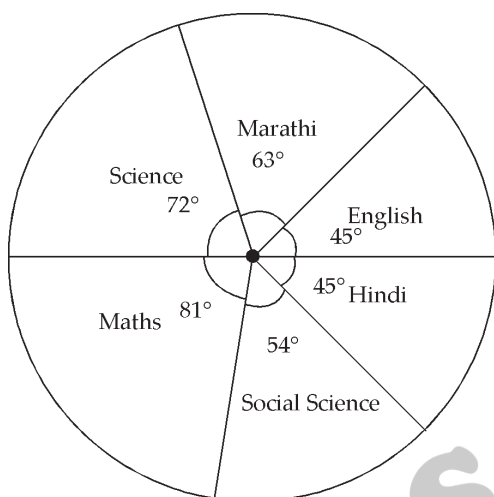


- (2) The marks obtained by a student in different subjects are shown. Draw a pie diagram showing the information. (4 marks)

Sub-ject	Eng-lish	Mar-athi	Sci-ence	Math-ematics	Social science	Hin-di
Marks	50	70	80	90	60	50

Solutions:

Subjects	Marks	Measure of Central angle
English	50	$\frac{50}{400} \times 360 = 45^\circ$
Marathi	70	$\frac{70}{400} \times 360 = 63^\circ$
Science	80	$\frac{80}{400} \times 360 = 72^\circ$
Maths	90	$\frac{90}{400} \times 360 = 81^\circ$
Social Science	60	$\frac{60}{400} \times 360 = 54^\circ$
Hindi	50	$\frac{50}{400} \times 360 = 45^\circ$
Total	400	360°

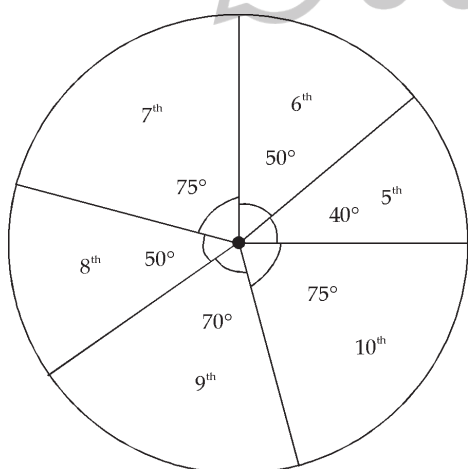


- (3) In a tree plantation programme, the number of trees planted by students of different classes is given in the following table. Draw a pie diagram showing the information. (4 marks)

Standard	5 th	6 th	7 th	8 th	9 th	10 th
No. of trees	40	50	75	50	70	75

Solutions:

Standard Class	No. of trees	Measure of Central angle
5 th	40	$\frac{40}{360} \times 360 = 40^\circ$
6 th	50	$\frac{50}{360} \times 360 = 50^\circ$
7 th	75	$\frac{75}{360} \times 360 = 75^\circ$
8 th	50	$\frac{50}{360} \times 360 = 50^\circ$
9 th	70	$\frac{70}{360} \times 360 = 70^\circ$
10 th	75	$\frac{75}{360} \times 360 = 75^\circ$
Total	360	360°

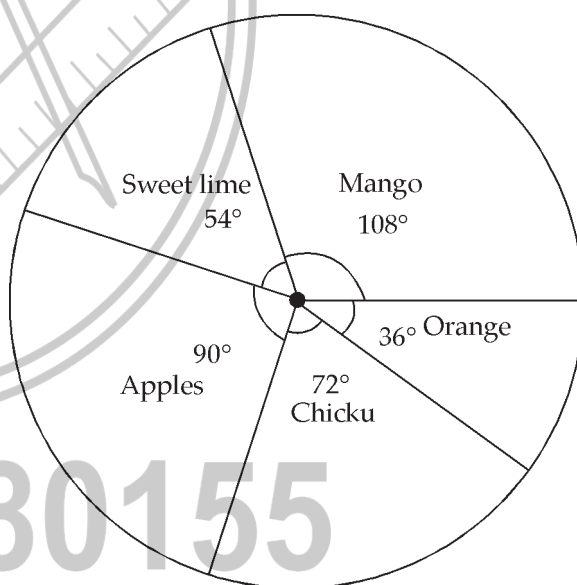


- (4) The following table shows the percentages of demands for different fruits registered with a fruit vendor. Show the information by a pie diagram. (4 marks)

Fruits	Mango	Sweet lime	Apples	Cheeku	Oranges
% of demand	30	15	25	20	10

Solution:

Fruits	Demand (%)	Measure of Central angle
Mango	30	$\frac{30}{100} \times 360 = 108^\circ$
Sweet lime	15	$\frac{15}{100} \times 360 = 54^\circ$
Apples	25	$\frac{25}{100} \times 360 = 90^\circ$
Chicku	20	$\frac{20}{100} \times 360 = 72^\circ$
Oranges	10	$\frac{10}{100} \times 360 = 36^\circ$
Total	100	360°



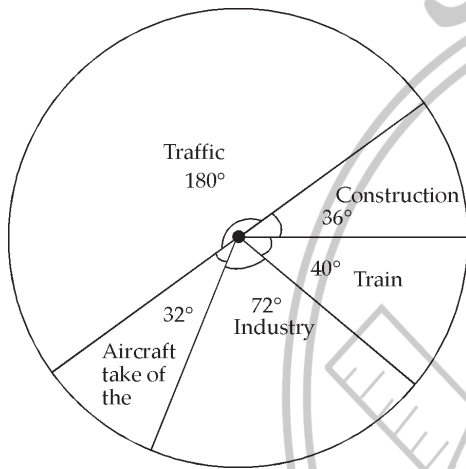
Problem Set - 6 (Textbook Page No. 167)

- (15) The following table shows causes of noise pollution. Show it by a pie diagram. (4 marks)

Construction	Traffic	Aircraft take offs	Industry	Trains
10%	50%	9%	20%	11%

Solution:

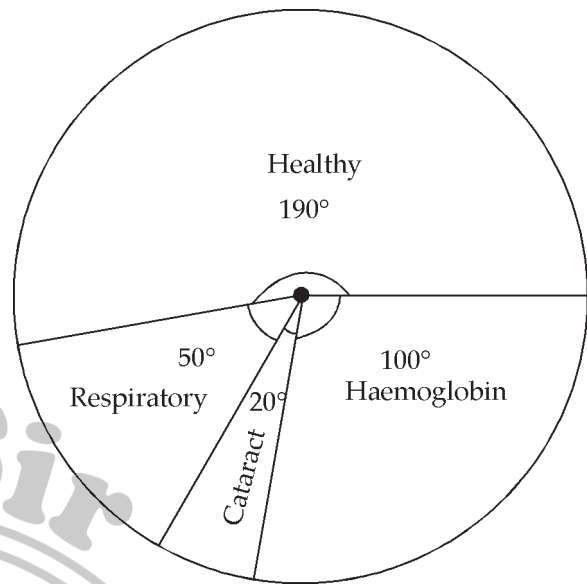
Components	%	Measure of Central angle
Construction	10	$\frac{10}{100} \times 360 = 36^\circ$
Traffic	50	$\frac{50}{100} \times 360 = 180^\circ$
Aircraft take offs	9	$\frac{9}{100} \times 360 = 32.4^\circ \approx 32^\circ$
Industry	20	$\frac{20}{100} \times 360 = 72^\circ$
Train	11	$\frac{11}{100} \times 360 = 39.6^\circ \approx 40^\circ$



- (17) Medical check up of 180 women was conducted in a health centre in a village. 50 of them were short of haemoglobin, 10 suffered from cataract and 25 had respiratory disorders. The remaining women were healthy. Show the information by a pie diagram. (4 marks)

Solution:

Disease	No. of women	Measure of Central angle
Haemoglobin	50	$\frac{50}{180} \times 360 = 100^\circ$
Cataract	10	$\frac{10}{180} \times 360 = 20^\circ$
Respiratory	25	$\frac{25}{180} \times 360 = 50^\circ$
Healthy	$180 - 95 = 95$	$\frac{95}{180} \times 360 = 190^\circ$
Total	180	360°

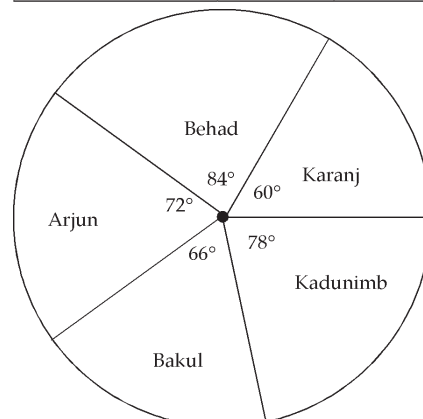


- (18) On an environment day, students in a school planted 120 trees under plantation project. The information regarding the project is shown in the following table. Show it by a pie diagram. (4 marks)

Tree Name	Karanj	Behada	Arjun	Bakul	Kadunimb
No. of trees	20	28	24	22	26

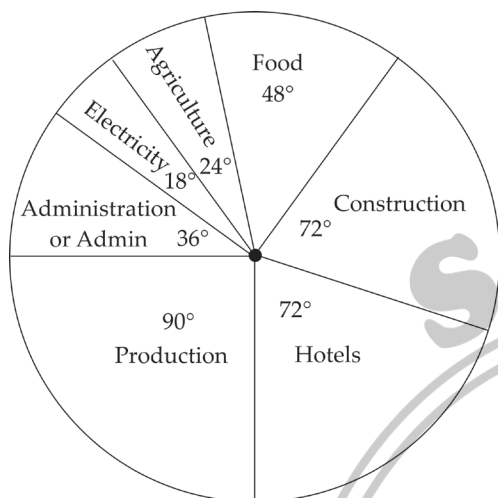
Solution:

Name of trees	No. of trees	Measure of Central angle
Karanj	20	$\frac{20}{120} \times 360 = 60^\circ$
Behad	28	$\frac{28}{120} \times 360 = 84^\circ$
Arjun	24	$\frac{24}{120} \times 360 = 72^\circ$
Bakul	22	$\frac{22}{120} \times 360 = 66^\circ$
Kadunimb	26	$\frac{26}{120} \times 360 = 78^\circ$
Total	120	360°



Practice Set - 6.6 (Textbook Page No. 164)

- (5) The pie diagram in figure 6.13 shows the proportions of different workers in a town. Answer the following questions with its help. (3 marks)



- (i) If the total workers is 10,000; how many of them are in the field of construction?
 (ii) How many workers are working in the administration?
 (iii) What is the percentage of workers in production?

Solution:

- (i) Total no. of workers = 10,000
 Total 10,000 workers corresponds to central angle = 360°
 The measure of central angle for construction = 72°
 $\therefore$ No. of professionals in construction industry

$$= \frac{\text{Central angle for construction}}{360} \times \text{Total}$$

$$= \frac{72}{360} \times 10,000 = 2,000$$
 $\therefore$ **No. of professionals in construction = 2,000**
- (ii) The measure of central angle for administration = 36°
 $\therefore$ No. of people in administration

$$= \frac{\text{Central angle for administration}}{360} \times \text{Total}$$

$$= \frac{36}{360} \times 10,000 = 1,000$$
 $\therefore$ **No. of professionals in administration = 1,000**
- (iii) Central angle for production = 90°
 No. of professionals in production industry

$$= \frac{\text{Central angle for production}}{360} \times \text{Total}$$

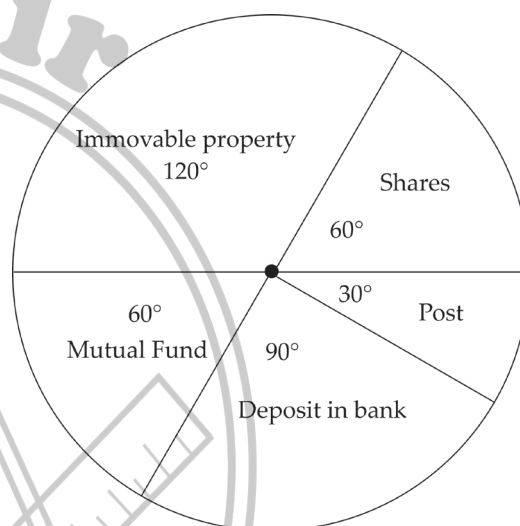
$$= \frac{90}{360} \times 10,000 = 2,500$$

$\therefore$ % of professionals in production industry

$$= \frac{2500}{10000} \times 100 = 25\%$$

$\therefore$ **25% of professionals are in production industry.**

- (6) The annual investments of a family are shown in the adjacent pie diagram. Answer the following questions based on it. (4 marks)



- (i) If the investment in shares is Rs. 2000/, find the total investment.
 (ii) How much amount is deposited in bank?
 (iii) How much more money is invested in immovable property than in mutual fund?
 (iv) How much amount is invested in post?

Solution:

- (i) Let x be the total amount invested.
 Total amount ' x ' corresponds to central angle = ' 360° '
 Central angle for shares

$$= \frac{\text{Amount invested in shares}}{\text{Total amount invested}}$$

$$60 = \frac{2000}{\text{Total amount invested}}$$

$$\therefore \text{Total amount invested} = \frac{2000 \times 360}{60}$$

$$= 12,000$$
Total amount invested = ₹ 12,000
- (ii) Central angle for investment in Bank = 90°
 Amount deposited in Bank

$$= \frac{\text{Central angle for bank}}{360} \times \text{Total}$$

$$= \frac{90}{360} \times 12,000 = 3,000$$

Amount deposited in Bank = ₹ 3000

- (iii) Central angle for Mutual fund = 60°

Amount invested in Mutual fund

$$= \frac{\text{Central angle for mutual fund}}{360} \times \text{Total}$$

$$= \frac{60}{360} \times 12,000 = 2,000$$

Amount invested in immovable property

$$= \frac{\text{Central angle for property}}{360}$$

$$= \frac{120}{360} \times 12,000 = 4,000$$

$\therefore$ **Amount invested in property is ₹ 2,000 more than in mutual fund.**

- (iv) Central angle for Post Office = 30°

Amount invested in Post office

$$= \frac{\text{Central angle for post office}}{360} \times \text{Total}$$

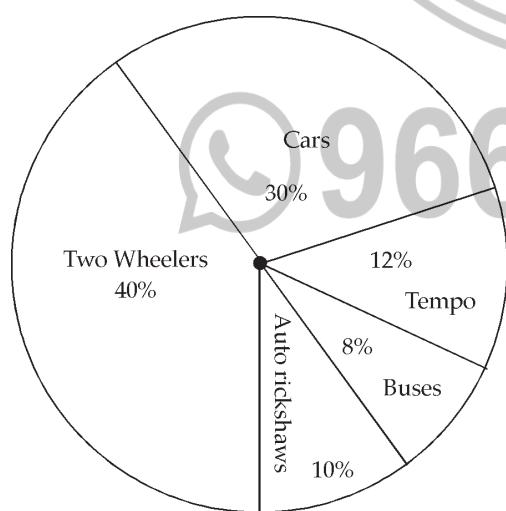
$$= \frac{30}{360} \times 12,000 = 1,000$$

$\therefore$ **Amount invested in post is ₹ 1,000.**

Problem Set - 6 (Textbook Page No. 167)

- (14) Observe the below pie diagram. It shows the percentages of number of vehicles passing a signal in a town between 8 am and 10 am

(4 marks)



- (i) Find the central angle for each type of vehicle.
 (ii) If the number of two-wheelers is 1200, find the number of all vehicles.

Solution:

(i)

Mode of transport	%	Measure of Central angle
Two wheelers	40%	$\frac{40}{100} \times 360 = 144^\circ$
Rickshaws	10%	$\frac{10}{100} \times 360 = 36^\circ$
Buses	8%	$\frac{8}{100} \times 360 = 28.8 \approx 29^\circ$
Tempos	12%	$\frac{12}{100} \times 360 = 43.2 \approx 43^\circ$
Cars	30%	$\frac{30}{100} \times 360 = 108^\circ$
Total	100%	360°

- (ii) Total no. of two wheelers = 1200

Central angle of two wheeler

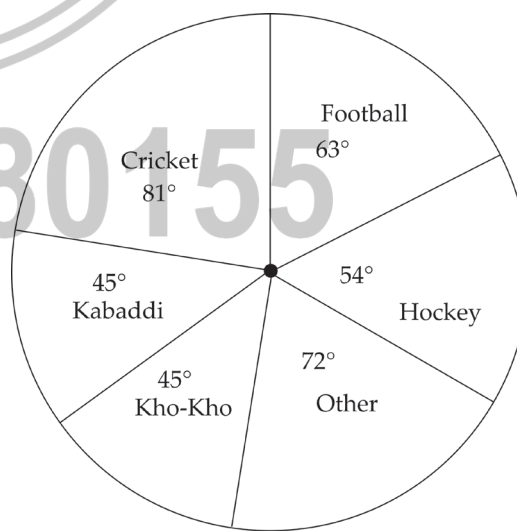
$$= \frac{\text{No. of two wheelers}}{\text{Total no. of vehicles}} \times 360$$

$$144 = \frac{1200}{\text{Total no. of vehicles}} \times 360$$

$$\begin{aligned} \text{Total no. of vehicles} &= \frac{1200 \times 360}{144} \\ &= 3000 \end{aligned}$$

$\therefore$ **Total number of vehicles is 3000.**

- (16) A survey of students was made to know which game they like. The data obtained in the survey is presented in the below pie diagram. If the total number of students are 1000, (3 marks)



- (i) How many students like cricket?
 (ii) How many students like football?
 (iii) How many students prefer other games?

Solution:

- (i) Total no. of students = 1000
Central angle for cricket = 81°
 $\therefore$ No. of students interested in cricket

$$= \frac{\text{Central angle}}{360} \times \text{Total no. of students}$$

$$= \frac{81}{360} \times 1000 = 225$$

$\therefore$ **No. of students interested in cricket = 225**

- (ii) Central angle for Football = 63°
 $\therefore$ No. of students interested in football

$$= \frac{\text{Central angle}}{360} \times \text{Total no. of students}$$

$$= \frac{63}{360} \times 1000 = 175$$

$\therefore$ **No. of students interested in football = 175**

- (iii) Central angle for other sports = 72°
 $\therefore$ No. of students interested in other sports

$$= \frac{\text{Central angle}}{360} \times \text{Total no. of students}$$

$$= \frac{72}{360} \times 1000 = 200$$

$\therefore$ **No. of students interested in other sports = 200.**

Problem Set - 6 (Textbook Page No. 164)**MCQ's**

Find the correct answer from the alternatives given.

(1 mark each)

- (1) The persons of O- blood group are 40%. The classification of persons based on blood groups is to be shown by a pie diagram. What should be the measures of angle for the persons of O- blood group?
 (A) 114° (B) 140° (C) 104° (D) 144°
- (2) Different expenditures incurred on the construction of a building were shown by a pie diagram. The expenditure Rs. 45,000 on cement was shown by a sector of central angle of 75° . What was the total expenditure of the construction?
 (A) 2,16,000 (B) 3,60,000
 (C) 4,50,000 (D) 7,50,000
- (3) Cumulative frequencies in a grouped frequency table are useful to find ...
 (A) Mean (B) Median
 (C) Mode (D) All of these

- (4) The formula to find mean from a grouped frequency table is $\bar{x} = A + \frac{\sum f_i u_i}{\sum f_i} h$ In the formula $u_i = \dots\dots$

- (A) $\frac{x_i + A}{h}$ (B) $(x_i - A)$
 (C) $\frac{x_i - A}{h}$ (D) $\frac{A - x_i}{h}$

(5)

Distance covered per litre (km)	12-14	14-16	16-18	18-20
No. of cars	11	12	20	7

The median of the distances covered per litre shown in the above data is in the group

- (A) 12-14 (B) 14-16 (C) 16-18 (D) 18-20

(6)

No. of trees planted by each student	1-3	4-6	7-9	10-12
No. of students	7	8	6	4

The above data is to be shown by a frequency polygon. The coordinates of the points to show number of students in the class 4-6 are ...

- (A) (4, 8) (B) (3, 5) (C) (5, 8) (D) (8, 4)

Additional MCQ's

- (7) The formula to find mean by direct method is
 (A) $A + \bar{d}$ (B) $\frac{\sum f_i d_i}{\sum f_i}$ (C) $\frac{\sum f_i d_i}{\sum d_i}$ (D) $\frac{\sum f_i x_i}{\sum f_i}$
- (8) Class width of any class interval is
 (A) Lower limit + upper limit
 (B) Lower limit - upper limit
 (C) Upper limit - lower limit
 (D) None of the above.
- (9) The formula for median is
 (A) $\frac{L}{2} + \left(\frac{N}{2} - c.f. \right) \frac{h}{f}$ (B) $L + \left(\frac{N}{2} - c.f. \right) \frac{h}{f}$
 (C) $L + \left(\frac{N}{2} - c.f. \right) \frac{f}{h}$ (D) $L + \left(\frac{N}{2} - f \right) \frac{c.f.}{h}$
- (10) The formula to find the mean deviation ($\bar{d}$) in Assumed mean method is
 (A) $\bar{d} \frac{\sum f_i d_i}{\sum d_i}$ (B) $\sum f_i d_i$
 (C) $\frac{\sum f_i d_i}{\sum f_i}$ (D) None of the above.
- (11) In step deviation method, u_i is given by
 (A) $A + \bar{d}$ (B) $x_i - A$ (C) $\frac{x_i + A}{g}$ (D) $\frac{x_i - A}{g}$
- (12) The median class for the following frequency distribution is

Class interval	0-10	10-20	20-30	30-40
Frequency	5	7	13	18

(A) 0 - 10 (B) 10 - 20 (C) 20-30 (D) 30-40

- (13) The value of lower limit (L) in the above example to calculate median is

(A) 0 (B) 10 (C) 20 (D) 30

- (14) If $\sum f_i d_i = 1885$ and $\sum f_i = 100$, then the value of $\bar{d}$ is
(A) 1.885 (B) 18.85 (C) 188.5 (D) 1885

- (15) The formula of mode is

(A) $L + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right] \times h$

(B) $L - \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right] \times h$

(C) $L + \left[\frac{f_1 - f_0}{2f_1 - f_0 + f_2} \right] \times h$

(D) $L - \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right] \times \frac{1}{h}$

- (16) The formula to find mean by step deviation method is

(A) $\frac{\sum f_i u_i}{\sum f_i}$

(B) $A + \bar{d}$

(C) $A + \bar{g} \bar{u}$

(D) None of these

ANSWERS

- (1) (D) 144° (2) (A) 2,16,000 (3) (B) Median

- (4) (C) $\frac{x_i - A}{h}$ (5) (C) 16-18 (6) (C) (5, 8)

- (7) (D) $\frac{\sum f_i x_i}{\sum f_i}$ (8) (C) Upper limit - lower limit

- (9) (B) $L + \left(\frac{N}{2} - c.f. \right) \frac{h}{f}$ (10) (C) $\frac{\sum f_i d_i}{\sum f_i}$ (11) (D) $\frac{x_i - A}{g}$

- (12) (C) 20-30 (13) (C) 20 (14) (B) 18.85

- (15) (A) $L + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right] \times h$ (16) (C) $A + \bar{g} \bar{u}$

PROBLEMS FOR PRACTICE

Based on Practice Set 6.1

- (1) A study related to time (in months) taken to settle a dispute in a lower court resulted the following data.

Time (in months)	0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12
No. of disputes	15	90	120	75	70	50

Find the mean time taken to settle a dispute in a lower court. (3 marks)

- (2) Find the mean marks of the student from the following cumulative frequency distribution. (3 marks)

Marks	Below 10	Below 20	Below 30	Below 40	Below 50
No. of students	5	9	17	29	45

Marks	Below 60	Below 70	Below 80	Below 90
No. of students	60	70	78	83

- (3) The following table gives the distribution of total household expenditure (in rupee) of workers in a city.

Expenditure (in rupees)	100-150	150-200	200-250	250-300
No. of workers	24	40	33	28

Expenditure (in rupees)	300-350	350-400	400-450
No. of workers	30	22	16

Find the mean expenses per household by step deviation method. (3 marks)

- (4) Rainfall (in mm) recorded in 50 cities in a partial region on a particular day is given below.

Rainfall in mm	36-39	40-43	44-47	48-51	52-55	56-59	60-63
No. of cities	6	7	10	7	7	9	4

Find the mean rainfall on that day in a city by Assumed Mean method. (3 marks)

- (5) The mean of the following frequency distribution is 62.8 and the sum of all frequencies is 50. Complete the missing frequencies f_1 and f_2 . (3 marks)

Class	0-20	20-40	40-60	60-80	80-100	100-120
Frequency	5	f_1	10	f_2	7	8

Based on Practice Set 6.2

- (6) The following table shows the ages of 300 patients getting medical treatment in a hospital on a particular day. (3 marks)

Age in years	10-20	20-30	30-40	40-50	50-60	60-70
No. of patients	60	42	55	70	53	20

Find the median age of patients. (4 marks)

- (7) Below is given the frequency distribution of no. of packages received at a post office per day.

No. of packages	10-20	20-30	30-40	40-50	50-60	60-70
No. of days	2	8	16	24	30	20

Find the median no. of packages received by the post-office per day. (4 marks)

- (8) Following table shows frequency distribution of no. of rooms occupied in a hotel per day.

No. of rooms occupied	0-10	10-20	20-30	30-40	40-50	50-60
No. of days	5	27	17	11	9	1

Find the median no. of rooms occupied in a hotel per day. (4 marks)

- (9) Time spent in queue by 100 passengers is classified and given below:

Time in mins	20-29	30-39	40-49	50-59	60-69	Total
No. of passengers	8	20	32	28	12	100

Find the median no. of passengers. (4 marks)

- (10) Following is the cumulative frequency distribution of employees in a certain office according to age.

Age	less than 20	less than 25	less than 30	less than 35	less than 40
Cumulative frequency	0	2	8	22	51

Age	less than 45	less than 50	less than 55	less than 60
Cumulative frequency	88	105	108	110

Find the median age of employee.

Based on Practice Set 6.3

- (11) Automatic filling machine was listed for its performance. A sample 100 filled packets generalised the data, which is classified as follows:

Weight in gms.	485-490	490-495	495-500	500-505	505-510	510-515
No. of packets	12	18	20	22	24	4

Find the modal weight of the packets. (4 marks)

- (12) The following table gives profit earned by companies in lacs. (4 marks)

Profit	5-10	10-15	15-20	20-25	25-30
No. of companies	4	28	49	17	2

Find the modal profit earned by the companies.

- (13) The following table shows the heights of students.

Height of students (cm)	140-144	145-149	150-154	155-159
No. of students	2	12	10	4

Find the modal height of the students. (4 marks)

- (14) Below is given frequency distribution of 'Daily wages (in ₹)' of 130 workers.

Daily wages (₹)	80-84	85-89	90-94	95-99	100-104	105-109
No. of workers	10	20	25	40	30	5

Find the modal wage of a worker. (4 marks)

- (15) The following is the frequency distribution of blood pressure measured for 100 patients.

Blood pressure in suitable units.	110-115	115-120	120-125	125-130	130-135
No. of patients	2	35	52	8	3

Find the modal Blood pressure of the patient.

(4 marks)

Based on Practice Set 6.4 and 6.5

- (16) Draw the frequency polygon for the following data. (4 marks)

Body Mass Index.	18-19	19-20	20-21	21-22	22-23	23-24
No. of patients	5	12	18	25	16	4

- (17) Below is given frequency distribution of marks (out of 100) obtained by students.

Marks	0-10	10-20	20-30	30-40	40-50	50-60
No. of students	3	5	7	10	12	15

Marks	60-70	70-80	80-90	90-100
No. of students	12	6	2	8

Draw the histogram and frequency polygon on the same graph papers. (4 marks)

- (18) Draw the frequency polygon using mid-points for the following data on time required to do a certain job. (4 marks)

Time required (in hours)	50-70	70-90	90-110	110-130
No. of workers	2	8	30	25

Time required (in hours)	130-150	150-170	170-190
No. of workers	14	19	2

Based on Practice Set 6.6

- (19) Draw a pie diagram to represent the world population given in the following table after determining the value of a . (4 marks)

Country	India	China	Russia	USA	Others	Total
Percentage population	15	20	a	a	25	100

- (20) The following table shows the expenditure incurred by a publisher in publishing a book. (4 marks)

Item	Paper	Printing	Binding	Advertising	Miscellaneous
Expenditure in %	35%	20%	10%	5%	30%

Draw a pie chart representing the above data.

- (21) Following is the breakup of expenditure of a family on different times of consumption. (4 marks)

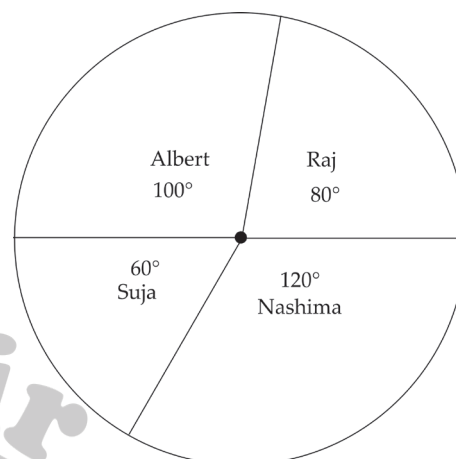
Item	Food	Clothing	Rent	Education
Expenditure in ₹	1600	200	600	150

Item	Fuel	Medicine	Miscellaneous
Expenditure in ₹	100	80	270

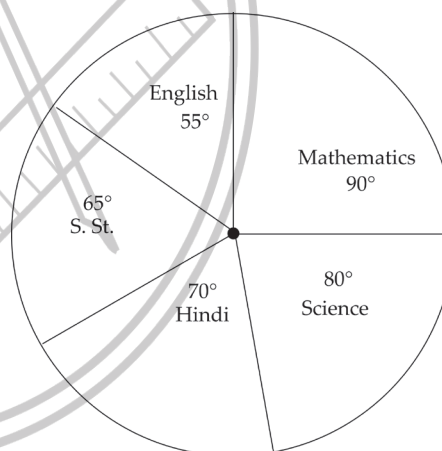
Draw a pie diagram of the above data.

- (22) The following pie diagram represents the number of valid votes obtained by four students who contested for school captain. The total of

valid votes polled was 720. Answer the following questions. (4 marks)



- (i) Who has won the election?
(ii) What is the minimum no. of votes? Who got it?
(iii) By how many votes did the winner defeat the nearest contestant?
(23) The following pie chart gives the marks scored in an examination by a student in various subjects. If the total marks obtained by the student were 360, answer the following questions. (4 marks)



- (i) Find the marks obtained in each subject.
(ii) How many more marks he got in Mathematics than in Science?
(iii) Which subject he get the least marks?

ANSWERS

- (1) 6.07 months (2) 48.41 (3) 258.7 (4) 49.1 mm
(5) $f_1 = 8, f_2 = 12$ (6) 38.73 years (7) 50 packets
(8) 21.76 (9) 47 (10) 40.5 years (11) 505.45 gm.
(12) 16.98 lacs (13) 148.67 cm (14) ₹97.5 (15) 121.39
(22) (i) Nashima (ii) 120, Suja (iii) 40
(23) (i) Eng. - 55, S. St. - 65, Hindi - 70, Science - 80 Maths - 90
(ii) He got 10 more marks in Mathematics than Science.
(iii) He got least marks in English.

ASSIGNMENT - 6

Time : 1 Hr.

Marks : 20

Q.1. (A) Choose the correct alternative among the following:

(3)

- (1) The class mark of the class interval 120-130 is
(A) 120 (B) 130 (C) 122.5 (D) 125
- (2) The height of the class interval 133-139 is
(A) 3 (B) 5 (C) 6 (D) 4
- (3) The persons of O- blood group are 40%. The classification of persons based on blood groups is to be shown by a pie diagram. What should be the measures of angle for the persons of O- blood group?
(A) 114° (B) 140° (C) 104° (D) 144°

(B) Answer the following :

(2)

Class Interval	Frequency	c.f.
0 - 20	4	4
20 - 40	20	
40 - 60		54
60 - 80	40	94
80 - 100	6	100
	N =	

Q.2. Answer the following: (Any 2)

(4)

- (1) For a certain frequency distribution median class is 129.5 to 134.5, f is 30 and c.f. is 24 and $N = 100$, find the median
- (2) Find the measure of central angle of Afternoon and night from the following informaton.

Part of a day	Morning	Afternoon	Evening	Night
Percentage of electricity used	20	25	15	10

- (3) Find the mean of the following data
12, 18, 15, 17, 11, 10

Q.3. Answer the following: (Any 1)

(3)

- (1) Draw a pie chart using the following information

Subject	English	Marathi	Science	Maths	Social Studies	Hindi
Marks	50	70	80	90	60	50

- (2) Following is the frequency distribution of students who participated in a sports event. Find the mode of students who participated in different sports.

Age group (in years)	6 - 8	8 - 10	10 - 12	12 - 14	14 - 16
No. of students	43	58	70	42	27

Q.4. Answer the following: (any 2)**(8)**

- (1) The following frequency distribution shows the no. of persons who visited the museum on a particular day. Find the median age of the visitors of that day.

Age (in years)	No of person
less than 10	3
less than 20	10
less than 30	22
less than 40	40
less than 50	54
less than 60	71

- (2) Draw a histogram and frequency polygon of the following data.

Area in hectare	12 - 20	21 - 30	31 - 40	41 - 52	51 - 60	61 - 70	71 - 80
No of farmers	58	103	208	392	112	34	12

- (3) The following frequency distribution table gives the ages of 200 patients treated in a hospital in a week. Find the mode of ages of the patients.

Age (years)	Less than 5	5 - 9	10 - 14	15 - 19	20 - 24	25 - 29
No. of patients	38	32	50	36	24	20



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