CHAPTER 6

STATISTICS

LONG QUESTIONS AND ANSWERS

Q. 1

Given below is the distribution of the daily income of workers

Daily Income in (₹)	300 – 350	350 – 400	400 – 450	450 – 500	500 – 550	550 – 600
No of workers	2	7	9	8	6	4

Find the daily income of worker

SOLUTION:

Here we assume mean A = 425 and g = 50

Class Daily income (in ₹)	Class Marks x_i	$d_i = x_i - A = x_i - 425$	$u_i = \frac{di}{g} = \frac{di}{50}$	Frequency (No of workers) f_i	$f_i u_i$
300 – 350	325	-100	-2	2	-4
350 – 400	375	-50	-1	7	-7
400 – 450	425	0	0	9	0

450 – 500	475→	50	1	8	8
500 – 550	525	100	2	6	12
550 – 600	575	150	3	4	12
Total				$\sum f_i$ = **36**	$\sum f_i u_i$ = **21**

$$\overline{u} = \frac{\sum f_i u_i}{\sum f_i} = \frac{21}{36} = 0.5277$$

Mean = $\overline{X}$ = A + $\overline{u}$g

= 425 + (0.5833) x 50

= 425 +29.16

= 454.16

Ans. The mean of daily income of worker is ₹ 454.16

Q. 2

Find the median of the following data:

16, 22, 56, 45, 32, 28, 27,

SOLUTION:

Arranging the data in ascending order we get

56, 45, 32, 28, 27 , 22, 16

Number of Observations n = 7 (odd)

$\therefore$ **Median** = $\left(\frac{7+1}{2}^{th}\right)$ **observation**

= 4^{th} **observation**

= **28**

Hence, Median is 28

Ans. The Median is 28

Q. 3

The following table shows the number of students and the time they utilized daily for their games. Find

the time spent by students for their games by direct method.

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

SOLUTION:

Class Time (hrs)	Class Marks x_i	Frequency (No of students) f_i	Frequency Class mark $f_i x_i$
2-4	3	7	21
4-6	5	18	90
6-8	7	12	84
8-10	9	10	90
10-12	11	3	33
TOTAL		$\sum f_i = 50$	$\sum f_i x_i = 318$

$$\overline{X} = \frac{\sum f_i x_i}{\sum f_i} = \frac{318}{50} = 6.36$$

Ans.: The mean time spent by the students for their studies is 6.36 hrs.

Q. 4

Sixty men were examined in a hospital by a doctor and the number of heart beats per minute were recorded and summarized as follows. Find the mean heart beats per minute for these men, choosing a suitable method

Number of heart beats per minute	No. of men
65-68	4
68-71	8
71-74	6
74-77	16
77-80	14
80-83	8
83-86	4

SOLUTION:

Class interval	Frequency (f_i)	Class marks (x_i)	$f_i x_i$
65-68	4	66.5	266.00
68-71	8	69.5	556.00
71-74	6	72.5	435.00

74-77	16	75.5	1208.00
77-80	14	78.5	1099.00
80-83	8	81.5	652.00
83-86	4	84.5	338.00
	$\sum f_i = 60$		$\sum f_i x_i = 4554$

Therefore mean of data $= \frac{\sum f_i x_i}{\sum f_i} = \frac{4554}{60} = 75.9$

Ans. Mean heart beats per minute is 75.9

Q. 5

Find the median of the data using an empirical formula, when it is given that mode is 161.6 and mean is 73.2

SOLUTION:

Mode = 3(Median) – 2(Mean)

161.6 = 3(Median) – 2(73.2)

161.6 + 146.4 = 3(Median)

308 = 3 (Median)

Median = $\frac{308}{3}$ = 102.67

Ans. The Median of the data is 102.67

Q. 6

Electricity used by some families is shown in the following table. Find the mode for use of electricity.

Use of Electricity (Unit)	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
No of Families	13	50	70 → f_0	100 → f_1	80 → f_2	17

SOLUTION:

Here, the maximum frequency (100) is in the class 30 – 40

∴ The modal class is 30 – 40

In the given example,

L = Lower class limit of modal class = 30

h = Class interval of the modal class = 10

f_1 = Frequency of the modal class = 100

f_0 = Frequency of the class preceding the modal class = 70

f_2 = Frequency of the class succeeding the modal class = 80

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

$$= 30 + \left[\frac{100 - 70}{2(100) - 70 - 80}\right] \times 10$$

$$= 30 + \left[\frac{30}{200 - 150}\right] \times 10$$

$$= 30 + \frac{30}{50} \times 10$$

$$= 30 + 6$$

$$= 36$$

Ans. The mode for the use of electricity is 36 units.

Q. 7

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	19	16	25	18	12	10

SOLUTION:

Less than 5 means 0 to 4. The age cannot be negative.

In the table, the classes are not continuous.

We get the following frequency distribution table after making the classes continuous.

Class Age (years)	Class	Continuous Classes f_i	Frequency (Number of patients)
Less than 5	0 – 4	0 – 4.5	19
5 – 9	5 – 9	4.5 – 9.5	16 → f_0
10 – 14	10 – 14	9.5 – 14.5	25 → f_1

15 – 19	15 – 19	14.5 – 19.5	18 → f_2
20 – 24	20 – 24	19.5 – 24.5	12
25 – 29	25 – 29	24.5 – 29.5	10

[Note: In continuous classes we have taken '0 – 4.5' and not '-0 – 4.5', because the age cannot be negative.]

From the table, the modal class is 9.5 – 14.5.

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

$$= 9.5 + \left[\frac{25-16}{(2\times 25)-16-18}\right] \times 5$$

$$= 9.5 + \left(\frac{9}{50-34}\right) \times 5$$

$$= 9.5 + \frac{9}{16} \times 5$$

$$= 9.5 + 2.8125$$

$$= 9.5 + 2.8125$$

$$= 12.3125$$

Ans. The mode of the ages of the patient is 12.30 years.

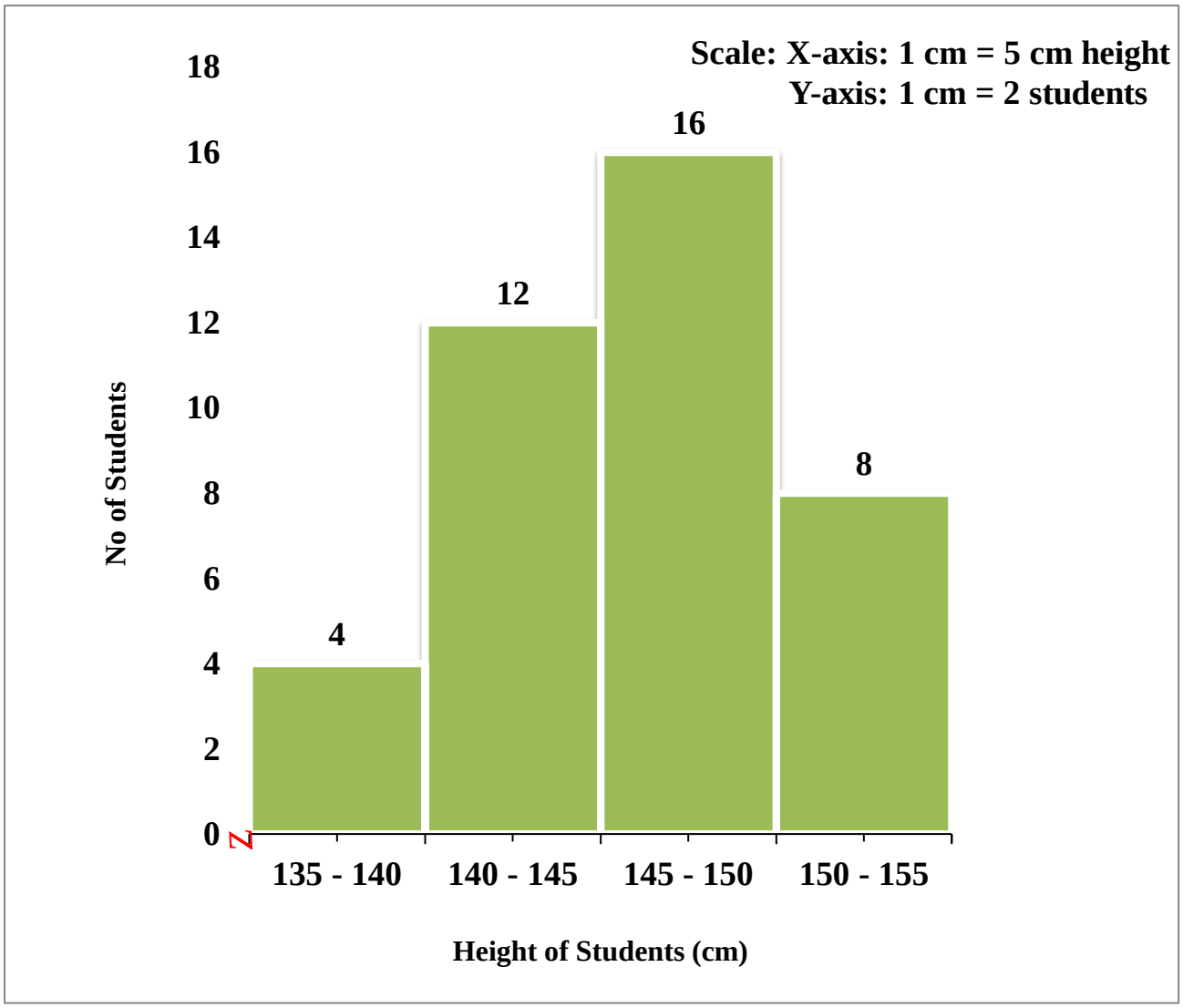
Q. 8

Draw a histogram of the following data:

Height of Student (cm)	135 – 140	140 – 145	145 – 150	150 – 155
Number of Students	4	12	16	8

Note down Highest frequency and lowest frequency classes

SOLUTION:



Highest frequency class 145-150

Lowest frequency class 135 – 140

Ans. Highest frequency class 145-150

Lowest frequency class 135 – 140

Q. 9

Grouped frequency distribution for supply of milk to hotels and number of hotels is given in following table. Find the mode of supply of milk.

Milk (Littre)	5 – 7	7 – 9	9 – 11	11 – 13	13 – 15	15 – 17
Number of hotels	7	5	15	20 → f_0	35 → f_1	18 → f_2

SOLUTION:

Here the maximum frequency (35) is in the class 13-15 Hence, the modal class 13-15

In the given example,

L = Lower class limit of modal class = 13

h = Class interval of the modal class = 2

f_1= Frequency of the modal class = 35

f_0 = Frequency of the class preceding the modal class = 20

f_2 = Frequency of the class succeeding modal class = 18

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

$$= 13 + \left[\frac{35 - 20}{2 \text{ x } 35 - 20 - 18}\right] \text{x } 2$$

$$= 13 + \left[\frac{15}{70 - 38}\right] \text{x } 2$$

$$= 13 + \left[\frac{15}{32}\right] \text{x } 2$$

$$= 13 + \frac{15}{16}$$

$$= 13 + 0.9375$$

$$= 13.94$$

Ans. The mode of the supply of milk is 13.94 liters

Q. 10

The following table shows ages of people who went to a particular theater for a movie in a day

Age (in years)	20-30	30-40	40-50	50-60	60-70
No of people	30	70	50	45	40

SOLUTION:

Class Age (in years)	Frequency(No of people)
20-30	30 → f_0
30-40 (Modal Class)	70 → f_1 (Maximum frequency)
40-50	50 → f_2
50-60	45
60-70	40

Here maximum frequency is 70

The Modal class is 30-40

***L* = Lower class limit of modal class = 30**

***h* = Class interval of the modal class = 10**

f_1 = Frequency of the modal class = 70

f_0 = Frequency of the class preceding the modal class = 30

f_2 = Frequency of the class succeeding modal class = 50

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

$$= 30 + \left[\frac{70 - 30}{2x70 - 30 - 50}\right] \times 10$$

$$= 30 + \left[\frac{40}{140 - 80}\right] \times 10$$

$$= 30 + \left[\frac{40}{60}\right] \times 10$$

$$= 30 + 6.67$$

$$= 36.67$$

Ans. Ages of the visitors is 36.67 liters

Q. 11

The following table shows income of farmers in a apple season. Find the mean of their income.

Income (Thousand rupees)	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80	80 – 90

Farmers	10	11	15	16	18	14

SOLUTION:

Class Income (₹ in thousands)	Class Mark x_i	Frequency (Farmers) f_i	Frequency x Class Marks $f_i x_i$
30-40	35	10	350
40-50	45	11	495
50-60	55	15	825
60-70	65	16	1040
70-80	75	18	1350
80-90	85	14	1190
TOTAL		$\sum f_i = 84$	$\sum f_i x_i = 5250$

Mean $= \overline{X} = \frac{\sum f_i x_i}{\sum f_i}$

$$= \frac{5250}{84}$$

$$= 62.5$$

Mean income in₹ = ₹ (62.5 x 1000)

= ₹ 62500

Ans. The mean of the income of farmers is ₹ 62500

Q. 12

The table shows the yield of Soyabean 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

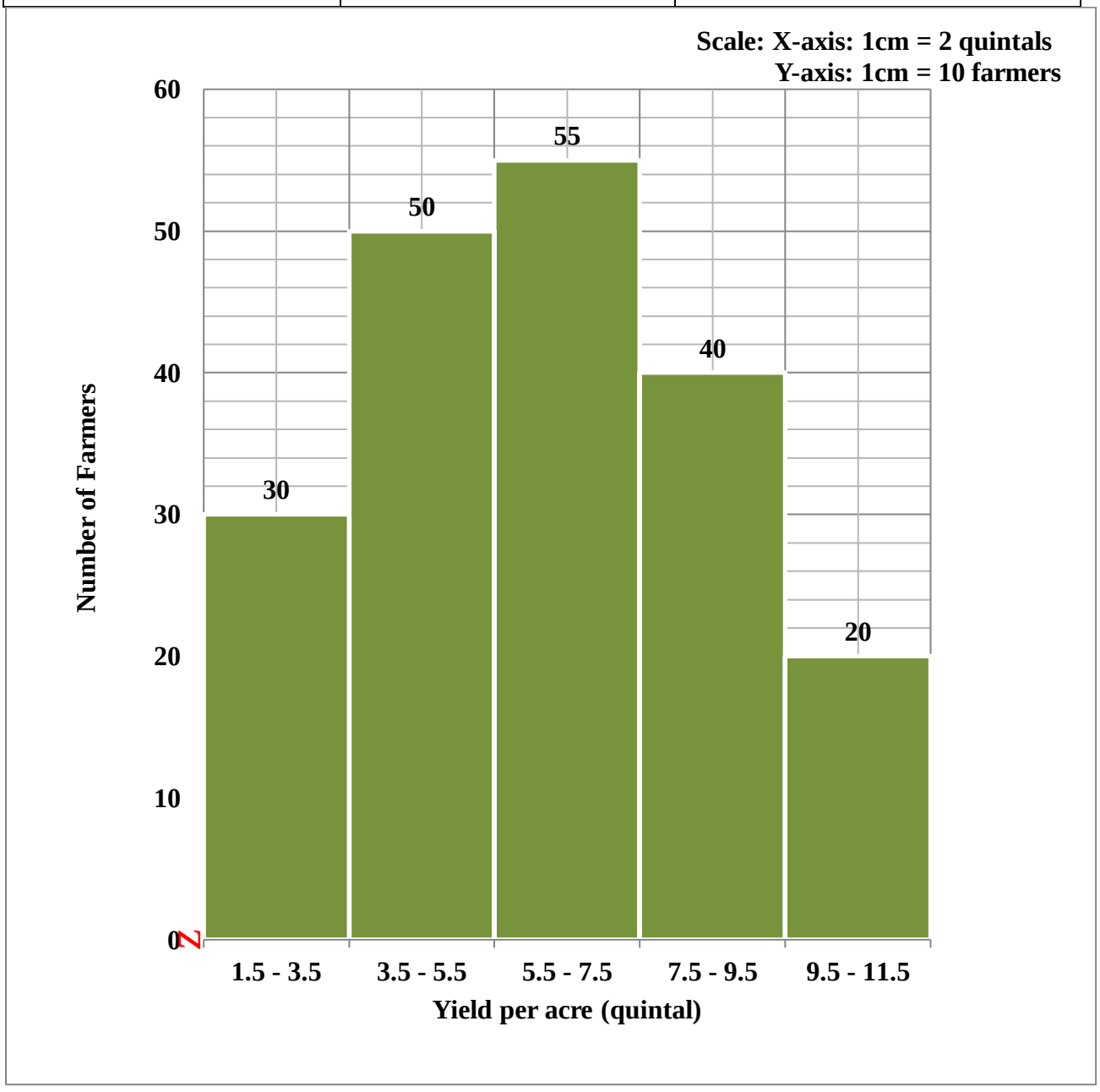
Mention Class having Highest frequency

Mention Class having Lowest

SOLUTION:

Yield per acre (quintal)	Continuous Classes	Number of Farmers
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



Class having Highest frequency 5.5-7.5

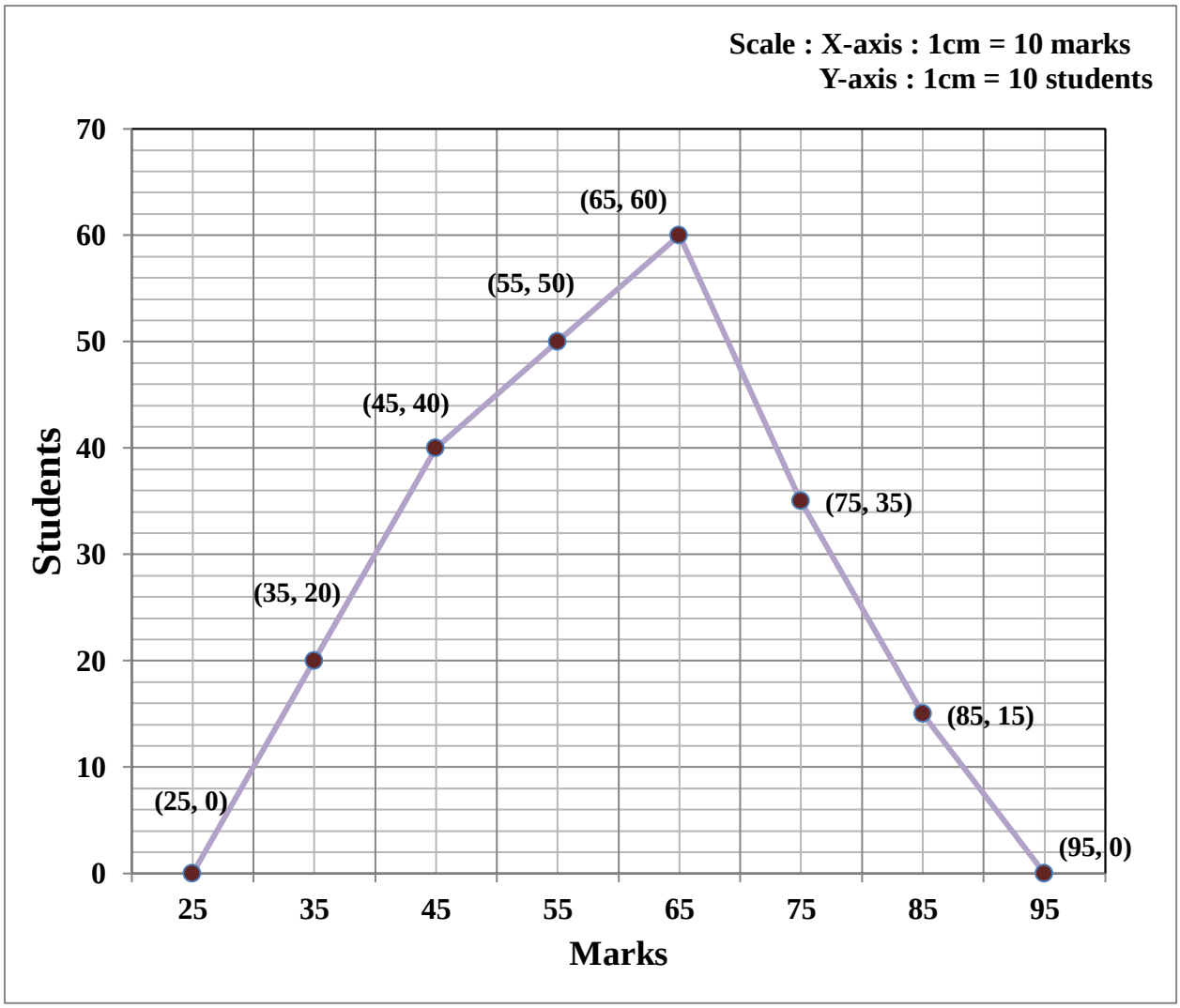
Class having Lowest frequency 9.5 -11.5

Ans. Class having Highest frequency 5.5-7.5

Class having Lowest frequency 9.5 -11.5

Q. 13

Observe the following frequency polygon and write the answers of the questions below it:



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

(2) Write the class having 20 frequency

(3) What is the class mark of the class, having frequency of 40 students?

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

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

SOLUTION:

(1) The class 60 – 70 has the maximum number of students.

(2) The classes 30 – 40 have 20 frequencies

(3) The class mark of the class, having frequency of 40 students is 45.

(4) The lower-class limit and the upper class limit of the class whose class marl is 85 are 80 and 90 respectively. (Class mark 85 is of the class 80 – 90)

(5) There are 15 students in the class 80 – 90

Q. 14

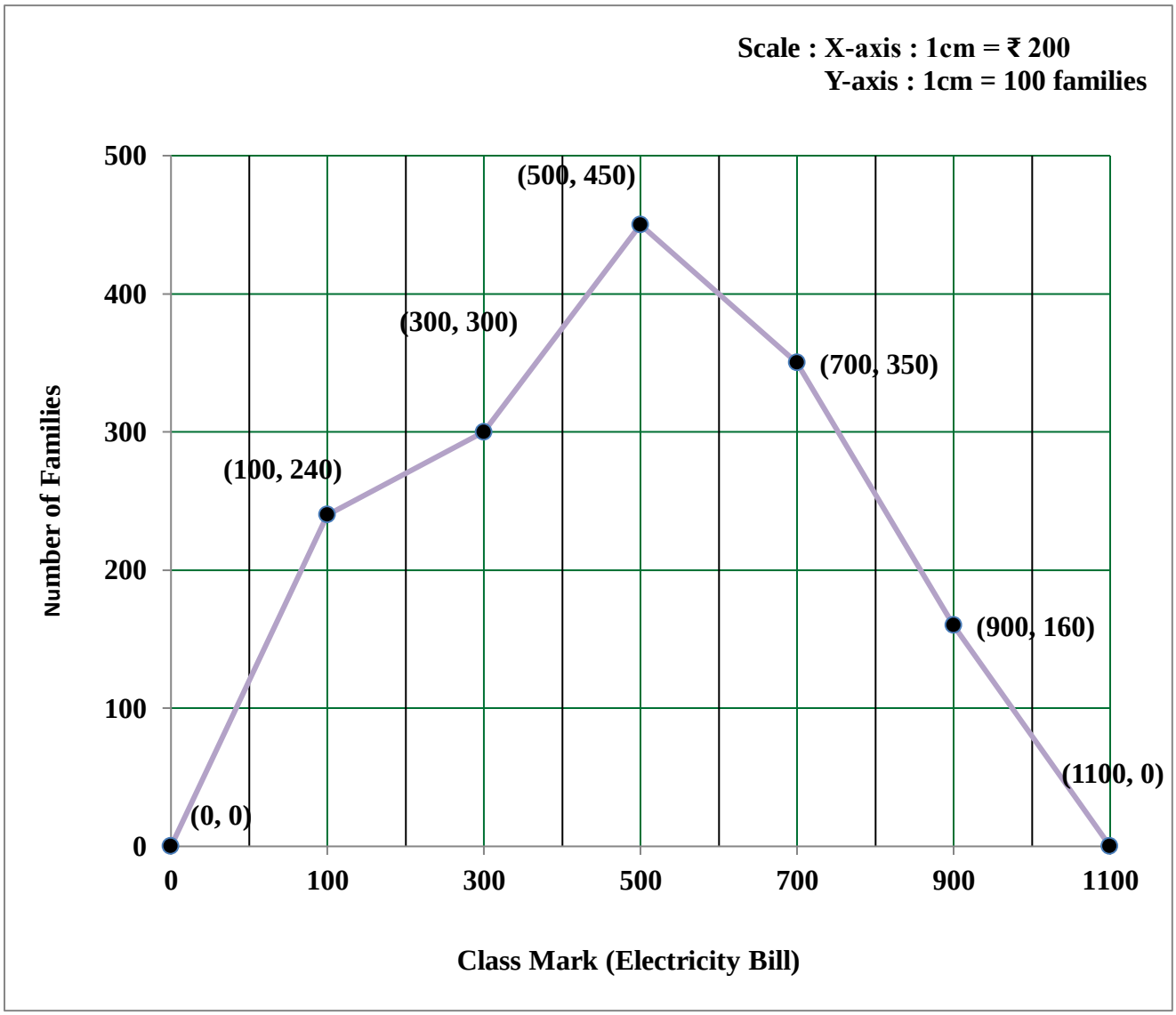
Draw frequency polygon of the following data .

Electricity Bill (₹)	0 – 200	200 – 400	400 – 600	600 – 800	800 – 1000	1000-1200
Families	240	300	450	350	160	0

SOLUTION:

First prepare a table showing co-ordinates necessary to draw a frequency polygon

Class Electricity Bill (₹)	Class Mark	Frequency (Families)	Coordinates of Points
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)



[Note: The class preceding the first class would be -200 – 0 and the midpoint would be -100. But the electricity bill cannot be negative. ∴ for convenience the midpoint of the preceding rectangle is taken as zero.]

Q. 15

Draw a pie diagram from the given data of age group and number of persons, who donated blood in a blood donation camp is given below.

Age Group (years)	20-25	25-30	30-35	35-40
Number of persons	80	60	35	25

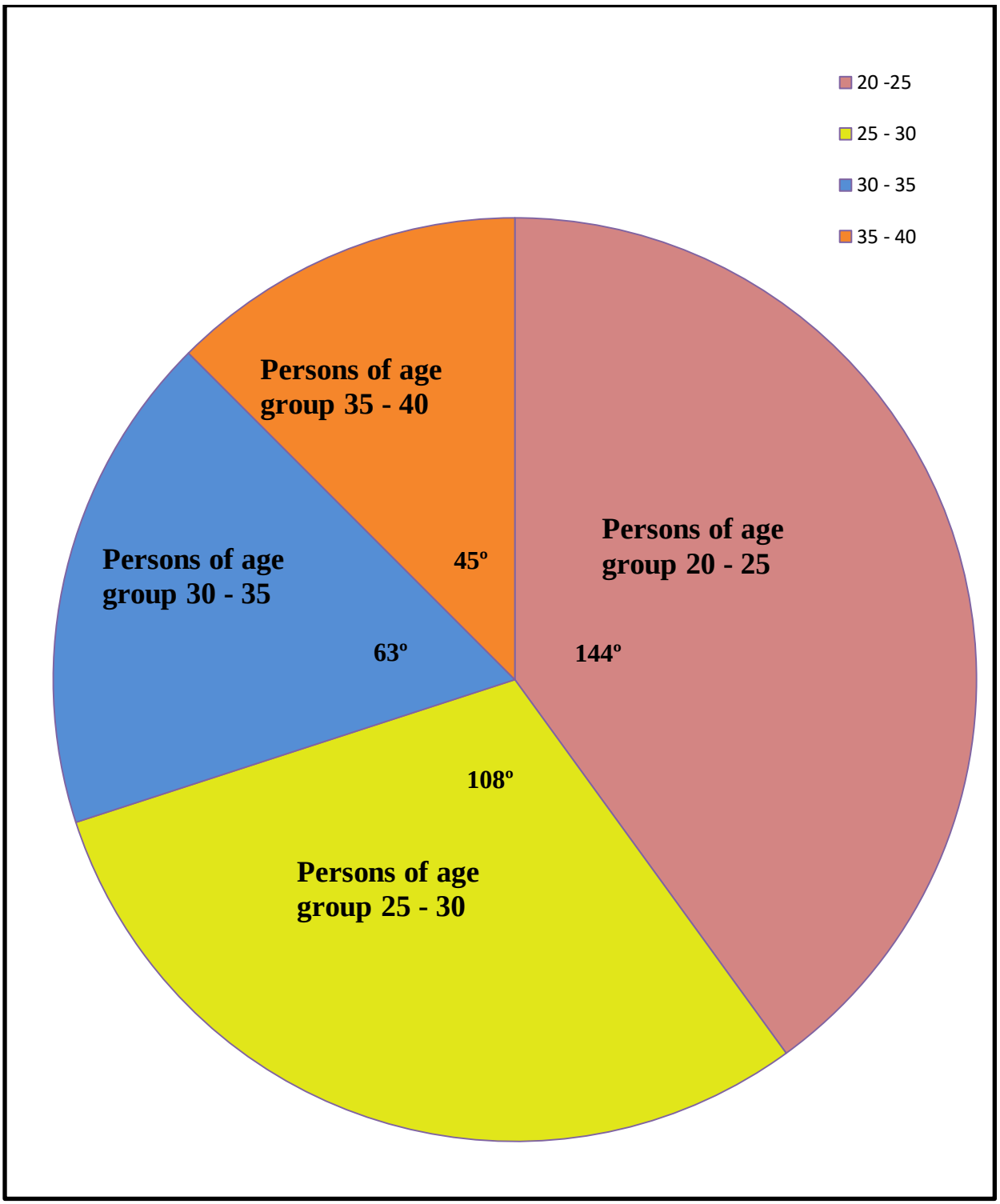
Name the biggest sector and smallest sector classes

SOLUTION:

The number of persons are converted into component parts of 360º in the following table:

Age Group	Number of Persons	Measure of the central angle
20 – 25	80	$\frac{80}{200} \times 360° = 144°$
25 – 30	60	$\frac{60}{200} \times 360° = 108°$
30 – 35	35	$\frac{35}{200} \times 360° = 63°$
35 – 40	25	$\frac{25}{200} \times 360° = 45°$
Total	**200**	**360°**

On the basis of the table, the pie diagram is drawn below:

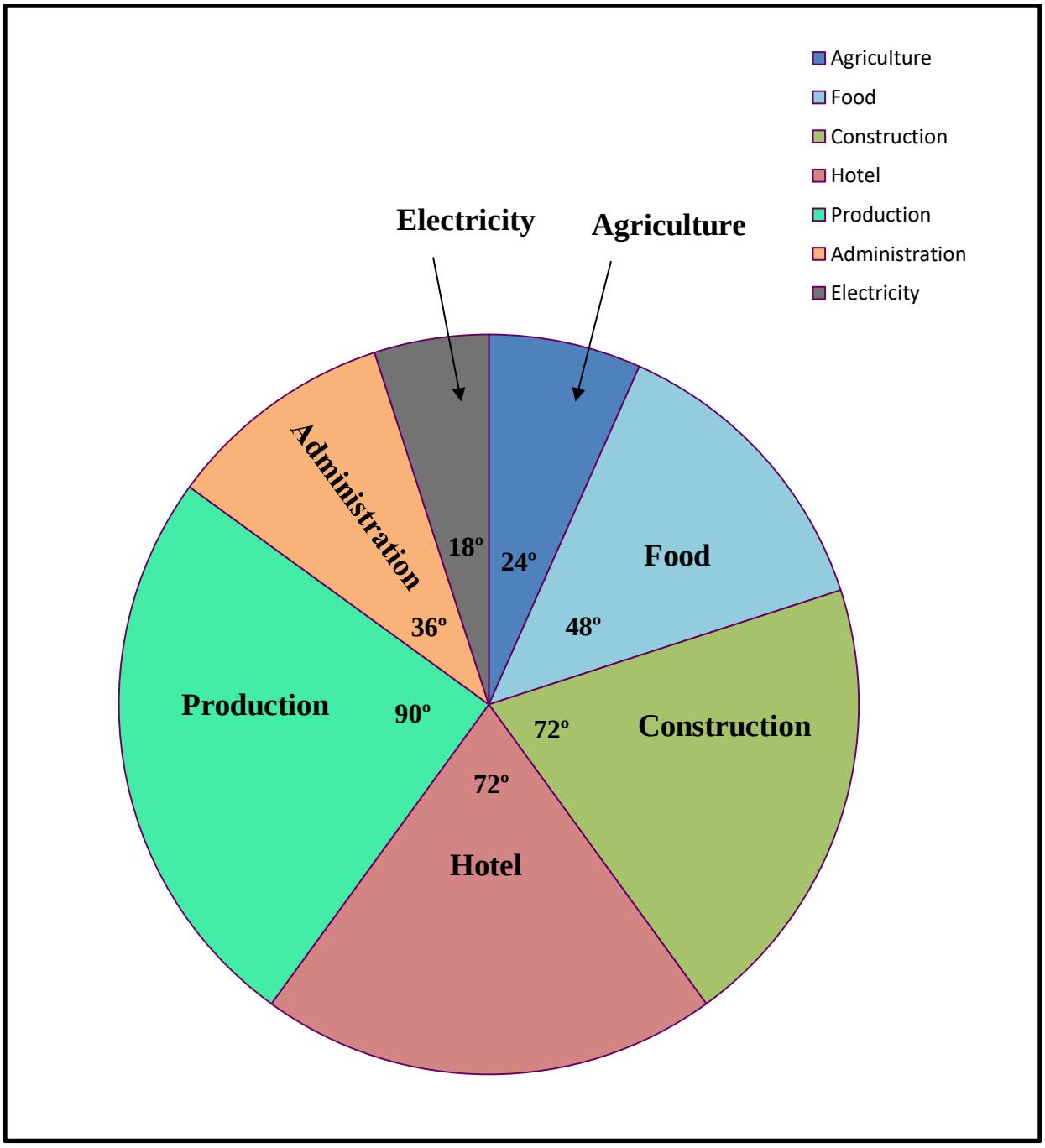


biggest sector class 20-25 and smallest sector class 35-40

Ans : biggest sector class 20-25 and smallest sector class 35-40

Q. 16

The proportions of different workers in a town by the pie diagram in figure is shown. Answer the following questions with its help.



(1) If the total number of workers is 10000; how many of them are in the field of food?

(2) How many workers are working in the hotel?

(3) What is the percentage of workers in the production?

SOLUTION:

(1) Let x worker are in the field of food.

The total number of workers is 10,000

The central angle for construction is

$$= \frac{\text{Workers in the field of construction}}{\text{the total number of workers}} \times 360°$$

$$\therefore 48° = \frac{x}{10000} \times 360°$$

$$\therefore x = \frac{48° \times 10000}{360}$$

$$\therefore x = 1333 \quad \ldots (1)$$

(2) Let y workers are working in the hotel

The central angle for administration

$$= \frac{\text{Workers in hotel}}{\text{the total number of workers}} \times 360°$$

$$\therefore 72° = \frac{y}{10000} \times 360°$$

$$\therefore y = \frac{72 \text{ x } 10000}{360°}$$

$$\therefore y = 2000 \quad \ldots (2)$$

(3) The central angle for the workers in production is given to be 90^o

The given percentage of workers in production

$$= \frac{90^\circ}{360^\circ} \times 100$$

$$= \frac{1}{4} \times 100$$

$$= 25 \qquad \ldots (3)$$

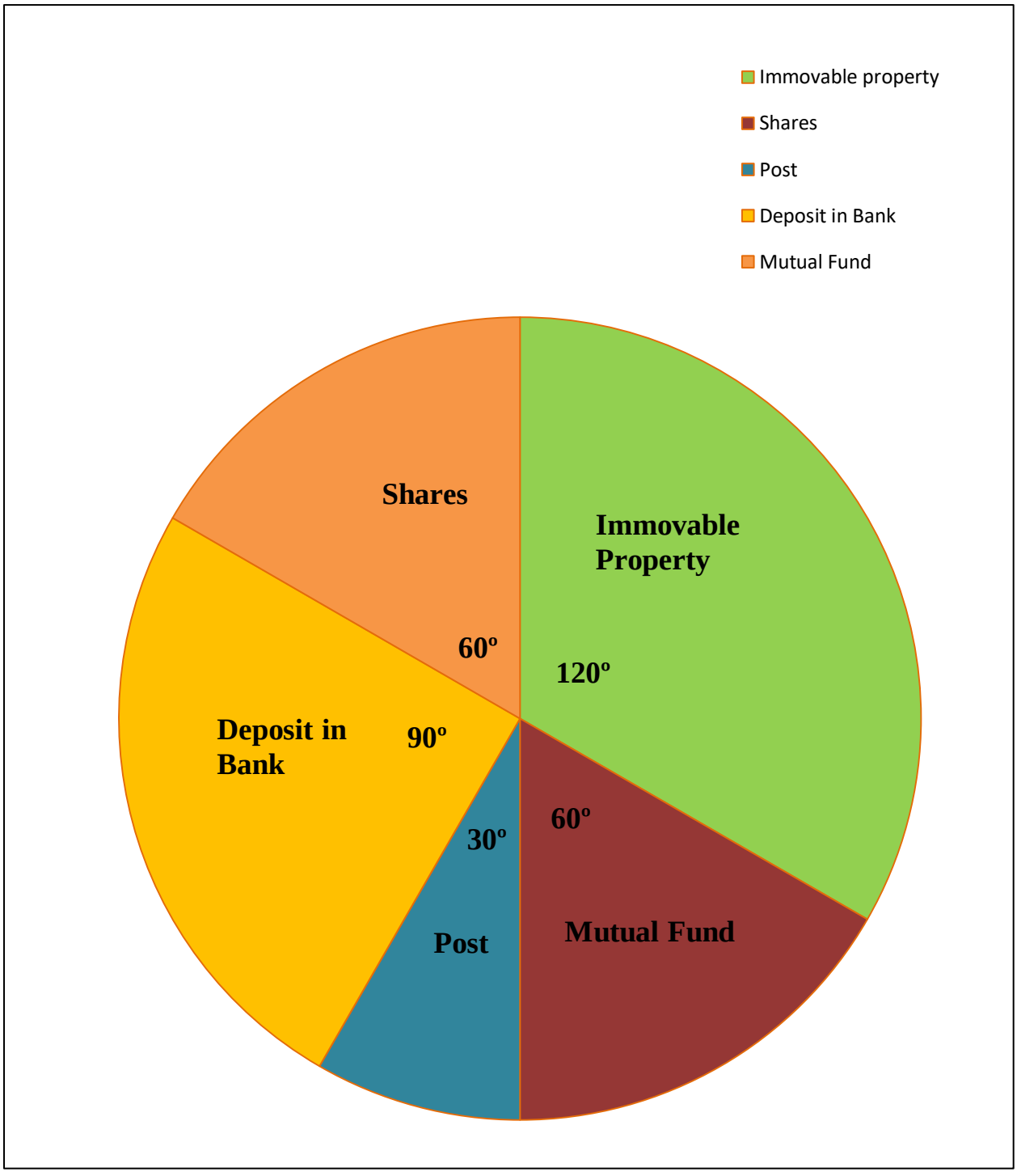
Ans. (1) 2000 workers are in the field of construction

(2) 1000 workers are working in the administration

(3) 25% workers are working in the production

Q. 17

The annual investments of a family are shown in the pie diagram.



Answer the following questions based on it.

(1) If the investment in shares is ₹ 2000, find the total investment.

(2) How much amount is deposited in the bank?

(3) How much more money is invested in the immovable property than in the mutual fund?

(4) How much amount is invested in the post?

SOLUTION:

(1) Let the total investment be ₹ x

The central angle for the investment in shares is given to be 60°

The central angle for the investment in shares

$$= \frac{Investment\ in\ shares}{Total\ Investment} \times 360°$$

$$\therefore 60° = \frac{2000}{x} \times 360°$$

$$\therefore x = \frac{2000 \times 360}{60}$$

$$\therefore x = 12000$$

∴ Total investment is ₹ 12,000 … (1)

(2) Let the amount deposited in the bank be ₹ y

The central angle for the amount deposited in the bank

$= \frac{Amount\ deposited\ in\ Bank}{Total\ Investment} \times 360°$

$\therefore\ 90° = \frac{y}{12000} \times 360°$ (The central angle for the amount deposited in bank is given to be 90º)

$\therefore\ y = \frac{90 \times 12000}{360}$

$\therefore\ y = 3000$ … (2)

(3) Let the amount invested in the mutual fund be ₹ z

The central angle for the amount invested in the mutual fund is 60°

The central angle for mutual fund

$= \frac{Amount\ deposited\ in\ Mutual\ Fund}{Total\ Investment} \times 360°$

$\therefore\ 60° = \frac{z}{12000} \times 360°$

$\therefore\ z = \frac{60 \times 12000}{360}$

$\therefore\ z = 2000$ … (3A)

Now we find the money invested in the immovable property. Let it be ₹ p

The central angle for the immovable property

$$= \frac{\textit{Amount deposited in Immovable Property}}{\textit{Total Investment}} \times 360°$$

$$\therefore 120° = \frac{p}{12000} \times 360°$$

$$\therefore p = \frac{120 \times 12000}{360}$$

$$\therefore p = 4000 \quad \ldots (3B)$$

More money invested in the immovable property

= ₹ (4000 – 2000) … [from (3B) and (3A)]

= ₹ 2000

(4) The amount invested in the post

= Total Investment – (Investments in MF + Immovable Property + Bank + Shares)

= ₹ [12000 – (2000 + 4000 + 3000 + 2000)]

= ₹ (12000 – 11000)

= ₹ 1000 … (4)

Ans. Investments are as follows:

(1) Total: ₹ 12,000

(2) Bank: ₹ 3000

(3) More in Immovable Property than MF: ₹ 2000

(4) Post: ₹ 1000

Q. 18

Calculate the mean of daily income (in ₹) of the following data about staff working in a company by using step deviation method.

Daily Income (in ₹)	< 100	< 200	< 300	< 400	< 500
Number of Men	12	28	34	41	50

SOLUTION:

Since, the given table has cumulative frequency distribution, we convert it into frequency distribution table.

Here, the number of men having income less than ₹ 100 is 12 and those less than ₹ 200 are 28

∴ Number of men having income between 0 and 100 = 12 – 0 = 12 and number of men having income between 100 and 200 = 28 – 12 = 16

Similarly, number of men having income between 200 – 300, 300 – 400 and 400 – 500 are calculated as follows:

Daily income (in ₹)	**Number of Men (f_i)**	**Class Mark (x_i)**	$d_i = x_i$ - A = $x_i - 250$	$u_i = \frac{di}{h} = \frac{di}{100}$	$f_i u_i$
0 – 100	12	50	-200	-2	-24
100 – 200	28–12=16	150	-100	-1	-16
200 – 300	34–28=6	250	0	0	0
300 – 400	41–34=7	350	100	1	7
400 – 500	50–41=9	450	200	2	18
Total	$\sum f_i = 50$				$\sum f_i u_i = -15$

By using step-deviation method,

$$\therefore \overline{X} = A + h \times \left(\frac{\sum f_i u_i}{\sum f_i}\right)$$

$$= 250 + 100 \times \left(\frac{-15}{50}\right)$$

$$= 250 - 30$$

$$= ₹\ 220$$

Ans. The mean of daily income is ₹ 220.

Q. 19

Find the median of the following data:

32,9, 44, 112, 90,16, 64, 56, 54,

SOLUTION:

Arranging the data in ascending order we get

112, 90, 64 , 56, 54 , 44, 32, 16, 9

Number of Observations n = 9 (odd)

$$\therefore \text{Median} = \left(\frac{9+1}{2}^{th}\right)\text{observation}$$

$$= 5^{th} \text{ observation}$$

$$= 54$$

Hence, Median is 54

Ans. The Median is 54

Q. 20

The following table gives the result of certain examination for 180 students

i. Find the value of x

ii. Draw histogram

iii Mention Class with highest frequency

Marks	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
No. of Students	10	x	25	$2x$	55	30

SOLUTION:

i. Total number of students = 180

$\therefore\ 10 + x + 25 + 2x + 55 + 30 = 180$

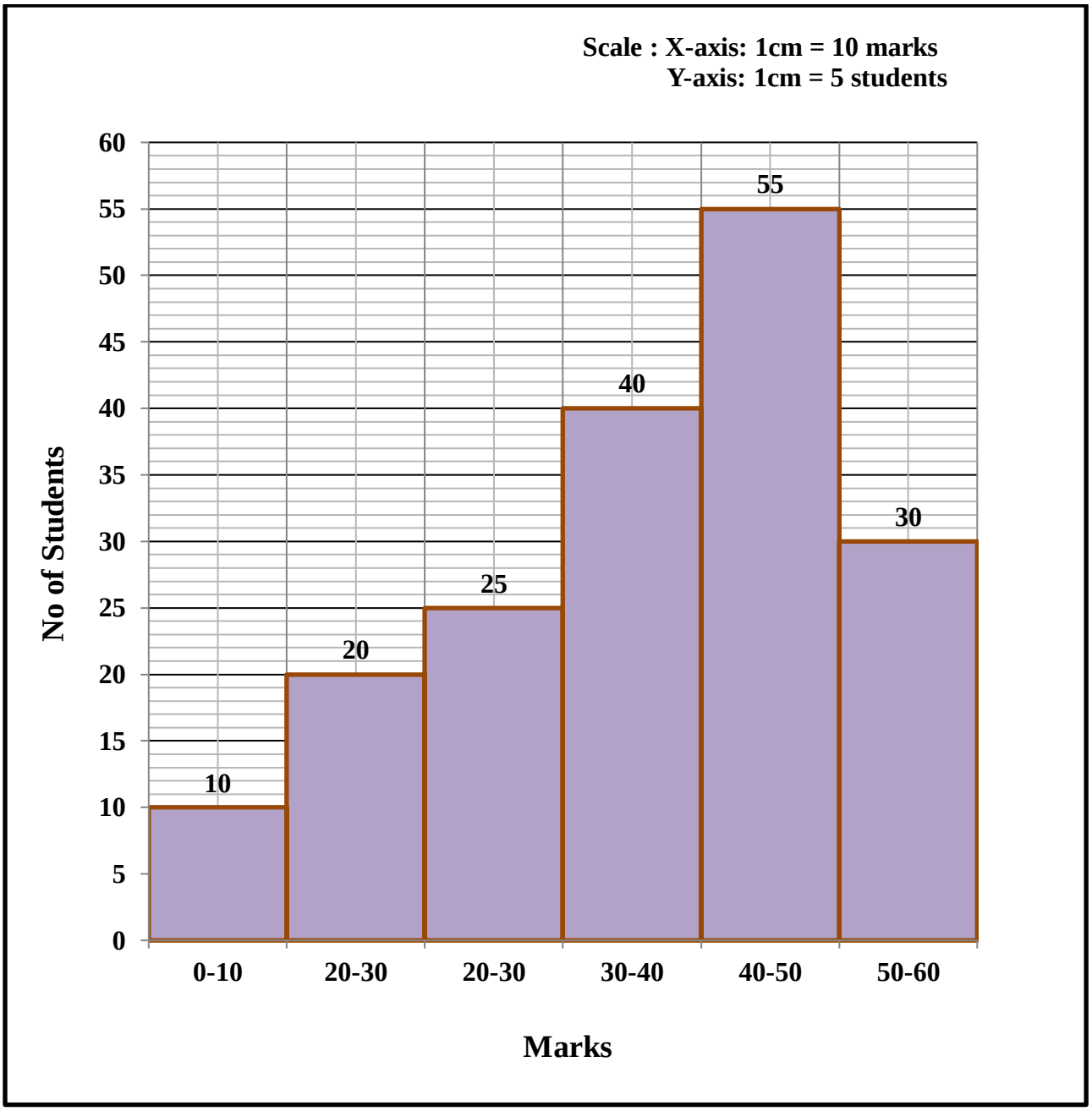
$\therefore\ 3x + 120 = 180$

$\therefore\ 3x = 60$

$\therefore\ x = 20$

ii.

Marks	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
No. of Students	10	20	25	40	55	30



Ans :1) Value of *x* is 20

2) Histogram as above

3)Class with highest frequency is 40-50

Q. 21

Amit noted the number of cakes she baked every day over the past week. If the numbers were 1,2,2,3,4,3 Calculate median value of cakes he backed

Solution :

Arranging data 1,2,2,3,4,3 in ascending order as 1,2,2,3,3,4

Number of observations =n =6 (even)

$$\text{Median} = \frac{(\frac{n}{2})th\ observation + \left(\frac{n}{2}+1\right)th\ observation}{2}$$

$$\text{Median} = \frac{(3\ rd\ observation) + (4)th\ observation}{2}$$

$$\text{Median} = \frac{(2)+(3)}{2}$$

$$\text{Median} = \frac{5}{2}$$

$$\text{Median} = 2.5$$

Ans: Median = 2. 5

Q. 22

Find the median of the data using an empirical formula, when it is given that mode is 80.62 and mean is 61.2

SOLUTION:

Mode = 3(Median) – 2(Mean)

80.62 = 3(Median) – 2(61.2)

80.62 + 122.4 = 3(Median)

203.02 = 3 (Median)

$$\text{Median} = \frac{203.02}{3} = 67.73$$

Ans: Median = 67.73

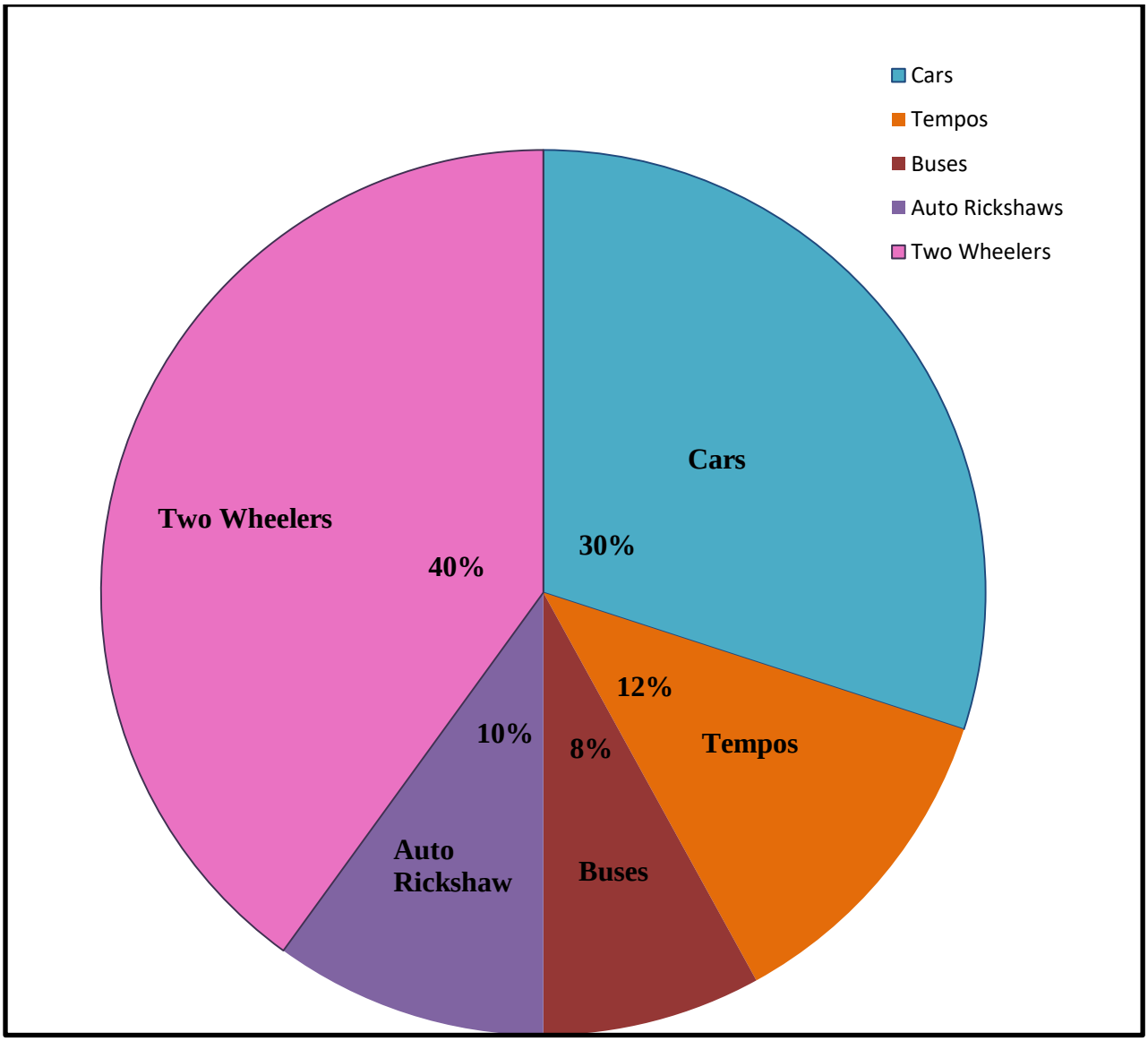
Q. 23

Observe the given pie diagram. It shows the percentages of number of vehicles passing a signal in

a town between 8 am and 10 am.

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:

Measure of Central Angle (θ) =

$$\frac{\textit{Number of scores in the components}}{\textit{Total number of scores}} \times 360°$$

i.

Vehicle	Measure of Central Angle (θ)
Cars	$\frac{30}{100} \times 360° = 108°$
Tempos	$\frac{12}{100} \times 360° = 43.2° = 43$
Buses	$\frac{8}{100} \times 360° = 28.8° = 29°$
Auto Rickshaws	$\frac{10}{100} \times 360° = 36°$
Two Wheelers	$\frac{40}{100} \times 360° = 144°$

ii. Central Angle for two wheelers (θ) = 144°

Measure of Central Angle (θ) =

$$\frac{\textit{Number of Two Wheelers}}{\textit{Total number of Vehicles}} \times 360°$$

$$\therefore 144° = \frac{1200}{\textit{Total number of Vehicles}} \times 360°$$

$$\therefore \textit{Total number of Vehicles} = \frac{1200 \times 360}{144} = 3000$$

Ans. The total number of vehicles is 3000

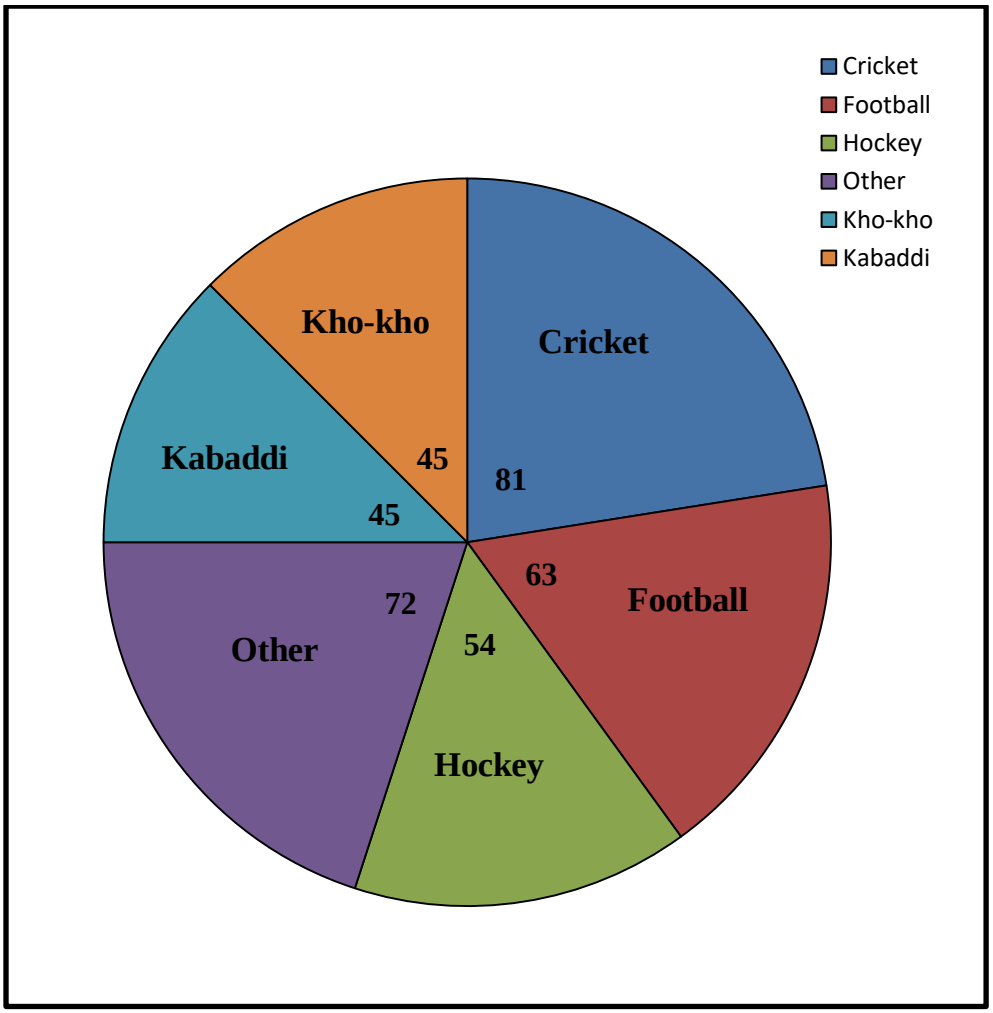
Q. 24

A survey of students was made to know which game they like. The data obtained in the survey is presented in the given pie diagram. If the total number of students are 1000.

i. how many students like hocky?

ii. How many students like kabadi?

iii. How many students prefer other games?



SOLUTION:

Measure of Central Angle (θ) =

$$\frac{Number\ of\ Scores\ in\ the\ Components}{Total\ number\ of\ Scores} \times 360°$$

i. Central Angle for Hockey (θ) = 54°

$$\therefore 54° = \frac{Students\ who\ like\ \text{Hockey}}{1000} \times 360°$$

$$\text{Students who like Hockey} = \frac{54 \times 1000}{360} = 150$$

$$\therefore 150 \text{ students like Hockey}$$

ii. Central Angle for Kabaddi (θ) = 45°

$$\therefore 45° = \frac{Students\ who\ like\ football}{1000} \times 360°$$

$$\text{Students who like Kabaddi} = \frac{45 \times 1000}{360} = 125$$

$\therefore$ **125students like Kabaddi**

iii. Central Angle for Other Games (θ) = 72°

$$\therefore 72° = \frac{Students\ who\ like\ other\ games}{1000} \times 360°$$

$$\text{Students who like other games} = \frac{72 \times 1000}{360} = 200$$

$\therefore$ **200 students like other games**

Ans i. 150 students like hocky.

ii. 125 students like Kabaddi.

iii. 200 students prefer other games.

Q. 25

The following table shows the ages of the patients admitted in a hospital during a year.

Age (In years)	No. of Patients
15 – 25	6

25 – 35	11
35 – 45	21
45 – 55	25
55 – 65	14
65-75	5

Find the mode of the data given above. Compare and interpret the two measures of central tendency. And the mean if number of patients replaced by 23 in the interval 45-55

SOLUTION:

FOR MODE:

Age (in Years)	**15 – 25**	**25 – 35**	**35 – 45**	**45 – 55**	**55 – 65**	**65-75**
No. of Patients	**6**	**11**	**21**	**25**	**14**	**5**

∴ Maximum frequency is 25

∴ Modal class is 45 – 55

Here, $l = 45$, $f_1 = 25$, $f_0 = 21$, $f_2 = 14$, $h = 10$

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

$$= 45 + \left[\frac{25-21}{50-21-14}\right] \times 10$$

$$= 45 + \frac{4}{15} \times 10$$

$$= 45 + 2.666$$

$$= 47.666 \text{ years}$$

FOR MEAN:

Age (in years)	Class Mark (x_i)	No of Patients (f_i)	$u_i = \frac{x_i - 40}{10}$	$f_i x_i$
15 – 25	20	6	-.2	-12
25 – 35	30	11	-1	-11
35 – 45	40 → A	21	0	0
45 – 55	50	23	1	23
55 – 65	60	14	2	28
65-75	70	5	3	15
		$\sum f_i = 80$		$\sum f_i u_i = 43$

Here A = 40, $\sum f_i u_i = 43$, $\sum f_i = 80$, h = 10

We have

$$\text{Mean} = A + \left[\frac{\sum f_i u_i}{\sum f_i}\right] \times h$$

$$= 40 + \frac{43 \times 10}{80}$$

$$= 40 + 5.37$$

$$= 45.37 \text{ years}$$

Ans. We conclude that the maximum number of patients in the hospital is of the age 47.666 years.

While on an average, the age of patient admitted to the hospital is 45.37 years.

Q. 26

If the median of the distribution given below is 16.5, find the values of x and y. Given total frequency is 60

Class Interval	Frequency
0 – 10	5
10 – 20	x
20 – 30	20
30 – 40	15

40 – 50	y
50 – 60	5

SOLUTION:

Class Interval	Frequency	Cumulative Frequency
0 – 10	5	5
10 – 20	x	$5 + x$
20 – 30	20	$25 + x$
30 – 40	15	$40 + x$
40 – 50	y	$40 + x + y$
50 – 60	5	$45 + x + y$
Total	**n = 60** $= 45 + x + y$	

We have $45 + x + y = 60$ …. (i)

n = 60, $\therefore \frac{n}{2} = \frac{60}{2} = 30$

Since the median lies in the class interval (20 – 30), so the median class is (20 – 30)

Hence $l = 20$, $f = 20$, $cf = 25 + x$ and $h = 10$

$$\therefore \text{Median} = l + \left(\frac{\frac{n}{2} - cf}{f}\right) \times h$$

$$\therefore 16.5 = 20 + \left(\frac{30-25-x}{20}\right) \times 10$$

$$\therefore 16.5 = 20 + \left(\frac{5-x}{2}\right)$$

$$\therefore -3.5 = 5 - x$$

$$\therefore -x = -3.5 - 5$$

$$\therefore x = 8.5$$

Putting $x = 8.5$ in equation (i), we get

$$45 + 8.5 + y = 60$$

$$y = 60 - 53.5$$

$$y = 6.5$$

Ans: Value of x = 8.5 and y = 6.5

Q. 27

Find the values of f_1 and f_2 of the frequency if the mean of the following frequency distribution is 23.4 and the total frequency is 40.

Class Interval	0 - 8	8 - 16	16 - 24	24 - 32	32 - 40
Frequency	6	f_1	10	f_2	9

SOLUTION:

Take a = 10 and h = 8

Class Interval	Mid-point (x_i)	f_i	$f_i x_i$
0 – 8	4	6	24
8 – 16	*12*	f_1	$12f_1$
16 – 24	20	10	200
24 – 32	28	f_2	$28f_2$
32 – 40	*36*	9	324
		$25 + f_1 + f_2 = 40$	$548 + 12f_1 + 28f_2$

$25 + f_1 + f_2 = 40$

$f_1 + f_2 = 15$ ..... (i)

$\therefore \bar{X} = \frac{548+12f_1+28f_2}{40}$

$23.4 = \frac{548+12f_1+28f_2}{40}$

$936 = 548 + 12f_1 + 28f_2$

$12f_1 + 28f_2 = 388$

$3f_1 + 7f_2 = 97$ ..... (ii)

Putting equation (ii) – 3(i)

$3f_1 + 7f_2 = 97$

$3f_1 + 3f_2 = 45$

$4f_2 = 52$

$f_2 = 13$

$\therefore f_1 = 15 - 13 = 2$

Ans: Values of $f_1 = 2$ and $f_2 = 13$

Q. 28

The median of the observations arranged in ascending order of 11, 12, 14, 18, (x + 2), (x + 4), 30, 32, 35, 41 is 26. Find the value of x.

SOLUTION:

The number of observations = n = 10. Since n is even,

$$\text{Median} = \frac{\left(\frac{n^{th}}{2}\right) observation + \left(\frac{n}{2}+1^{th}\right) observation}{2}$$

$$26 = \frac{\left(5^{th}\right) observation + \left(6^{th}\right) observation}{2}$$

$$26 = \frac{(x+2)+(x+4)}{2}$$

$$26 = \frac{2x+6}{2}$$

$$2x + 6 = 52$$

$$2x = 46$$

$$x = 23$$

Ans: Values of x = 23

Q. 29

Given below the distribution of daily income of workers

Daily income (in ₹)	200-250	250-300	300-350	350-400	400-450	450-500
No of farm ponds	2	7	9	8	6	4

Find the mean of daily income

SOLUTION:

Class Daily Income in (Rs)	Class Mark x_i	$d_i = x_i - A = x_i - 325$	Frequency (No of workers)	Frequency x Deviation
200-250	225	-100	2	-200
250-300	275	-50	7	-350
300-350	325 A	0	9	0
350-400	375	50	8	400
400-450	425	100	6	600
450-500	475	150	4	600
Total			$\sum f_i = 36$	$\sum f_i d_i = 1050$

$$\overline{d} = \frac{\sum f_i d_i}{\sum f_i}$$

$= \frac{1050}{36}$

$= 29.17$

Mean = X = $\overline{A}$ + $\overline{d}$= d_i + $\overline{d}$= 325 + 29.17

= 354.17

Ans. Mean daily income of the worker is Rs 354.17

Q. 30

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.

Toll (Rs)	300-400	400-500	500-600	600-700	700-800
No of vehicles	40	55	60	35	20

SOLUTION:

Class Toll (Rs)	Cass Mark (x_i)	$d_i = x_i$ - A = x_i - 550	Frequency (No of vehicles) (f_i)	Frequency x Deviation $f_i d_i$
300-400	350	-200	40	-8000

400-500	450	-100	55	-5500
500-600	550	0	60	0
600-700	650	100	35	3500
700-800	750	200	20	4000
TOTAL			$\sum f_i = 210$	$\sum f_i d_i = -6000$

$$\overline{d} = \frac{\sum f_i d_i}{\sum f_i}$$

$$= \frac{-6000}{210}$$

$$= -28.57$$

$$\text{Mean} = X = \overline{A} + \overline{d}$$

$$= 550 - 28.57$$

$$= 521.43$$

Ans. Mean of the toll paid by the driver is Rs 521.43

Q. 31

A milk center sold milk to 50 customers. The table gives the number of customers and the milk they purchased. Find the milk sold by direct method.

Milk Sold (Litre)	2-3	3-4	4-5	5-6	6-7
No of Customers	17	13	10	7	3

SOLUTION:

Class Milk Sold (Litres)	Cass Mark (x_i)	Frequency (No of customers) f_i	Frequency x Class Marks $f_i x_i$
2-3	2.5	17	42.5
3-4	3.5	13	45.5
4-5	4.5	10	45
5-6	5.5	7	38.5
6-7	6.5	3	19.5
Total		$\sum f_i = 50$	$\sum f_i x_i = 191$

$$\text{Mean} = \overline{X} = \frac{\sum f_i x_i}{\sum f_i}$$

$$= \frac{191}{50}$$

$$= 3.82$$

Ans. Mean of the milk sold is 3.82 litres

Q. 32

Find the median of the following data:

18, 24, 58, 47, 34, 30, 29, 31, 50. If 24 is replaced by 51 and 18 by 28, what will be the new median?

SOLUTION:

Arranging the data in ascending order we get

18, 24, 29, 30, 31, 34, 47, 50, 58

Number of Observations n = 9 (odd)

$\therefore$ **Median** = $\left(\frac{9+1}{2}^{th}\right)$ **observation**

= 5th observation

= 31

Hence, Median is 31

If 24 is replaced by 51 and 18 by 28, then the new observations in ascending order are as

28, 29, 30, 31, 34, 47, 50, 51, 58

∴ New Median = 5th observation = 34

Ans: 1) Median31

2)New Median = 34

Q. 33

Find the value of *a* if the mean of the following distribution is 20.

x	15	17	19	$20 + a$	23
f	2	3	4	$5a$	6

SOLUTION:

x_i	f_i	$f_i x_i$

15	2	30
17	3	51
19	4	76
$20 + a$	$5a$	$100a + 5a^2$
23	6	138
TOTAL	$\mathbf{15 + 5a}$	$\mathbf{5a^2 + 100a + 295}$

Mean $= \overline{X} = \frac{\sum fixi}{\sum fi}$

$\therefore\ 20 = \frac{5a^2 + 100a + 295}{15 + 5a}$

$\therefore\ 5a^2 + 100a + 295 = 300 + 100a$

$\therefore\ 5a^2 - 5 = 0$

$\therefore\ 5(a^2 - 1) = 0$

$\therefore\ (a + 1)(a - 1) = 0$

$\therefore\ a = 1$ or $a = -1$

Ans : $a = 1$ or $a = -1$

Q. 34

Find the median of the data using an empirical formula, when it is given that mode is 70.6 and mean is 61

SOLUTION:

Mode = 3(Median) – 2(Mean)

70.6 = 3(Median) – 2(61)

70.6 = 3(Median) – 122

192.6 = 3 Median

$$\textbf{Median} = \frac{192.6}{3} = 64.2$$

Ans : Median = 64.2

Q. 35

Show that the mode of the series obtained by combining the two series S_1 and S_2 given below is different from that of S_1 and S_2 taken separately:

S_1: 2, 4, 7, 7, 8, 11, 12, 8, 8

S_2: 6, 3, 6, 7, 6, 7, 12

SOLUTION:

In S_1: Number 8 occurs 3 times (maximum)

∴ Mode of S_1 Series = 8

In S_2: Number 6 occurs 3 times (maximum)

∴ Mode of S_2, Series = 6

After combination:

2, 4, 7, 7, 8, 11, 12, 8, 8, 6, 3, 6, 7, 6, 7, 12

In S_1 & S_2: No. 7 occurs 4 times (maximum)

∴ Mode of S_1 & S_2 taken combined = 7

So, mode of S_1 & S_2 combined is different from that of S_1 & S_2 taken separately.

Ans : As per above solution

Q. 36

The average score two subjects of boys in the examination of a school is 142 and that of the girls is 146. The average score of the two subjects of the school in the examination is 143.6. Find the ratio of number of boys to the number of girls who appeared in the examination.

SOLUTION:

Let the number of boys = n_1 and number of girls = n_2

Average boys' score = 142 = $\overline{X}_1$

Average girls' score = 146 = $\overline{X}_2$

$$\therefore \text{Combined Mean} = \frac{n_1\overline{X}1 + n_2\overline{X}2}{n_1 + n_2}$$

$$\therefore 143.6 = \frac{n_1(142) + n_2(146)}{n_1 + n_2}$$

$$\therefore 142\, n_1 + 146\, n_2 = 143.6\, n_1 + 143.6\, n_2$$

$$\therefore 142\, n_1 - 143.6\, n_1 = 143.6 n_2 - 146\, n_2$$

$$\therefore -1.6 n_1 = -2.4 n_2$$

$$\therefore \frac{n_1}{n_2} = \frac{2.4}{1.6}$$

$\therefore \frac{n_1}{n_2} = \frac{3}{2}$

$\therefore n_1 : n_2 = 3 : 2$

$\therefore$ No of boys: no of girls = 3 : 2

Ans : No of boys: no of girls = 3 : 2

Q. 37

If $\sum f_i d_i = 210$, $\sum f_i = 72$, A = 45, then find $\overline{X}$

SOLUTION:

$\overline{X} = A + \frac{\sum fidi}{\sum fi}$

$= 45 + \frac{210}{72}$

$= 45 + 2.92$

$= 47.92$

Ans: $\overline{X} = 47.92$

Q. 38

If $L = 2500$, $f = 21$, $c.f. = 53$, $h = 500$, $N = 120$, then find the median.

SOLUTION:

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

$$= 2500 + \left(\frac{\frac{120}{2} - 53}{21}\right) \times 500$$

$$= 2500 + \left(\frac{60 - 53}{21}\right) \times 500$$

$$= 2500 + \left(\frac{60 - 53}{21}\right) \times 500$$

$$= 2500 + \left(\frac{7}{21}\right) \times 500$$

$$= 2500 + 166.67$$

$$= 2666.67$$

Ans. Median = 2666.67

Q. 39

If $L = 402, f_1 = 52, f_0 = 24, f_2 = 40, h = 2$, then find the mode.

SOLUTION:

GIVEN

$$L = 402, f_1 = 52, f_0 = 24, f_2 = 40, h = 2$$

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

$$= 402 + \left[\frac{52 - 24}{2(52) - 24 - 40}\right] \times 2$$

$$= 402 + \left[\frac{28}{104 - 24 - 40}\right] \times 2$$

$$= 402 + \left[\frac{28}{40}\right] \times 2$$

$$= 402 + 0.7 \times 2$$

$$= 402 + 0.7 \times 2$$

$$= 403.4$$

Ans : Mode 403.4

Q. 40

Find the mean of the data using an empirical formula, when it is given that mode and median is 98.05 and 98.57 respectively.

SOLUTION:

Mode = 3(Median) – 2(Mean)

98.05 = 3(98.57) – 2(Mean)

98.05 = 295.71 – 2(Mean)

2(Mean) = 295.71 – 98.05

2(Mean) = 197.66

$$\text{Mean} = \frac{197.66}{2}$$

= 98.83

Ans : Mean= 98.83

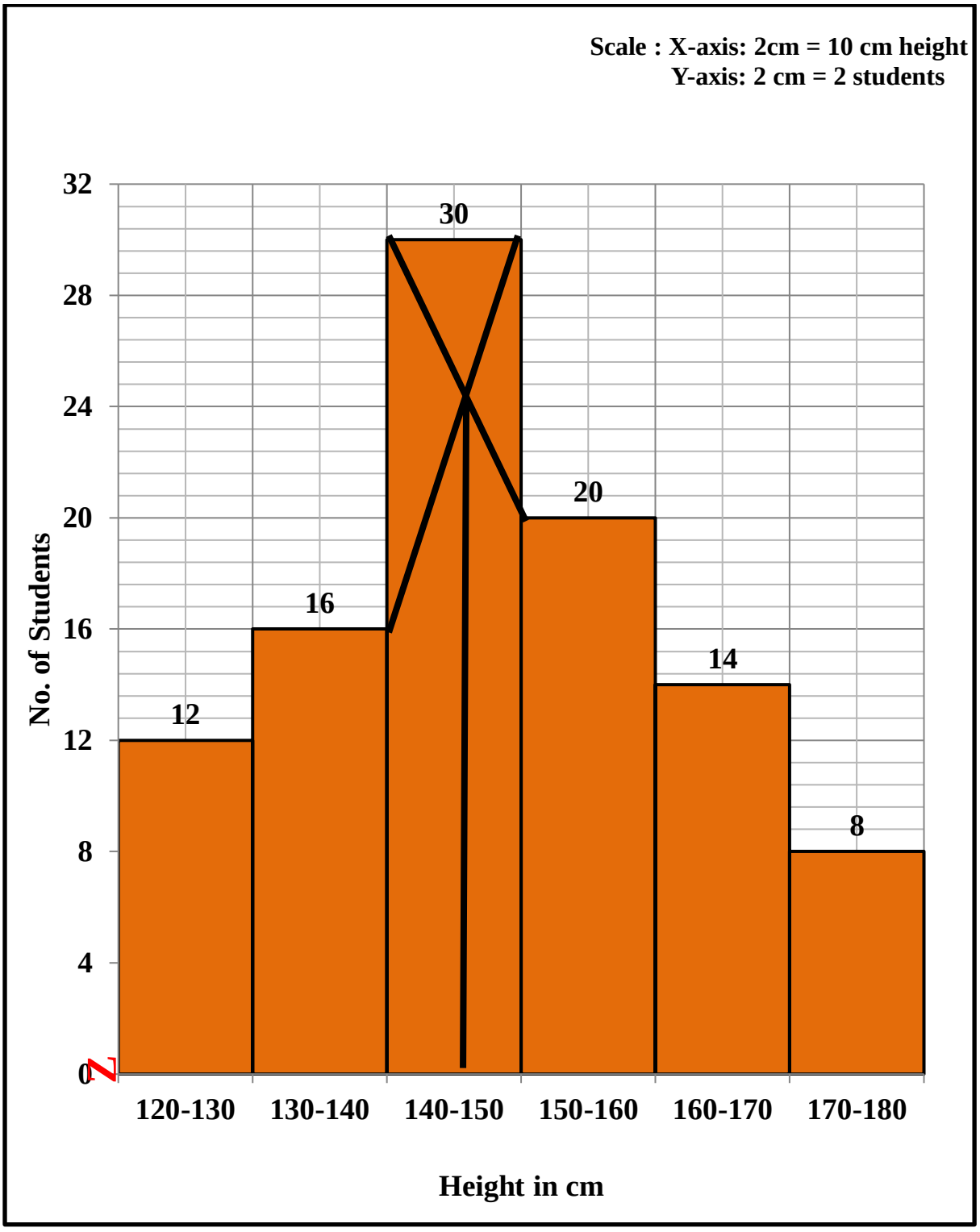
Q. 41

Data of number of students and their height is given .Draw a histogram and also find the modal

frequency for the data. Also find out class with lowest frequency

Height (cm)	120 – 130	130 – 140	140 – 150	150 – 160	160 – 170	170 – 180
Number of Students	12	16	30	20	14	08

SOLUTION:



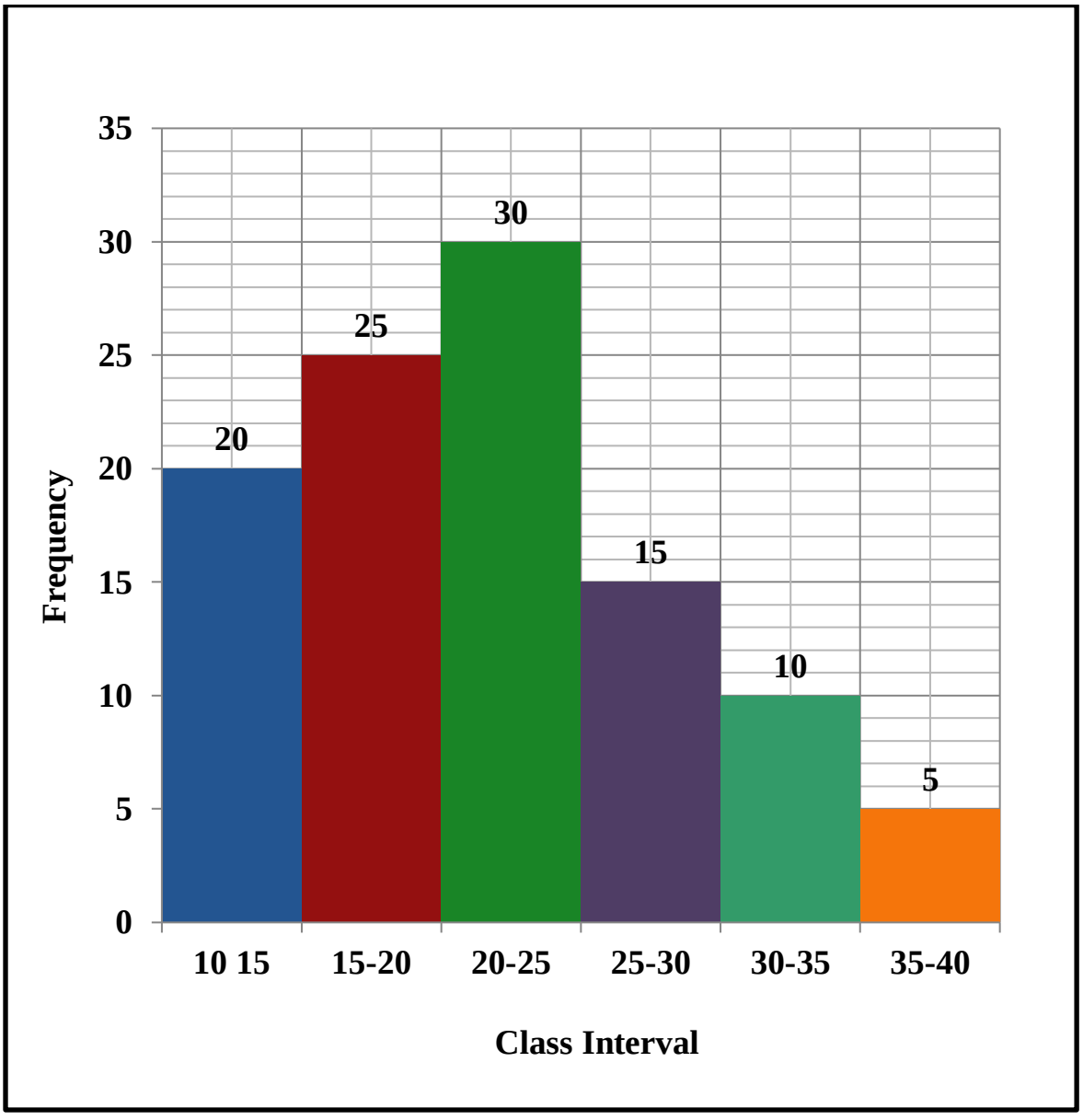
Ans. From the above histogram.

1)modal frequency of the data is 30

2) Class of lowest frequency is 170-180

Q. 42

The histogram for a frequency distribution is given below:



Answer the following:

(i) What is the frequency of the class interval 25 – 30?

(ii) What is the class interval having the lowest frequency?

(iii) What is the cumulative frequency of the class interval 25 – 30?

(iv) Construct a short frequency table of the distribution.

(v) Construct a cumulative frequency table of the distribution.

SOLUTION:

(i) Frequency of the class interval 25 – 30

is 15

(ii) Class interval having the lowest frequency 35 – 40

(iii) Cumulative frequency of the class interval 25 – 30 is

20 + 25 + 30 + 15 = 90

(iv) Frequency Distribution Table:

Class Interval	Frequency
10 – 15	20
15 – 20	25
20 – 25	30
25 – 30	15
30 – 35	10
35 – 40	5

(v) Cumulative Frequency Distribution Table:

Class Interval	Frequency	Cumulative Frequency
10 – 15	20	20
15 – 20	25	45
20 – 25	30	75

25 – 30	15	90
30 – 35	10	100
35 – 40	5	105

Q. 43

The following table gives the information of frequency distribution of weekly wages of 250 workers of a company. Find the mean of the weekly wages by 'step deviation' method.

Weekly Wages (₹)	**2000-3000**	**3000-4000**	**4000-5000**	**5000-6000**
Number of Workers	**25**	**45**	**50**	**30**

SOLUTION:

Here, we take A = 3500 and g = 1000

Class Weekly Wages (₹)	**Class Marks x_i**	**$d_i = x_i$ - A = $x_i - 3500$**	**$u_i = \frac{di}{g} = \frac{di}{1000}$**	**Frequency (No of workers) f_i**	**$f_i u_i$**
2000-3000	2500	-1000	-1	25	-25
3000-4000	3500 → A	0	0	45	0

4000-5000	4500	1000	1	50	50
5000-6000	5500	2000	2	30	60
TOTAL				$\sum f_i = 150$	$\sum f_i u_i = 85$

Here, $\sum f_i u_i = 85$, $\sum f_i = 150$

$$\bar{u} = \frac{\sum f_i u_i}{\sum f_i} = \frac{85}{150} = 0.57$$

Mean = $\bar{X}$ = A + $\bar{u}$g

= 3500 + (0.57) x 1000

= 3500 + 570

= 4070

Ans. Mean of the weekly wages is ₹ 4070.

Q. 44

If the mean of the numbers 14, *x*, 21, 39 and 52 is 31, what is the mean of 24, 31, 49, 62 and *x*?

SOLUTION:

x is common to both the series, so x is not going to make a difference to the average.

Only the remaining 4 numbers will contribute to the difference in average between the two series.

Sum of the 4 numbers, excluding x, of the first series is

$14 + 21 + 39 + 52 = 126$ … (i)

Sum of the 4 numbers, excluding x, of the second series is

$24 + 31 + 49 + 62 = 166$ … (ii)

Difference between the sum of two sets of numbers =

$166 – 126$ … [(ii) – (i)]

$= 40$

The sum of the second series is 40 more than the sum of the first series. If the sum of the second series is 35 more than that of first series, the average of the second series will be $= \frac{40}{5} = 8$ more than the first series.

Therefore the average of the second series

= 31 + 8

= 39

Ans. Mean of second series is 39.

Q. 45

If *x* is the average (arithmetic mean) of 2*m* and 18, *y* is the average of 4*m* and 30, and *z* is the average of 6*m* and 36, what is the average of *x*, *y* and *z* in terms of *m*?

SOLUTION:

We know that average of two numbers is the sum of those two numbers divided by 2.

That means

$$x = \frac{2m+18}{2}$$

$$y = \frac{4m+30}{2}$$

$$z = \frac{6m+36}{2}$$

Now we need to find the average of *x*, *y* and *z*.

The average of 3 numbers = $\frac{x+y+z}{3}$

Substituting the previous expressions for *m* gives us

$$\text{Average} = \frac{\left[\frac{2m+18}{2} + \frac{4m+30}{2} + \frac{6m+36}{2}\right]}{3}$$

$$= \frac{\left[\frac{2m+18+4m+30+6m+36}{2}\right]}{3}$$

$$= \frac{\left[\frac{12m+84}{2}\right]}{3}$$

$$= \frac{12m+84}{6}$$

$$= 2m + 14$$

Ans. Average of *x*, *y* and *z* in terms of *m* is 2*m* + 14

Q. 46

7 terms are arranged in descending order in a sequence. The mean value of the sequence is 70. If 30 is added to each term, and then each term is divided by 2 to get the new mean as 'K', find the difference between K and the original mean.

SOLUTION:

Let the 7 terms are a_1, a_2, a_3, a_4, a_5, a_6, a_7 are the 7terms.

70 is Mean of theses 7 numbers is. … (a)

$\therefore a_1 + a_2 + a_3 + a_4 + a_5 + a_6 + a_7 = 70 \times 7 = 490$

(i) Add 30 to each term, the new sum becomes

$(a_1 + 30) + (a_2 + 30) + (a_3 + 30) + (a_4 + 30) + (a_5 + 30) + (a_6 + 30) + (a_7 + 30) = (70 \times 7) + (30 \times 7)$

$\therefore (a_1 + 30) + (a_2 + 30) + (a_3 + 30) + (a_4 + 30) + (a_5 + 30) + (a_6 + 30) + (a_7 + 30) = 700$

The mean becomes 100.

(ii) Divide each term by 2, the new sum becomes

$$\frac{a_1+30}{2} + \frac{a_2+30}{2} + \frac{a_3+30}{2} + \frac{a_4+30}{2} + \frac{a_5+30}{2} + \frac{a_6+30}{2} + \frac{a_7+30}{2} = \frac{700}{2}$$

$$\therefore \frac{a_1+30}{2} + \frac{a_2+30}{2} + \frac{a_3+30}{2} + \frac{a_4+30}{2} + \frac{a_5+30}{2} + \frac{a_6+30}{2} + \frac{a_7+30}{2} = 350$$

New Mean $= \frac{350}{7} = 50$ … (b)

Difference between new mean and original mean

$= 70 - 50$ … [(a) – (b)]

$= 20$

Ans. Difference between new mean and original mean is 20

Q. 47

Find $\overline{X}$ by step deviation method if

$A = 705$, $\sum f_i u_i = -9$, $\sum f_i = 87$ and $h = 103$

SOLUTION:

By using step-deviation method,

$$\therefore \overline{X} = A + h \times \left(\frac{\sum f_i u_i}{\sum f_i}\right)$$

$$= 705 + 103 \times \left(\frac{-9}{87}\right)$$

$$= 705 + 103 \times (-0.103)$$

$$= 705 + (-10.609)$$

= 694.391

Ans. $\overline{X}$ = 694.391

Q. 48

The classification of percentages of marks of students and the number of students is given in following table. Draw a frequency polygon from the table.

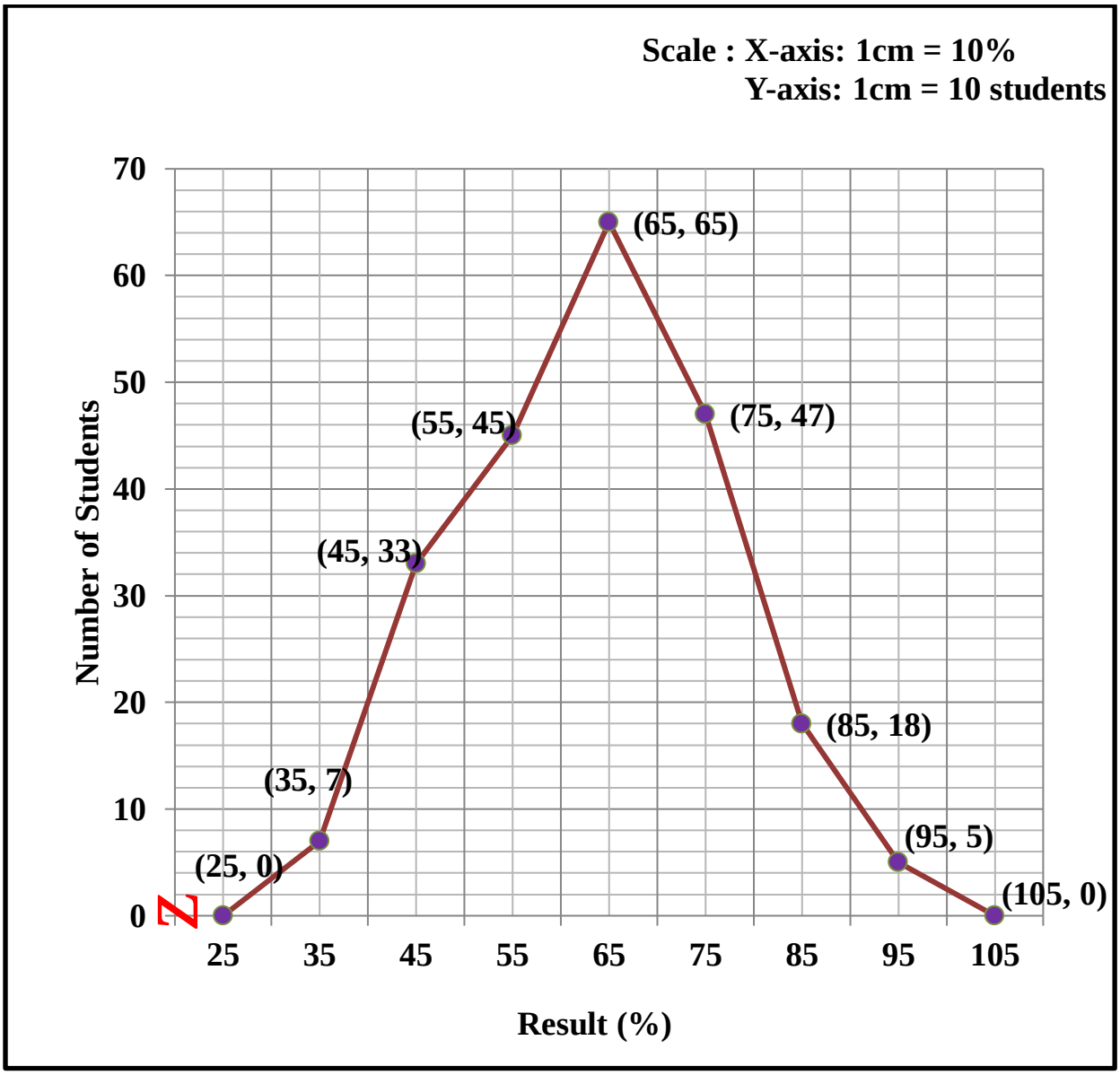
Result (%)	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Number of Students	7	33	45	65	47	18	5

SOLUTION:

First prepare a table showing coordinates necessary to draw a frequency polygon.

Class Result (%)	Cass Mark	Frequency (No of students)	Coordinates 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)



Q. 49

The time required for students to do a science experiment and the number of students is shown in the following grouped frequency distribution table.

Draw a histogram and also a frequency polygon Show the information.

Time required for experiment (%)	20-22	22-24	24-26	26-28	28-30	30-32
Number of Students	8	16	22	18	14	12

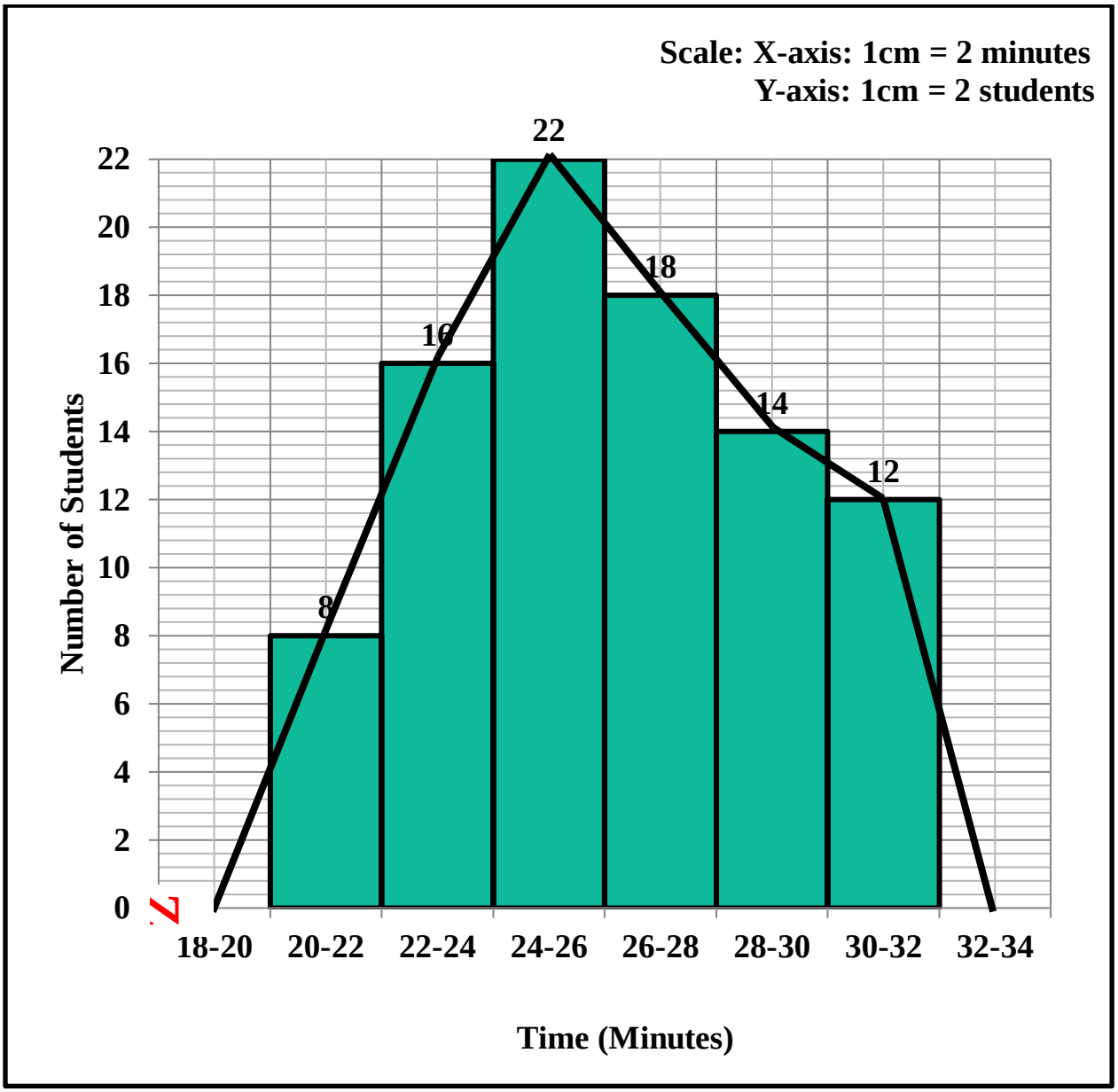
What are the class marks of Highest and Lowest frequencies

SOLUTION:

For drawing a frequency polygon, we take two additional classes.

18-20 with frequency 0 and 32-34 with frequency 0

Class (Time in Minutes)	Cass Mark	Frequency	Coordinates 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)



Ans:

Class mark of Highest frequency is 25

Class mark of Lowest frequency is 21

Q. 50

Find $\overline{X}$ by step deviation method if

A = 1100, $\sum f_i u_i$ = -15, $\sum f_i$ = 100 and h = 200

SOLUTION:

By using step-deviation method,

$$\therefore \overline{X} = A + h \times \left(\frac{\sum f_i u_i}{\sum f_i}\right)$$

$$= 1100 + 200 \times \left(\frac{-15}{100}\right)$$

$$= 1100 - 30$$

$$= 1070$$

Ans:

$\overline{X}$= 1070