Measures of Central Tendency

EXERCISE - 23.1

Q1. (a) Calculate the arithmetic mean of 5.7, 6.6, 7.2, 9.3, 6.2

(b) The weight (in kg) of 8 new born babies are 3, 3.2, 3.4, 3.5, 4, 3.6, 4.1, 3.2. find the mean weight of the babies.

Sol. (a) Sum of 5 observations $= 5.7+6.6+7.2+9.3+6.2 = 35.0$

$$\text{Mean} = \frac{35.0}{5} = 7$$

(b) Sum of 8 weight $= 3+3.2+3.4+3.5+4+3.6+4.1+3.2$

$$= 28$$

$$\text{Mean} = \frac{28}{8} = 3.5 \text{ kg}.$$

Q2. The marks obtained by 15 students in a class test are 12, 14, 07, 09, 23, 11, 08, 13, 11, 19, 16, 24, 17, 03, 20. find

(i) The mean of their marks.

(ii) The mean of their marks when the marks of each student increased by 4.

(iii) The mean of their marks when 2 marks are deducted from the marks of each student.

(iv) The mean of their marks when the marks of each student are doubled.

Sol. Sum of marks of 15 students $= 12+14+7+9+23+11+8+13+11+19+16+24+17+3+20$

$= 207$

(i) Mean $= \frac{207}{15} = 13.8$

(ii) By increasing 4 marks in each student then increase marks $= 15 \times 4 = 60$

New sum $= 207 + 60 = 267$

New mean $= \frac{267}{15} = 17.8$

(iii) By deducting 2 marks from each students, then total deduction $= 15 \times 2 = 30$

New Sum $= 207 - 30 = 177$

New mean $= \frac{177}{15} = 11.8$

(iv) The marks being doubled of each student then the new sum $= 207 \times 2 = 414$.

New mean $= \frac{414}{15} = 27.6$

Q3. (a) The mean of the numbers $6, y, 7, x, 14$ is 8. Express y interms of x.

(b) The mean of 9 variates is 11. If eight of them are 7, 12, 9, 14, 21, 3, 8 and 15, find the 9th variate.

Sol. (a) Sum of number $= 6+y+7+x+14 = 27+x+y$ —(i)

But mean of 5 numbers $= 8$

Sum $= 8 \times 5 = 40$ —(ii)

from (i) & (ii)

$27 + x + y = 40$

$\Rightarrow x + y = 13 \Rightarrow y = 13 - x$

(b) Mean of 9 variates = 11

Total Sum = $11 \times 9 = 99$

But Sum of 8 of these variates = $7+12+9+14+21+3+8+15 = 89$

$\therefore$ 9th variate = $99 - 89 = 10$

Q4. (a) The mean age of 33 students of a class is 13 years. If one girl leaves the class, the mean becomes $12\frac{15}{16}$ years. what is the age of the girl?

(b) In a class test, the mean of marks scored by a class of 40 students was calculated as 18.2 later on, it was detected that the marks of one student was wrongly copied as 21 instead of 29. Find the correct mean.

Sol. (a) Mean age of 33 Students = 13 years.

Total age = $13 \times 33 = 429$ years.

After leaving one girl, the mean of 32 Students

$= 12\frac{15}{16} = \frac{207}{16}$ years.

Total age of 32 Students = $\frac{207}{16} \times 32 = 414$ years.

Hence the age of girl = $429 - 414 = 15$.

(b) Mean of marks = $\frac{\text{Incorrect marks of 40 students}}{40}$

$\Rightarrow \quad 18.2 = \frac{x}{40} \Rightarrow x = 728.$

As marks of one Student was wrongly copied as 21 instead of 29. = $728 - 21 + 29 = 736$

$\therefore$ Correct mean = $\frac{736}{40} = 18.4$

Q5. Find the mean of 25 given numbers when the mean of 10 of them is 13 and the mean of the remaining numbers is 18.

Sol. Mean of 10 numbers = 13

$\therefore$ Sum = $13 \times 10 = 130$

and mean of remaining 15 numbers = 18

Sum = $18 \times 15 = 270$

Total Sum of 25 numbers = $130 + 270 = 400$

Mean of 25 numbers = $\frac{400}{25} = 16$

Q6. Find the mean of the following distribution:

Number	5	10	15	20	25	30	35
Frequency	1	2	5	6	3	2	1

Sol.

x	f	fx
5	1	5
10	2	20
15	5	75
20	6	120
25	3	75
30	2	60
35	1	35
Total	20	390

Mean = $\frac{\Sigma fx}{\Sigma f} = \frac{390}{20} = \frac{39}{2} = 19.5$

Q7. The contents of 100 matchboxes were checked to determine the no. of matches they contained.

No. of matches	35	36	37	38	39	40	41
No. of boxes	6	10	18	25	21	12	8

(i) Calculate, correct to one decimal place, the mean no. of matches per box.

(ii) Determine how many extra matches would have to be added to the total contents of the 100 boxes to bring the mean upto exactly 39 matches.

Sol.

No. of matches (x)	No. of boxes (f)	fx
35	6	210
36	10	360
37	18	666
38	25	950
39	21	819
40	12	480
41	8	328
Total	100	3813

(i) Mean $= \frac{\Sigma fx}{\Sigma f} = \frac{3813}{100} = 38.13 = 38.1$

(ii) New mean = 39, Total Sum $= 39 \times 100 = 3900$

$\therefore$ New matches to be added $= 3900 - 3813 = 87$.

Q8. Calculate the mean for the following distribution:

Pocket money (in Rs.)	60	70	80	90	100	110	120
No. of students	2	6	13	22	24	10	3

Sol.

Pocket money (in Rs.) (x)	No. of students (f)	fx
60	2	120
70	6	420
80	13	1040
90	22	1980
100	24	2400
110	10	1100
120	3	360
Total	80	7420

$$\text{Mean} = \frac{\Sigma fx}{\Sigma f} = \frac{7420}{80} = 92.75$$

Q9. Six coins were tossed 1000 times, and at each toss the no. of heads were counted the results were recorded as under:

No. of heads	6	5	4	3	2	1	0
No. of tosses	20	25	160	283	338	140	34

Calculate the mean for this distribution.

Sol.

No. of heads (x)	No. of tosses (f)	fx
6	20	120
5	25	125
4	160	640
3	283	849
2	338	676
1	140	140
0	34	0
Total	1000	2550

$$\text{Mean} = \frac{\Sigma fx}{\Sigma f} = \frac{2550}{1000} = 2.55$$

Q10 Find the mean for this distribution:

Numbers	60	61	62	63	64	65	66
Cumulative frequency	8	18	33	40	49	55	60

Sol.

Numbers (x)	Cumulative frequency c.f.	frequency f	f.x
60	8	8	480
61	18	10	610
62	33	15	930
63	40	7	441
64	49	9	576
65	55	6	390
66	60	5	330
Total		60	3757

$$\text{Mean} = \frac{\Sigma fx}{\Sigma f} = \frac{3757}{60} = 62.616 = 62.62$$

Q11.

Category	A	B	C	D	E	F	G
Wages in Rs per day	50	60	70	80	90	100	110
No. of workers	2	4	8	12	10	6	8

(i) Calculate the mean wage, correct to the nearest rupee.

(ii) If the no. of workers in each category is doubled, what would be the new mean wage?

Sol.

Category	Wages (in Rs.) X	No. of workers f	f.x
A	50	2	100
B	60	4	240
C	70	8	560
D	80	12	960
E	90	10	900
F	100	6	600
G	110	8	880
Total		50	4240

(i) Mean $= \frac{\Sigma fx}{\Sigma f} = \frac{4240}{50} = 84.80 = 85$

(ii) If the workers are doubled, then

Total no. of workers $= 50 \times 2 = 100$

Total wage also be doubled

$\therefore$ Total wages $= 4240 \times 2 = 8480$

$\therefore$ New mean $= \frac{8480}{100} = 84.80 = 85$

Q12. The marks obtained by a set of students in an examination are given below:

Marks	5	10	15	20	25	30
No. of students	6	4	6	12	x	4

Given that the mean marks of the set is 18, calculate the numerical value of x.

Sol.

Marks (x)	No. of students (f)	fx
5	6	30
10	4	40
15	6	90
20	12	240
25	x	25x
30	4	120
Total	32+x	520+25x

$$\text{Mean} = \frac{\Sigma fx}{\Sigma f} = \frac{520 + 25x}{32 + x}$$

But mean = 18 (given)

$$\therefore \quad \frac{520 + 25x}{32 + x} = \frac{18}{1}$$

$$\Rightarrow \quad 520 + 25x = 576 + 18x$$

$$\Rightarrow \quad 25x - 18x = 576 - 520$$

$$\Rightarrow \quad 7x = 56$$

$$\Rightarrow \quad x = \frac{56}{7}$$

$$\Rightarrow \quad x = 8.$$

Q13. If the mean of the following distribution is 7.5, find the missing frequency f :

Variate	5	6	7	8	9	10	11	12
Frequency	20	17	f	10	8	6	7	6

Sol.

Variate (x)	Frequency (f)	f. x
5	20	100
6	17	102
7	f	7f
8	10	80
9	8	72
10	6	60
11	7	77
12	6	72
Total	74+f	563 + 7f

$$\text{Mean} = \frac{\Sigma fx}{\Sigma f} = \frac{563+7f}{74+f}$$

$$\Rightarrow \frac{563+7f}{74+f} = \frac{75}{10} = \frac{15}{2}$$

$$\Rightarrow 2(563+7f) = 15(74+f)$$

$$\Rightarrow 1126 + 14f = 1110 + 15f$$

$$\Rightarrow f = 1126 - 1110$$

$$\Rightarrow f = 16.$$

Q14. Find the value of the missing variate for the following distribution whose mean is 10:

Variate (x_i)	5	7	9	11	-	15	20
Frequency (f_i)	4	4	4	7	3	2	1

Sol. let missing variate be x, then.

Variate (x)	Frequency (f)	fx
5	4	20
7	4	28
9	4	36
11	7	77
x	3	3x
15	2	30
20	1	20
Total	25	211+3x

$$\text{Mean} = \frac{\Sigma fx}{\Sigma f} = \frac{211 + 3x}{25}$$

But mean = 10 (given)

$$\therefore \frac{211+3x}{25} = 10 \Rightarrow 211 + 3x = 250$$

$$\Rightarrow 3x = 39 \Rightarrow x = 13$$

$\therefore$ Missing variate = 13.

Q15. In an Examination taken by 50 candidates, the marks obtained are given in the table below. Calculate the mean marks.

Marks	0-10	10-20	20-30	30-40	40-50
No. of candidates	8	14	13	10	5

Sol.

Marks	Class Mark x	No of candidates x	fx
0-10	5	8	40
10-20	15	14	210
20-30	25	13	325
30-40	35	10	350
40-50	45	5	225
Total		50	1150

$$\text{Mean} = \frac{\Sigma fx}{\Sigma f} = \frac{1150}{50} = 23.$$

Q16. Find the mean of the following distribution:

Class - intervals	0-10	10-20	20-30	30-40	40-50
Frequency	10	6	8	12	5

Sol.

Class	Frequency (f)	Class Mark x	f. x
0-10	10	5	50
10-20	6	15	90
20-30	8	25	200
30-40	12	35	420
40-50	5	45	225
Total	41		985

$$\text{Mean} = \frac{\Sigma fx}{\Sigma f} = \frac{985}{41} = 24.024.$$

Q17. The frequency distribution of marks obtained by 40 students of a class is as under. Calculate the arithmetic mean.

Marks	0-8	8-16	16-24	24-32	32-40	40-48
students	5	3	10	16	4	2

Sol.

Marks	No. of students f	Class Mark x	fx
0-8	5	4	20
8-16	3	12	36
16-24	10	20	200
24-32	16	28	448
32-40	4	36	144
40-48	2	44	88
Total	40		936

Arithmetic Mean $= \frac{\Sigma fx}{\Sigma f} = \frac{936}{40} = 23.4$

Q18. Find the mean of the following frequency distribution:

Class -intervals	0-50	50-100	100-150	150-200	200-250	250-300
Frequency	4	8	16	13	6	3

Sol.

Class -interval	Frequency	Class Mark	fx
0-50	4	25	100
50-100	8	75	600
100 - 150	16	125	2000
150-200	13	175	2275
200- 250	6	225	1350
250-300	3	275	825
Total	50		7150

Arithmetic mean $= \frac{\Sigma fx}{\Sigma f} = \frac{7150}{50} = 143$

Q19. Weights of 50 eggs were recorded as given below:

Weight (in gms)	80-84	85-89	90-94	95-99	100-104	105-109	110-114
No. of eggs	5	10	12	12	8	2	1

Calculate their mean weight to the nearest gram.

Sol. let assumed Mean(A) = 97.

Weight (in gms)	No. of eggs (f)	Class Mark (x)	$u_i = \frac{x-A}{h}$	fu_i
80-84	5	82	-5	-15
85-89	10	87	-2	-20
90 - 94	12	92	-1	-12
95-99	12	97	0	0
100- 104	8	102	1	8
105-109	2	107	2	4
110-114	1	112	3	3
Total	50			-52

$$\text{Mean} = A + h \times \frac{\Sigma f u_i}{\Sigma f} = 97 + 5 \times \frac{-32}{50} = 97 - 3.2$$

$$= 93.8 = 94 \text{ grams}.$$

Q20. The following table gives the daily wages of 50 workers of a factory:

Wages (in Rs)	25-30	30-35	35-40	40-45	45-50	50-55	55-60
No. of workers	2	1	5	9	21	10	2

Calculate the mean daily wage of a worker of the factory. If the daily wages of all the workers are increased by Rs. 8, what will be the new mean daily wage of a worker?

Wages (in Rs.)	No. of workers (f)	Class Mark (x)	$u = \frac{x - A}{h}$	fu
25-30	2	27.5	-3	-6
30-35	1	32.5	-2	-2
35-40	5	37.5	-1	-5
40-45	9	42.5	0	0
45-50	21	47.5	1	21
50-55	10	52.5	2	20
55-60	2	57.5	3	6
Total	50			34

let assumed mean (A) = 42.5 and h = 5

(i) Mean $= A + h \times \frac{\Sigma fu}{\Sigma f} = 42.5 + 5 \times \frac{34}{50}$

$= 42.5 + 3.4 = 45.9$

∴ Mean = Rs. 45.90

(ii) If Rs. 8 are increased to each worker, then the increased part $= 50 \times 8 = 400$

Total wages = Rs. 45.9×50 + Rs. 400 = Rs. 2695

∴ New mean $= \frac{2695}{50}$ = Rs. 53.90

Q21. The mean of the following distribution is 23.4. find the value of P:

Class-intervals	0-8	8-16	16-24	24-32	32-40	40-48
Frequency	5	3	10	p	4	2

Sol.

Class Interval	Class Mark x	Frequency (f)	f. x
0 - 8	4	5	20
8 - 16	12	3	36
16 - 24	20	10	200
24 - 32	28	P	28 p
32 - 40	36	4	144
40 - 48	44	2	88
		24 + p	488 + 28p

$$\text{Mean} = a + h \times \frac{\Sigma fx}{\Sigma f} = 23.4$$

$$\Rightarrow \frac{488 + 28p}{24 + p} = \frac{234}{10}$$

$$\Rightarrow (488 + 28p)\,10 = 234\,(24 + p)$$

$$\Rightarrow 4880 + 280p = 5616 + 234p$$

$$\Rightarrow 46p = 736$$

$$\Rightarrow p = 16.$$

Q22. The following distribution shows the daily pocket allowance of a children of a locality. The mean pocket allowance is Rs. 18. find the value of f :

Daily pocket allowance (in Rs)	11-13	13-15	15-17	17-19	19-21	21-23	23-25
No. of children	3	6	9	13	f	5	4

sol.

Class Interval	Class Mark x	Frequency (f)	f. x
11 - 13	12	3	36
13 - 15	14	6	84
15 - 17	16	9	144
17 - 19	18	13	234
19 - 21	20	f	20f
21 - 23	22	5	110
23 - 24	24	4	96
		40 + f	704 + 20f

$$\text{Mean} = \frac{\Sigma fx}{\Sigma f} = \frac{704 + 20f}{40 + f} = 18$$

$\Rightarrow 704 + 20f = 18(40 + f)$

$\Rightarrow 704 + 20f = 720 + 18f$

$\Rightarrow 2f = 16$

$\Rightarrow f = 8$

Q23. The mean of the following distribution is 50 and the sum of all the frequencies is 120. Find the values of p and q:

Class intervals	0-20	20-40	40-60	60-80	80-100
Frequency	17	p	32	q	19

Sol.

Class Interval	Class Mark x	Frequency (f)	f. x
0 - 20	10	17	170
20 - 40	30	p	30 p
40 - 60	50	32	1600
60 - 80	70	q	70q
80 - 100	90	19	1710
		68 + p + q	3480 + 30 p + 70q

Sum of all frequencies is 120

$\Rightarrow 68 + P + 9 = 120 \Rightarrow P + 9 = 52$ ——(i)

$$\text{Mean} = \frac{\Sigma fx}{\Sigma f} = \frac{3480 + 30P + 709}{68 + P + 9} = 50$$

$\Rightarrow 3480 + 30P + 709 = 50(68 + P + 9)$

$\Rightarrow 3480 + 30P + 709 = 3400 + 50P + 509$

$\Rightarrow 3480 - 3400 = 50P - 30P + 509 - 709$

$\Rightarrow 20P - 209 = 80$

$\Rightarrow P - 9 = 4$ —— (ii)

Adding (i) & (ii), $2P = 56 \Rightarrow P = 28$

put $P = 28$ in equation (ii), $28 - 9 = 4 \Rightarrow 9 = 24$

Q24. The mean of the following distribution is 57.6 and the sum of all the frequencies is 50. find the value of p and q:

Classes	0-20	20-40	40-60	60-80	80-100	100-120
Frequency	7	p	12	q	8	5

Class Interval	Class Mark x	Frequency (f)	f. x
0 – 20	10	7	70
20 – 40	30	p	30 p
40 – 60	50	12	600
60 – 80	70	q	70q
80 – 100	90	8	720
100 – 120	110	5	550
		32 + p + q	1940 + 30 p + 70q

Sum of all frequencies is 50

$\Rightarrow 32 + p + q = 50 \Rightarrow p + q = 18$

Now proceed as above question.

Q25. The following table gives the life time in days of 100 electricity tubes of a certain make

Life time in days	No. of tubes
Less than 50	8
Less than 100	23
Less than 150	55
Less than 200	81
less than 250	93
Less than 300	100

Find the mean life time of electricity tubes.

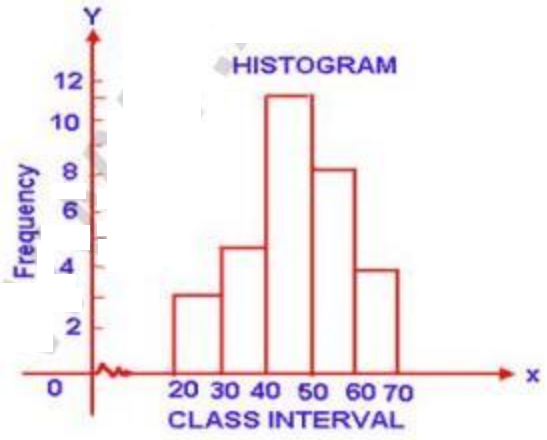
Life time (in days) (Class intervals)	e.f.	Frequency (f)	Class Mark (x)	$u=\frac{x-a}{h}$	fu
0-50	8	8	25	-3	-24
50-100	23	15	75	-2	-30
100-50	55	32	125	-1	-32
150-200	81	26	175	0	0
200-250	93	12	225	1	12
250-300	100	7	275	2	14
Total		100			-60

let assumed mean (A) = 175 and h = 50

$$\text{Mean} = A + h \times \frac{\Sigma fu}{\Sigma f} = 175 + 50 \times \frac{-60}{100}$$

$$= 175 - 30 = 145 \text{ days.}$$

Q26. Using the information given in the adjoining histogram, calculate the mean correct to one decimal place.



5d. From the histogram given we represent the information in the following table:

Class -interval	Frequency (f)	Class Mark (x)	(fx)
20-30	3	25	75
30-40	5	35	175
40 - 50	12	45	540
50-60	9	55	495
60- 70	4	65	260
Total	33		1545

$$\text{Mean} = \frac{\Sigma fx}{\Sigma f} = \frac{1545}{33} = 46.81 = 46.8$$

EXERCISE - 23.2

Q1. A student scored the following marks in 11 questions of a question paper: 3, 4, 7, 2, 5, 6, 1, 8, 2, 5, 7
Find the median marks.

Sol. Arranging in the ascending order 1, 2, 2, 3, 4, 5, 5, 6, 7, 7, 8

Here $n = 11$ i.e., odd

The middle term $= \frac{n+1}{2} = \frac{11+1}{2} = \frac{12}{2} = 6^{th}$ term.

Median $= 5$.

Q2. (a) Find the median of the following set of numbers:
9, 0, 2, 8, 5, 3, 5, 4, 1, 5, 2, 7.
(b) For the following set of numbers, find the median:
10, 75, 3, 81, 17, 27, 4, 48, 12, 47, 9 and 15.

Sol. (a) Arranging in ascending order: 0, 1, 2, 2, 3, 4, 5, 5, 7, 8, 9

Here $n = 12$ which is even

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

$$= \frac{1}{2}\left[\frac{12}{2}^{th} + \left(\frac{12}{2}+1\right)^{th}\right]$$

$$= \frac{1}{2}\left[6^{th} + 7^{th}\right]$$

$$= \frac{1}{2}\left[4+5\right]$$

$$= 4.5$$

(b) Arranging the given numbers in ascending order
3, 4, 9, 10, 12, 15, 17, 27, 47, 48, 75, 81

Here $n = 12$ which is even

$$\text{Median} = \text{Mean of } \frac{1}{2}\left[\frac{n^{th}}{2} \text{ term} + \left(\frac{n}{2}+1\right)^{th} \text{ term}\right]$$

= Mean of 6^{th} and 7^{th} term

$= \frac{15+17}{2}$

$= 16.$

Q3. If 3, 8, 10, x, 14, 16, 18, 20 are in ascending order and their median is 13, calculate the numerical value of x

Sol. 3, 8, 10, x, 14, 16, 18, 20 are in ascending order and their median = 13

Here $n = 8$ which is even

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

$= \frac{1}{2}\left[\frac{8}{2}^{th} + \left(\frac{8}{2}+1\right)^{th} \text{terms}\right]$

$= \frac{1}{2}\left[4^{th} \text{term} + 5^{th} \text{term}\right]$

$= \frac{1}{2}(x+14)$

$\therefore \quad \frac{x+14}{2} = 13 \Rightarrow x+14 = 26 \rightarrow x = 12$

Q4. Calculate the mean and the median of the numbers: 2, 1, 0, 3, 1, 2, 3, 4, 3, 5.

Sol. Writing in ascending order is 0, 1, 1, 2, 2, 3, 3, 3, 4, 5

Here $n = 10$ which is even

$\text{Mean} = \frac{1}{n}(\Sigma x_i) = \frac{1}{10}(0+1+1+2+2+3+3+3+4+5)$

$= \frac{1}{10}(24) = 2.4$

$\text{Median} = \frac{1}{2}\left[\frac{10}{2}^{th} \text{term} + \left(\frac{10}{2}+1\right)^{th} \text{term}\right]$

$= \frac{1}{2}(5^{th} + 6^{th} \text{ terms})$

$= \frac{1}{2}(2+3) = 2.5$

Q5. Calculate the mean and the median of the numbers:
1, 9, 10, 8, 2, 4, 4, 3, 9, 1, 5, 6, 2, 4

Sol. Writing in ascending order

1, 1, 2, 2, 3, 4, 4, 4, 5, 6, 8, 9, 9, 10

Here $n = 14$ which is even

(i) Mean $= \frac{\Sigma x_i}{n} = \frac{1}{14}(1+1+2+2+3+4+4+4+5+6+8+9+9+10)$

$= \frac{1}{14}(68) = \frac{34}{7} = 4.86$

(ii) Median $= \frac{1}{2}\left[\left(\frac{n}{2}\right)^{th} \text{term} + \left(\frac{n}{2}+1\right)^{th} \text{term}\right]$

$= \frac{1}{2}\left[\left(\frac{14}{2}\right)^{th} \text{term} + \left(\frac{14}{2}+1\right)^{th} \text{term}\right]$

$= \frac{1}{2}\left[7^{th} \text{term} + 8^{th} \text{term}\right]$

$= \frac{1}{2}(4+4) = 4$

Q6. The mean of the numbers 1, 7, 5, 3, 4, 4 is m. The numbers 3, 2, 4, 2, 3, 3, P have mean m−1 and median q. Find (i) P (ii) q (iii) The mean of P and q.

Sol. (i) Mean of 1, 7, 5, 3, 4, 4 is m. Here $n = 6$

$m = \frac{1+7+5+3+4+4}{6} = \frac{24}{6} = 4$

Mean of 3, 2, 4, 2, 3, 3, P is m−1

$m-1 = \frac{3+2+4+2+3+3+P}{7} \Rightarrow 4-1 = \frac{17+P}{7}$

$\Rightarrow \frac{17+P}{7} = 3 \Rightarrow P = 4$

(ii) Now median of 3, 2, 4, 2, 3, 3, 4

Writing them in ascending order 2, 2, 3, 3, 3, 4, 4

Here $n = 7$ which is odd

Median $= \frac{n+1}{2}$ th term $= \frac{7+1}{2} = 4^{th}$ term $= 3$

$\therefore q = 3$

(iii) Mean of p and $q = \frac{1}{2}(4+3) = 3.5$

Q7. Find the median for the following distribution:

Wages per day (in rupees)	38	45	48	55	62	65
No. of workers	14	8	7	10	6	2

Sol. Writing the distribution in cumulative frequency table:

Wages per day (in Rs.)	No. of workers (f)	c.f.
38	14	14
45	8	22
48	7	29
55	10	39
62	6	45
65	2	47

Here $n = 47$ which is odd

Median $= \frac{n+1}{2}$ th term $= \frac{47+1}{2} = 24^{th}$ term $= 48$

(∵ Here all the observations from 23 to 29 are equal to 48)

$\therefore$ Median = Rs. 48

Q8. Find the median for the following distribution :

Marks	35	45	50	64	70	72
No. of students	3	5	8	10	5	5

Sol. writing the distribution in cumulative frequency table :

Marks	No. of students (f)	c.f.
35	3	3
45	5	8
50	8	16
64	10	26
70	5	31
72	5	36

Here $n = 36$ which is even

$$\text{Median} = \frac{1}{2}\left[\left(\frac{36}{2}\right)^{th} \text{ term} + \left(\frac{36}{2}+1\right)^{th} \text{ term}\right]$$

$$= \frac{1}{2}\left[18^{th} \text{ term} + 19^{th} \text{ term}\right]$$

$$= \frac{1}{2}(64+64)$$

Median $= 64$.

Q9. Marks obtained by 70 students are given below:

Marks	20	70	50	60	75	90	40
No. of students	8	12	18	6	9	5	12

Calculate the median marks.
(Hint: Arrange the variates in ascending order)

Sol. Arranging the variate in ascending order and in c.f. table.

Marks	No. of students (f)	c.f.
20	8	8
40	12	20
50	18	38
60	6	44
70	12	56
75	9	65
90	5	70

Here $n = 70$ which is even

$$\text{Median} = \frac{1}{2}\left[\frac{70}{2}\text{th term} + \left(\frac{70}{2}+1\right)^{\text{th}}\text{ term}\right]$$

$$= \frac{1}{2}\left[35^{\text{th}}\text{ term} + 36^{\text{th}}\text{ term}\right]$$

$$= \frac{1}{2}\left[50 + 50\right]$$

$$= 50$$

(Here all the observations from 21 to 38 all are equal to 50)

Q10. Calculate the mean and median for the following distribution:

Number	5	10	15	20	25	30	35
Frequency	1	2	5	6	3	2	1

Sol. writing the distribution in C.F table

Number (x)	Frequency (f)	c.f.	fx
5	1	1	5
10	2	3	20
15	5	8	75
20	6	14	120
25	3	17	75
30	2	19	60
35	1	20	35
Total	20		390

(i) Mean $= \frac{\Sigma fx}{\Sigma f} = \frac{390}{20} = 19.5$

(ii) Here $n=0$ which is even

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

$= \frac{1}{2}\left[\frac{20}{2}^{th} \text{ term} + \left(\frac{20}{2}+1\right)^{th} \text{ term}\right]$

$= \frac{1}{2}\left[10^{th} \text{term} + 11^{th} \text{ term}\right]$

$= \frac{1}{2}(20+20) = 20$

Q11. The daily wages (in rupees) of 19 workers are:
41, 21, 38, 27, 31, 45, 23, 26, 29, 30, 28, 25, 35, 42, 47, 53, 29, 31, 35.
Find (i) the median (ii) lower quartile (iii) upper quartile (iv) inter quartile range.

Sol. (i) Median = $\frac{n+1}{2}$ th term = $\frac{19+1}{2}$ = 10th term = 31

(ii) lower quartile (Q_1) = $\frac{n+1}{4}$ = $\frac{19+1}{4}$ = 5th term = 27

(iii) upper quartile (Q_3) = $3\left(\frac{n+1}{4}\right)$ = $3\left(\frac{19+1}{4}\right)$ = 15th term = 41

(iv) inter quartile range = $Q_3 - Q_1$ = 41 − 27 = 14

Q12. From the following frequency distribution, find:
(i) The median (ii) lower quartile (iii) upper quartile
(iv) inter quartile range.

Variate	15	18	20	22	25	27	30
Frequency	4	6	8	9	7	8	6

Sol. wring frequency in distribution in C.F. table:

Variates	Frequency (f)	c.f.
15	4	4
18	6	10
20	8	18
22	9	27
25	7	34
27	8	42
30	6	48

Here $n = 48$ which is even

(i) Median $= \frac{1}{2}\left[\frac{48}{2}\text{th term} + \left(\frac{48}{2}+1\right)\text{th term}\right]$

$= \frac{1}{2}\left[24^{\text{th}}\text{ term} + 25^{\text{th}}\text{ term}\right] = \frac{1}{2}[22+22]$

$= 22$

observations for 19 to 27 are all equal to 22.

(ii) lower quartile $(Q_1) = \frac{n}{4}\text{th term} = \frac{48}{4} = 12^{\text{th}}\text{ term} = 20$

(iii) upper quartile $(Q_3) = \frac{3n}{4}\text{th term} = \frac{3\times 48}{4} = 36^{\text{th}}\text{ term} = 27$

(iv) Inter quartile range $= Q_3 - Q_1 = 27 - 20 = 7$

Q13. For the following frequency distribution, find (i) the median (ii) lower quartile (iii) upper quartile.

Variate	25	31	34	40	45	48	50	60
Frequency	3	8	10	15	10	9	6	2

Sol. writing the distribution in cf table:

Variates	Frequency (f)	c.f.
25	3	3
31	8	11
34	10	21
40	15	36
45	10	46
48	9	55
50	6	61
60	2	63

Here $n = 63$ which is odd

(i) median $= \frac{63+1}{2}$ th term $= 32^{th}$ term $= 40$

(ii) lower quartile $(Q_1) = \frac{n+1}{4} = \frac{63+1}{4} = 16^{th}$ term $= 34$

(iii) upper quartile $(Q_3) = \frac{3(n+1)}{4} = \frac{3(63+1)}{4} = 48^{th}$ term $= 48$

Q14. Use graph paper for this question.

The table given below shows the monthly wages of some factory workers.

(i) Using the table, calculate the cumulative frequencies of workers.

(ii) Draw the cumulative frequency curve.

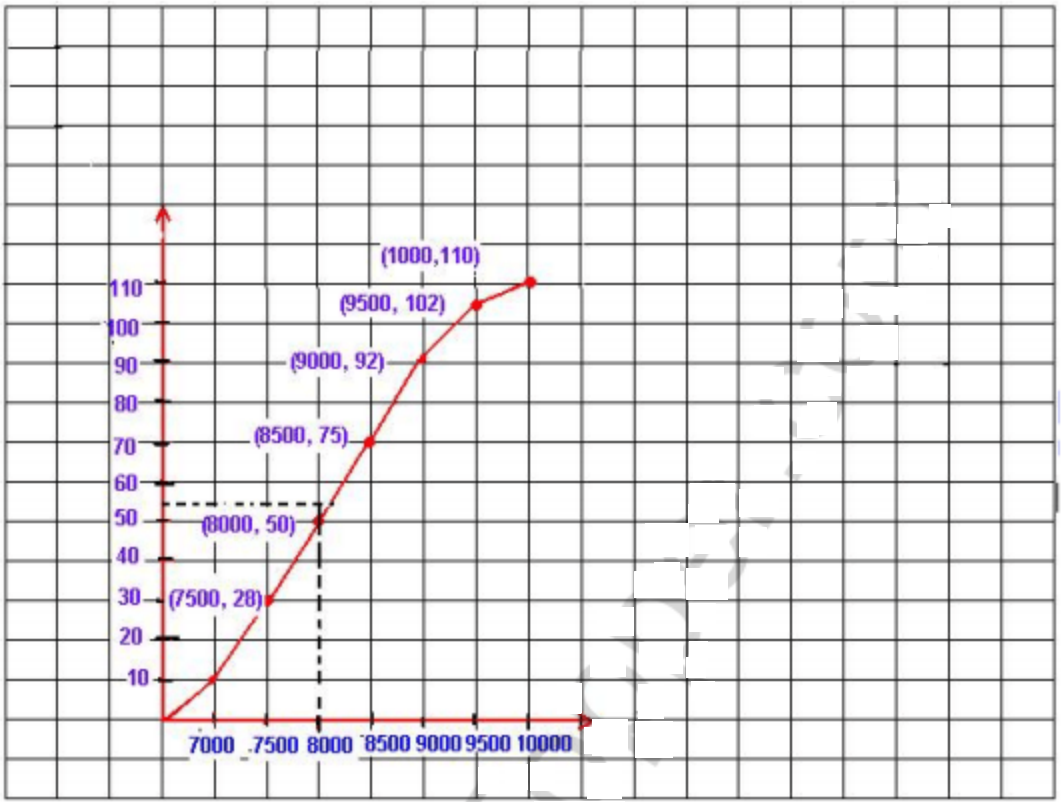
Use 2 cm = Rs. 500, starting the origin at Rs. 6500 on x-axis, and 2 cm = 10 workers on y-axis

(iii) Use your graph to write down the median wage in Rs.

Wages in Rs.	6500-7000	7000-7500	7500-8000	8000-8500	8500-9000	9000-9500	9500-10000
frequency	10	18	22	25	17	10	8

Sol. writing the distribution in cumulative frequency table.

Wages (in Rs).	Frequency	(c.f.)
6500–7000	10	10
7000–7500	18	28
7500–8000	22	50
8000–8500	25	75
8500–9000	17	92
9000–9500	10	102
9500–10000	8	110



Now taking points (7000, 10), (7500, 28), (8000, 50), (8500, 75), (9000, 92), (9500, 102), (10,000, 110) on the graph and join them in free hand to form an ogive (CF Curve) as shown.

$\therefore n = 110$ which is even

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

$$= \frac{1}{2}\left[55^{th}\text{ term} + 56^{th}\text{ term}\right]$$

$$= 55.5^{th}\text{ observations.}$$

Take a point A(55.5) on y-axis and through draw a line parallel to x-axis which meets the curve at P, draw a 1^{lar} on x-axis which meets x-axis at Q. which represents Rs. 8100

$\therefore$ Hence median = 8100.

Q15. the following table shows the distribution of the heights of a group of factory workers:

Height (cm)	150-155	155-160	160-165	165-170	170-175	175-180	180-185
No. of workers	6	12	18	20	13	8	6

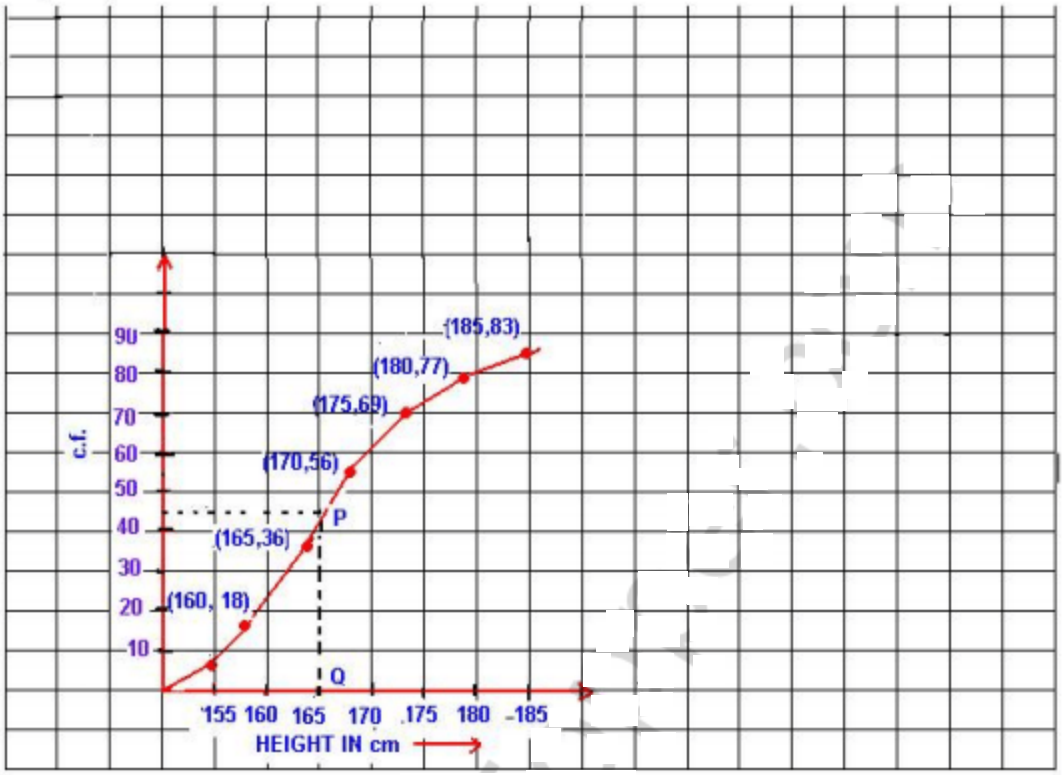
(i) Determine the cumulative frequencies

(ii) Draw the C.F curve on a graph paper.
Use 2cm = 5cm height on one axis and 2cm = 10 workers on the other.

(iii) From your graph, write down the median height in cm.

Sol. Representing the distribution in CF distribution:

Height (cm)	No. of workers (f)	c.f.
150-155	6	6
155-160	12	18
160-165	18	36
165-170	20	56
170-175	13	69
175-180	8	77
180-185	6	83



Here $n = 83$ which is even

Now taking points (155, 6), (160, 18), (165, 36), (170, 56), (175, 69), (180, 77), (185, 83) on the graph.

Now join them with free hand to form the ogive or CF curve as shown.

Here $n = 83$ which is odd

Median = $\frac{n+1}{2}$ th observation = $\frac{83+1}{2}$ = 42nd observation.

Take a point A(42) on y-axis and from A, draw a horizontal line parallel to x-axis meeting the curve at P. from P draw a line $\perp^{lar}$ to x-axis which meets it at Q.

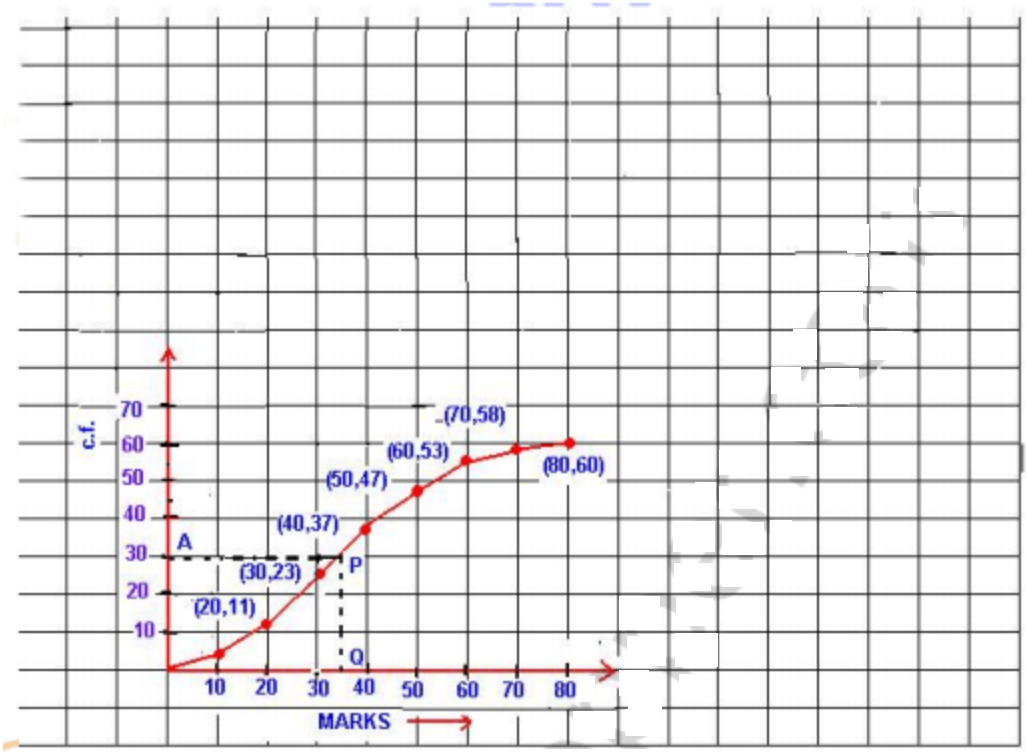
∴ Q is the median which is 166.5cm..

Q16. Using the data given below construct the cumulative frequency table and draw the ogive. From the ogive, determine the median.

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
No. of students	3	8	12	14	10	6	5	2

Sol. Representing the distribution in cumulative frequency distribution.

Marks	No. of students (f)	c.f.
0–10	3	3
10–20	8	11
20–30	12	23
30–40	14	37
40–50	10	47
50–60	6	53
60–70	5	58
70–80	2	60



Taking points (10,3), (20,11), (30,23), (40,37), (50,47), (60,53), (70,58), (80,60) on the graph. Now join them in free hand to form an ogive as shown.

Here $n = 60$ which is even

$$\text{Median} = \frac{1}{2}\left[\left(\frac{60}{2}\right)^{th} \text{term} + \left(\frac{60}{2}+1\right)^{th} \text{term}\right]$$

$$= \frac{1}{2}\left[30^{th} \text{term} + 31^{th} \text{term}\right]$$

$$= 30.5^{th} \text{ observation.}$$

Now take a point A(30.5) on y-axis and from A, draw a line parallel to x-axis meeting the curve at P and from P, draw a $\perp^{lar}$ to x-axis meeting is at Q.

$\therefore$ Q is the median which is 35.

Q17. Use graph paper for this question.

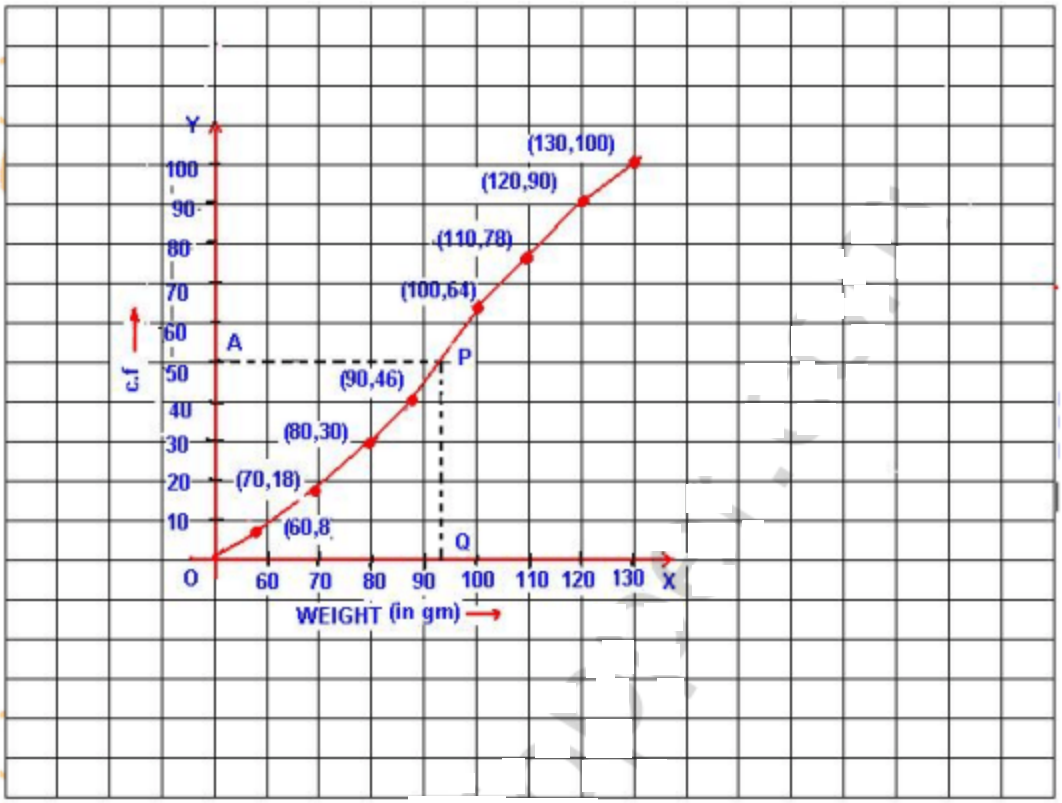
The following table shows the weights in gm of a sample of 100 potatoes taken from a large consignment:

Weight (gm)	50-60	60-70	70-80	80-90	90-100	100-110	110-120	120-130
Frequency	8	10	12	16	18	14	12	10

(i) Calculate the cumulative frequencies.

(ii) Draw a CF curve and from it determine the median weight of potatoes.

Weight (gm)	Frequency	c.f.
50-60	8	8
60-70	10	18
70-80	12	30
80-90	16	46
90-100	18	64
100-120	14	78
110-120	12	90
120-130	10	100



Now plot the points (60,8), (70,18), (80,30), (90,46), (100,64), (110,78), (120,90), (130,100) on the graph and join them in freehand to form an ogive as shown.

Here $n = 100$ which is even

$$\text{Median} = \frac{1}{2}\left[\frac{100}{2}^{th}\text{term} + \left(\frac{100}{2}+1\right)^{th}\text{term}\right]$$

$$= \frac{1}{2}(50+51) = 50.5$$

Now take a point A(50.5) on the y-axis and from A draw a line parallel to x-axis meeting the curve at P. from P, draw a $\perp^{lar}$ on x-axis meeting it at Q.

Q is the median which is 93 gm.

Q18. Attempt this question on graph paper.

Age (yrs)	5-15	15-25	25-35	35-45	45-55	55-65	65-75
No. of casualties due to accidents	6	10	15	13	24	8	7

(i) Construct the 'lessthan' CF curve for the above data, using 2cm = 10 years, on one axis and 2cm = 10 Casualties on the other.

(ii) From your graph determine

(a) The median (b) The upper quartile.

Age	No. of Casualties	Cumulative Frequency
Less than 15	6	6
Less than 25	10	16
Less than 35	15	31
Less than 45	13	44
Less than 55	24	68
Less than 65	8	76
Less than 75	7	83

Now plot the points (15,6), (25,16), (35,31), (45,44), (55,68), (65,76) and (75,83) on the graph and join these points in free hand to form a cf curve (ogive) as shown.

Here $n = 83$, which is odd.

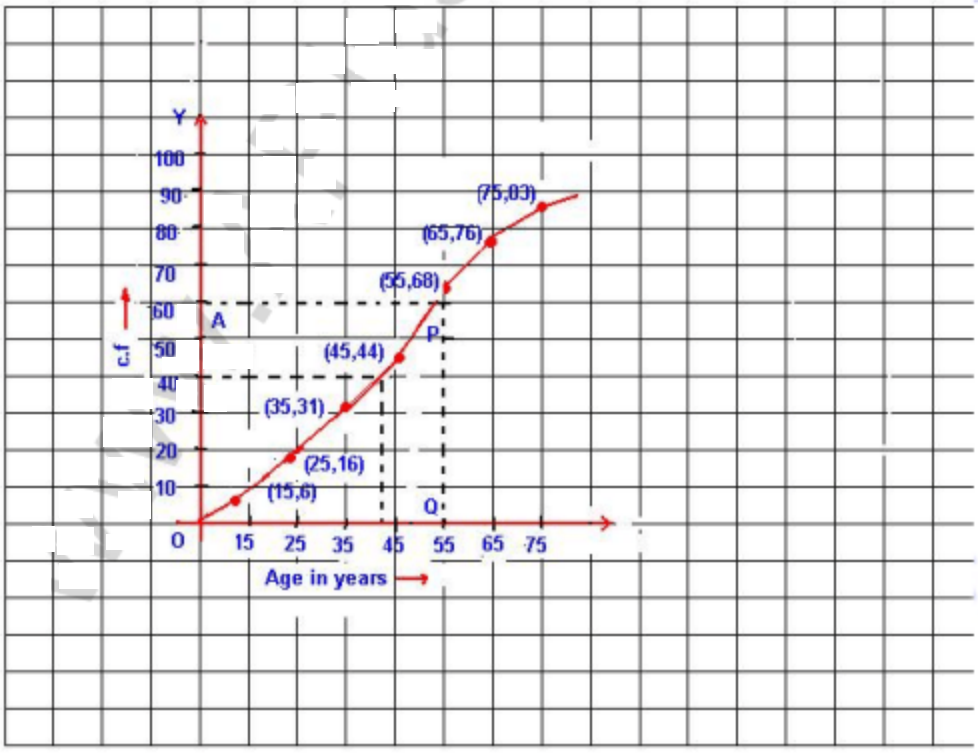
(i) Median $= \frac{n+1}{2} = \frac{83+1}{2} = \frac{84}{2} = 42$.

Now we take point A(42) on y-axis and from A, draw a line parallel to x-axis meeting the curve at P and from P, draw a $\perp^{lar}$ to x-axis meeting it at Q.

Q is the median which is 43.

(ii) Upper quartile $= \frac{3(n+1)}{4} = \frac{3(83+1)}{4} = \frac{252}{4} = 63$

Take a point B(63) on y-axis and from B, draw a $\parallel^{el}$ line to x-axis meeting the curve at L. from L, draw a $\perp^{lar}$ to x-axis meeting it at M which is 52. upper quartile = 52 years.



Q19. The daily wages of 160 workers in a building project are given below:

Weight (kg)	40-45	45-50	50-55	55-60	60-65	65-70	70-75	75-80
Frequency	5	17	22	45	51	31	20	9

Using a graph paper, draw an ogive for the above distribution. Use your ogive to estimate:

(i) The median wage of the workers.

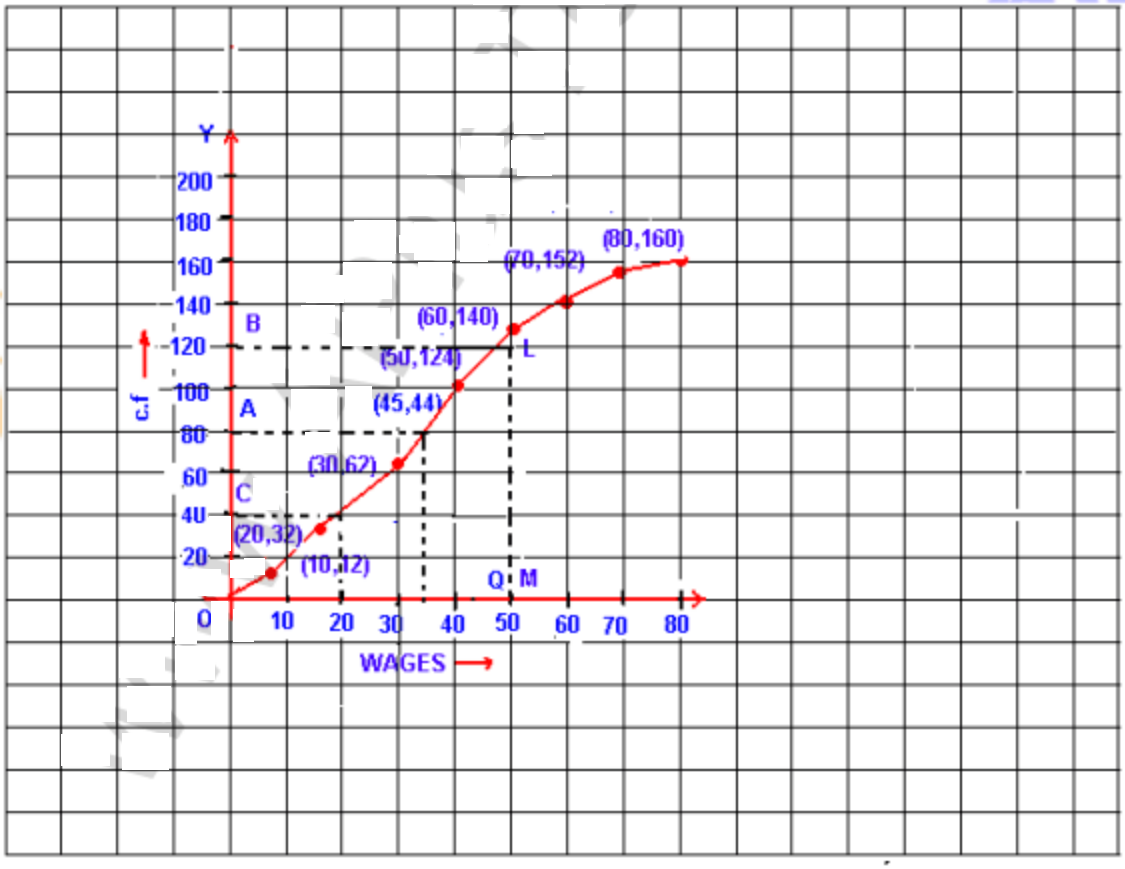
(ii) The upper quartile wage of the workers.

(iii) The lower quartile wage of the workers.

(iv) the percentage of workers who earn more than Rs. 45 a day.

Wages in Rs. per day	Number of workers	Cumulative Frequency
0–10	12	12
10–20	20	32
20–30	30	62
30–40	38	100
40–50	24	124
50–60	16	140
60–70	12	152
70–80	8	160

Sol.



Now plot the points (10, 12), (20, 32), (30, 62), (40, 100), (50, 124), (60, 140), (70, 152), (80, 160) on the graph and join them in free hand to form an ogive as shown.

Here $n = 160$ which is even

(i) Median $= \frac{1}{2}\left[\frac{n}{2} + \left(\frac{n}{2}+1\right)\right] = \frac{1}{2}\left[\frac{160}{2} + \left(\frac{160}{2}+1\right)\right]$

$= \frac{1}{2}[80+81] = 80.5$

Now take a point A(80.5) on y-axis and from A, draw a $\parallel^{el}$ line to x-axis meeting the curve at P and from P, draw a $\perp^{ar}$ to x-axis meeting it at Q

Median = Rs. 34.3 or Rs. 34.30.

(ii) (a) upper quartile $= \frac{3n}{4} = \frac{3\times160}{4} = 120$

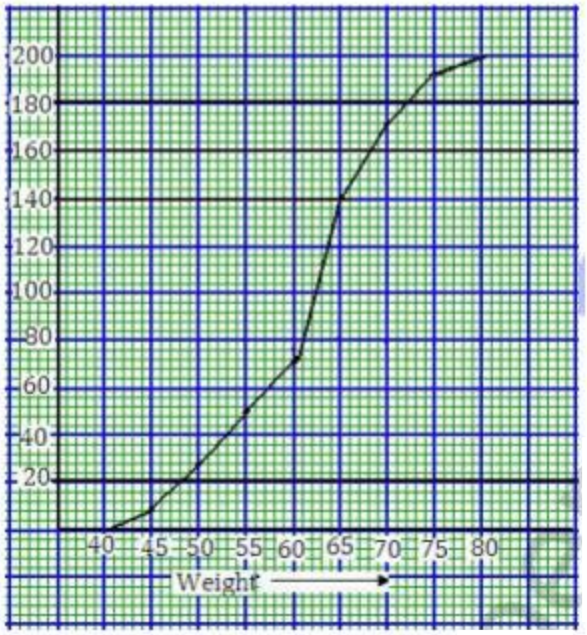
Take point B(120) on y-axis and from B, draw a line $\parallel^{el}$ to x-axis meeting the curve at L and from L, draw a line $\perp^{ar}$ to x-axis meeting it at M and M is the upper quartile.

upper quartile M = 47 or Rs. 47

(b) lower quartile $= \frac{n}{4} = \frac{160}{4} = 40$

Take a point C(40) on y-axis and from C, drawa a line $\parallel^{el}$ to x-axis meeting the curve at R and from R, draw a line $\perp^{ar}$ to x-axis meeting it at S.

S is the lower quartile which is Rs. 25.



(i) percentage $= \frac{156}{200} \times 100 = 78\%$ (approx)

(ii) $\% = \frac{30}{100} \times 200 = 60$

∴ The weight = 65 kg.

(iii) Under weight = 45

Over weight = 200 − 45 = 155.

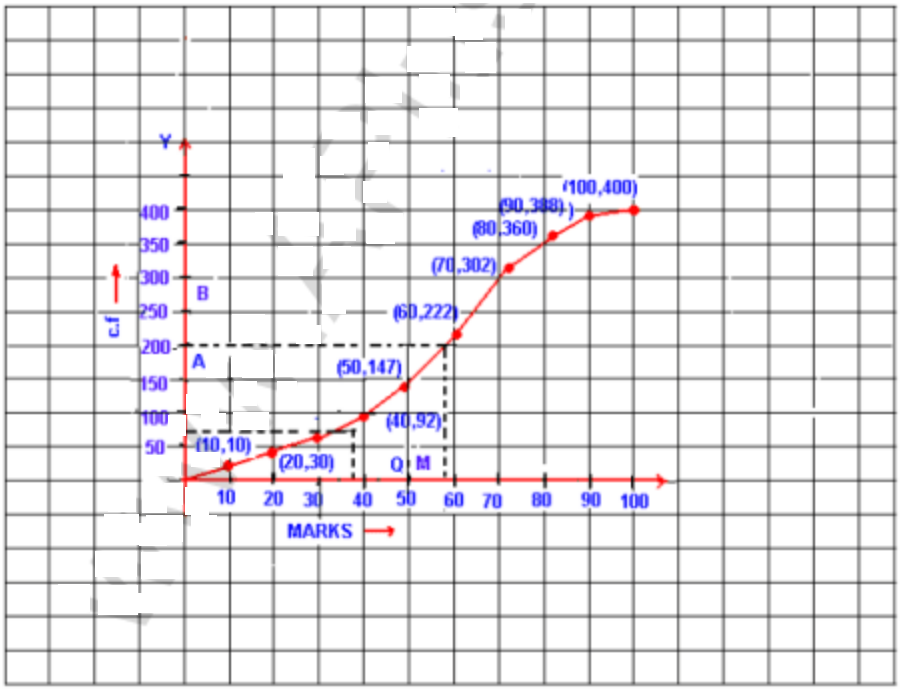
Q21. Marks scored by 400 students in an examination are as follows:

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
No. of students	10	20	22	40	55	75	80	58	28	12

Draw the ogive and from it determine:
(i) The median mark, and (ii) The pass marks if 80% of the students pass examination.

Sol. Representing the given data in the C.F table as given below:

Marks	Number of students	Cumulative Frequency
0-10	10	10
10-20	20	30
20-30	22	52
30-40	40	92
40-50	55	147
50-60	75	222
60-70	80	302
70-80	58	360
80-90	28	388
90-100	12	400



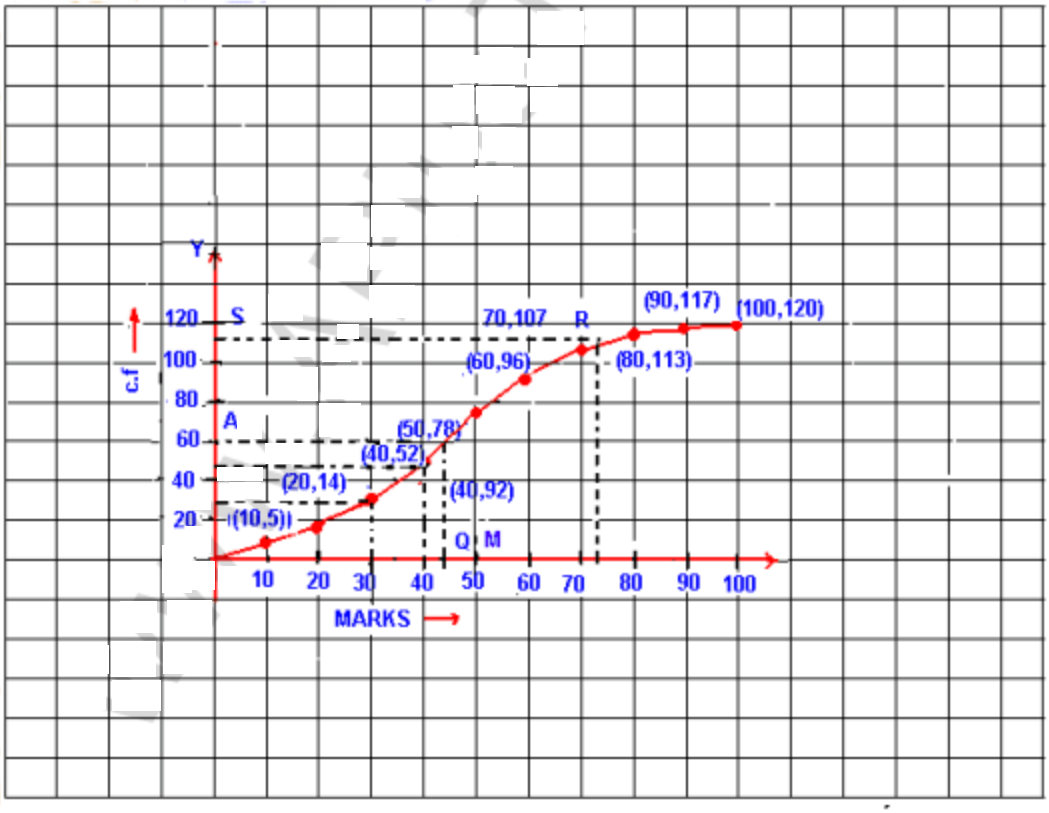
Q22. The marks obtained by 120 students in a mathematics test are given below:

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
No. of students	5	9	16	22	26	18	11	6	4	3

Draw an ogive for the given distribution on a graph sheet. Use a suitable scale for your ogive. Use your ogive to estimate: (i) The median (ii) The lower median
(iii) The no. of students who obtained morethan 75% marks in the test.
(iv) The no. of students who did not pass in the test if the pass percentage was 40.

sol. Representing the given data in CF table as given below:

Marks	Number of student	Cumulative Frequency
0–10	5	5
10–20	9	14
20–30	16	30
30–40	22	52
40–50	26	78
50–60	18	96
60–70	11	107
70–80	6	113
80–90	4	117
90–100	3	120



Now we plot the points (10,5), (20,14), (30,30), (40,52), (50,78), (60,96), (70,107), (80,113), (90,117) and (100,120) on the graph and join the points in free hand to form an ogive as shown.

Here $n = 120$ which is an even number

(i) Median $= \frac{1}{2}\left[\frac{120}{2} + \left(\frac{120}{2}+1\right)\right] = \frac{1}{2}(60+61) = 60.5$

Now take a point A(60.5) on y-axis and from A draw a parallel to x-axis meeting the the curve in P and from P, draw a $\perp^{lar}$ to x-axis meeting it at Q.

$\therefore$ Q is the median which is 43.00 (Approx).

(ii) Lower quartile $= \frac{n}{4} = \frac{120}{4} = 30$

Now take a point B(30) on y-axis & from B, draw a line $\parallel^{el}$ to x-axis meeting the curve in L and from L draw a $\perp^{lar}$ to x-axis meeting it at M.

$\therefore$ M is the lower quartile which is 30.

(iii) Take a point C(75) on x-axis & from C draw a line $\perp^{el}$ to it meeting the curve at R. from R, draw a line $\parallel^{el}$ to x-axis meeting y-axis at S.

$\therefore$ S shows 110 students getting below 75% and $120 - 110 = 10$ students getting morethan 75% marks.

(iv) pass percentage is 40%

Now take a point D(40) on x-axis and from D draw a $\perp^{lar}$ to x-axis meeting the curve at E and from E, draw a line $\parallel^{el}$ to x-axis meeting the y-axis at F.

$\therefore$ F shows 52.

$\therefore$ No. of students who could not get 40% and failed in the Examination are 52.

Q23. Draw an ogive for the following frequency distribution. Use your ogive to estimate : (i) The median
(ii) The no. of students who obtained more than 75% marks.
(Use square paper to solve this question)

Marks	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99
No. of students	5	9	16	22	26	18	11	6	4	3

Sol. Representing the given data in cf table as given below:

Marks	Number of students	Cumulative Frequency
0.5–9.5	5	5
9.5–19.5	9	14
19.5–29.5	16	30
29.5–39.5	22	52
39.5–49.5	26	78
49.5–59.5	18	96
59.5–69.5	11	107
69.5–79.5	6	113
79.5–89.5	4	117
89.5–99.5	3	120

Now plot the points (9.5, 5), (19.5, 14), (29.5, 30), (39.5, 52), (49.5, 78), (59.5, 96), (69.5, 107), (79.5, 113), (89.5, 117), (99.5, 120) on the graph and join them in freehand to form an ogive as shown.

Here $n = 120$ which is even.

(i) Median $= \frac{1}{2}\left[\frac{n}{2} + \left(\frac{n}{2}+1\right)\right] = \frac{1}{2}\left[\frac{120}{2} + \left(\frac{120}{2}+1\right)\right]$

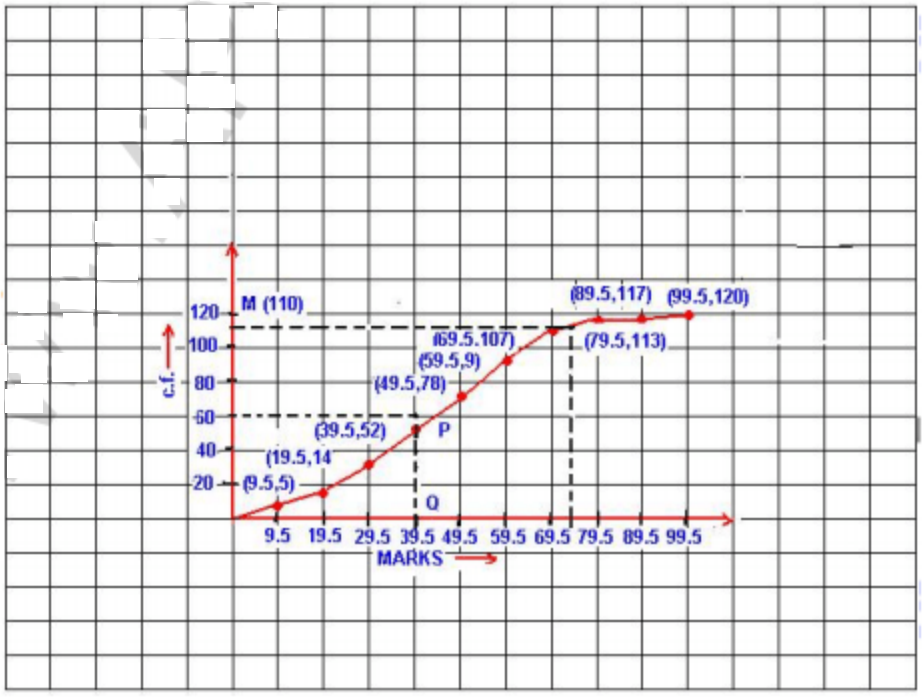
$= \frac{1}{2}\left[60+61\right] = \frac{121}{2} = 60.5$

Now take a point A(60.5) on y-axis and from A, draw line $\parallel^{el}$ to x-axis meeting the curve at P and from P, draw a $\perp^{ar}$ to x-axis meeting it in Q.

$\therefore$ Q is the median which is 45.

(ii) No. of students who get morethan 75% marks. now get a point B(75) on x-axis and from B draw a line $\perp^{ar}$ to x-axis meeting the curve L and from L, draw line $\parallel^{el}$ to x-axis meeting the y-axis at M

$\therefore$ M shows (120 − 110) = 10 students getting morethan 75% marks.



Q24. 100 pupils in a school have heights as tabulated below:

Height (in cm)	121-130	131-140	141-150	151-160	161-170	171-180
No. of pupils	12	16	30	20	14	8

Draw the ogive for the above data and from it determine the median (use graph paper)

Sol. Representing the given data in cumulative frequency table (in continuous distribution):

Height in cm	No. of pupils	c.f.
120.5- 130.5	12	12
130.5-140.5	16	28
140.5-150.5	30	58
150.5-160.5	20	78
160.5-170.5	14	92
170.5-180.5	8	100

Here $n = 100$ which is an even number.

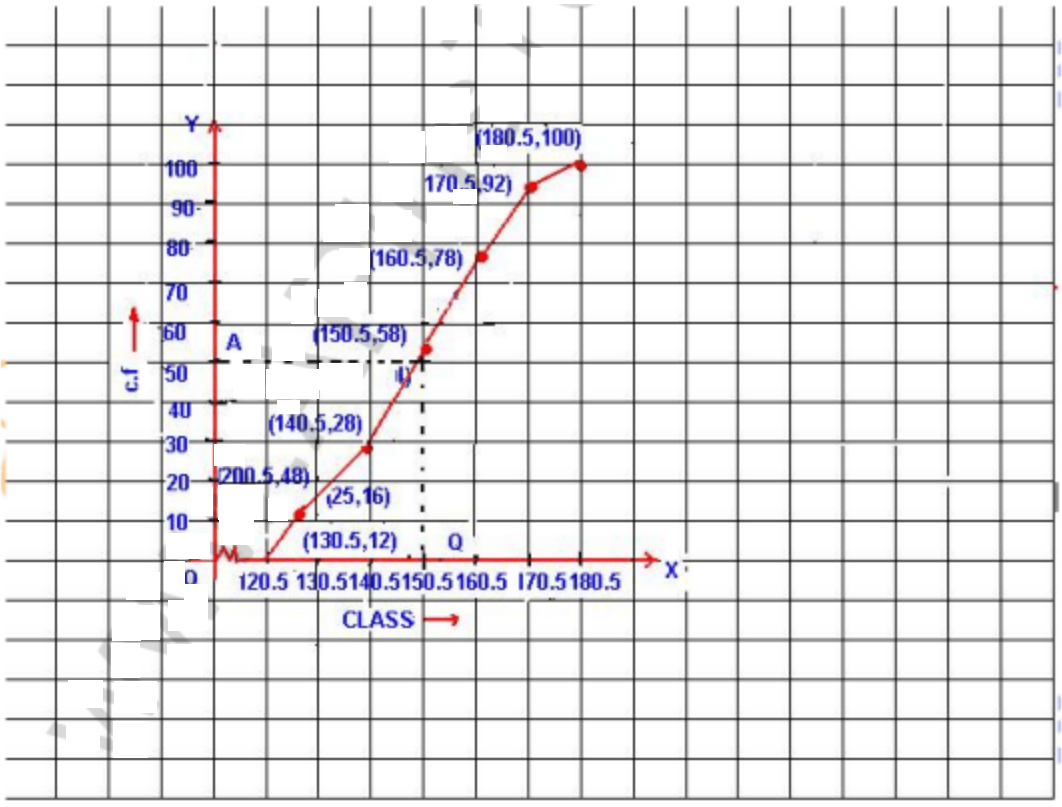
$$\text{Median} = \frac{1}{2}\left[\frac{n}{2} + \left(\frac{n}{2}+1\right)\right] = \frac{1}{2}\left[\frac{100}{2} + \left(\frac{100}{2}+1\right)\right]$$

$$= \frac{1}{2}(50+51) = \frac{101}{2} = 50.5$$

Now plot the points (130.5, 12), (140.5, 28), (150.5, 58), (160.5, 78), (170.5, 92) and (180.5, 100) on the graph and join them in free hand to form an ogive as shown.

Now take point A(50.5) on y-axis and from A draw a line $\parallel^{el}$ to x-axis meeting the curve at P and from P, draw a line $\perp^{ar}$ to x-axis meeting it at Q.

$\therefore$ Q(147.5) is the median.



EXERCISE - 23.3

Q1. Find the mode of the following sets of

(i) 3, 2, 0, 1, 2, 3, 5, 3

(ii) 5, 7, 6, 8, 9, 0, 6, 8, 1, 8

(iii) 9, 0, 2, 8, 5, 3, 5, 4, 1, 5, 2, 7

Sol. (i) The number 3 occurs maximum times. i.e. mode = 3

(ii) The number 8 occurs maximum times i.e, mode = 8

(iii) The number 5 occurs maximum time, i.e, mode = 5

Q2. Calculate the mean, the median and the mode of the numbers: 3, 2, 6, 3, 3, 1, 1, 2.

Sol. Arranging in ascending order 1, 1, 2, 2, 3, 3, 3, 6

(i) Mean $= \frac{\Sigma x}{n} = \frac{1+1+2+2+3+3+3+6}{8} = \frac{21}{8} = 2.625$

(ii) Here $n = 8$ which is even

$$\text{Median} = \frac{1}{2}\left[\frac{n}{2} + \left(\frac{n}{2}+1\right)\right] = \frac{1}{2}\left[\frac{8}{2} + \left(\frac{8}{2}+1\right)\right]$$

$$= \frac{1}{2}(4\text{th} + 5\text{th}) = \frac{1}{2}(2+3) = 2.5$$

(iii) Here 3 occurs maximum times

$\therefore$ Mode = 3

Q3. Calculate the mean, the median and the mode of the following numbers : 3, 1, 5, 6, 3, 4, 5, 3, 7, 2.

Sol. Arranging in ascending order 1, 2, 3, 3, 3, 4, 5, 5, 6, 7

(i) Mean $= \frac{\Sigma x_i}{n} = \frac{1+2+3+3+3+4+5+5+6+7}{10} = \frac{39}{10} = 3.9$

(ii) Here $n = 10$ which is even

$$\text{Median} = \frac{1}{2}\left[\frac{10}{2}\text{th term} + \left(\frac{10}{2}+1\right)^{\text{th}}\text{term}\right] = \frac{1}{2}\left[5^{\text{th}} + 6^{\text{th}}\text{ terms}\right]$$

$$= \frac{1}{2}(3+4) = \frac{7}{2} = 3.5$$

(iii) Here 3 occurs maximum times. Mode = 3.

Q4. A boy scored the following marks in various class tests during a term, each test being marked out of 20:
15, 17, 16, 7, 10, 12, 14, 16, 19, 12, 16
(i) what are his modal marks?
(ii) what are his median marks?
(iii) what are his mean marks?

Sol. Arranging in ascending order 7, 10, 12, 12, 14, 15, 16, 16, 16, 17, 19

(i) Modal marks is 16 as it occurs in maximum times.

(ii) Here $n = 11$ which is odd

$$\text{Median} = \left(\frac{n+1}{2}\right)^{th} \text{term} = \frac{11+1}{2} = 6^{th} \text{ term.}$$

$\therefore$ Median = 15

(iii) $$\text{Mean} = \frac{\Sigma x_i}{n} = \frac{7+10+12+12+14+15+16+16+16+17+19}{11}$$

$$= \frac{154}{11} = 14$$

Q5. Find the mean, median and mode of the following marks obtained by 16 students in a class test marked out of 10 marks: 0, 0, 2, 2, 3, 3, 3, 4, 5, 5, 5, 5, 6, 6, 7, 8

Sol. Here $n = 16$

(i) $$\text{Mean} = \frac{\Sigma x_i}{n} = \frac{0+0+2+2+3+3+3+4+5+5+5+5+6+6+7+8}{16}$$

$$= \frac{64}{16} = 4.$$

(ii) $$\text{Median} = \frac{1}{2}\left[\frac{16}{2} + \left(\frac{16}{2}+1\right)\right] = \frac{1}{2}\left(8^{th} + 9^{th} \text{ terms}\right)$$

$$= \frac{1}{2}(4+5) = 4.5$$

(iii) Here 5 occurs in maximum times

$\therefore$ mode = 5

Q6. Find the mode for the following distribution :

15	17	20	21	25	28
6	7	23	18	6	4

Sol. Here 20 occurs in maximum times i.e 23 times

Mode = 20.

Q7. Calculate the mean, the median and the mode of the following distribution :

No. of goals	0	1	2	3	4	5
No. of matches	2	4	7	6	8	3

Sol. Writing the given distribution in cf distribution :

No. of goals (x)	No. of matches(f)	c.f.	fx
0	2	2	0
1	4	6	4
2	7	13	14
3	6	19	18
4	8	27	32
5	3	30	15
Total	30		83

(i) Mean $= \frac{\Sigma fx}{\Sigma f} = \frac{83}{30} = 2.77$

(ii) Here $n = 30$ which is an even number

Median $= \frac{1}{2}\left[\frac{n}{2} + \left(\frac{n}{2}+1\right)\right] = \frac{1}{2}\left[\frac{30}{2} + \left(\frac{30}{2}+1\right)\right]$

$= \frac{1}{2}(15^{th} + 16^{th} \text{ terms}) = \frac{1}{2}(3+3) = 3$

(iii) frequency of 4 is maximum i.e, 8

$\therefore$ Mode $= 4$.

Q8. At a shooting competition, the scores of a competitor were as given below:

Score	0	1	2	3	4	5
Number of shots	0	3	6	4	7	5

(i) what was his modal score ?
(ii) what was his median score ?
(iii) what was his total score ?
(iv) what was his mean score ?

Sol. Writing the distribution in cf table :

Score (x)	No.of shots (f)	c.f.	f.x.
0	0	0	0
1	3	3	3
2	6	9	12
3	4	13	12
4	7	20	28
5	5	25	25
Total	25		80

(i) Model score is 4 as it occurs in maximum times i.e, 7, Mode = 4

(ii) Here $n = 25$ which is an odd number.

$$\text{Median} = \frac{25+1}{2} = 13^{th} \text{ term}$$

Hence median = 3

(iii) total score = 80

(iv) $$\text{Mean} = \frac{\Sigma fx}{\Sigma f} = \frac{80}{25} = 3.2$$

Q9. The following table gives the weekly wages (in Rs) of workers in a factory:

Weekly wages (In Rs)	50-55	55-60	60-65	65-70	70-75	75-80	80-85	85-90
No. of workers	5	20	10	10	9	6	12	8

Calculate:

(i) The mean

(ii) The modal class

(iii) The no. of workers getting weekly wages below Rs. 80.

(iv) The no. of workers getting Rs. 65 or more but less than Rs. 85 as weekly wages.

Weekly wages	No. of workers (f)	Class marks (x)	c.f.	f.x.
50–55	5	52.5	5	262.5
55–60	20	57.5	25	1150.0
60–65	10	62.5	35	625.0
65–70	10	67.5	45	675.0
70–75	9	72.5	54	652.0
75–80	6	77.5	60	465.0
80–85	12	82.5	72	990.0
85–90	8	87.5	80	700.0
Total	80			5520.

(i) Mean $= \frac{\Sigma fx}{\Sigma f} = \frac{5520}{80} = 69$

(ii) Modal class :

frequency of class 55–60 is maximum i.e. 20

Class 55–60 is the modal class.

(iii) No. of workers getting weekly wages below Rs. 80 = 60

(iv) No. of workers getting above Rs. 65 and below Rs. 85 as weekly wages = 70 − 35 = 37.

Q10. Calculate the mean of the distribution given below :

Marks	0–9	10–19	20–29	30–39	40–49	50–59
Frequency	4	6	12	6	7	5

Also state (i) The median class (ii) The modal class.

Sol. Representing the given distribution in cf table:

Class (before adjustment)	Class (after adjustment)	Frequency (f)	C.f. (x)	Class Mark	f.x
0-9	0.5-9.5	4	4	4.5	18.0
10-19	9.5-19.5	6	10	14.5	87.0
20-29	19.5-29.5	12	22	24.5	294.0
30-39	29.5-39.5	6	28	34.5	207.0
40-49	39.5-49.5	7	35	44.5	311.5
50-59	49.5-59.5	5	40	54.5	272.5
Total		40			1190.0

(i) Mean $= \frac{\Sigma fx}{\Sigma f} = \frac{1190}{40} = 29.75$

(ii) Here $n = 40$, which is even.

Median $= \frac{1}{2}\left[\frac{40}{2}\text{th} + \left(\frac{40}{2}+1\right)^{\text{th}} \text{ term}\right]$

$= \frac{1}{2}(20^{\text{th}} + 21^{\text{th}} \text{ terms})$

$\therefore$ Median classes are 20-29

(iv) Frequency of the classes 20-29 is greatest

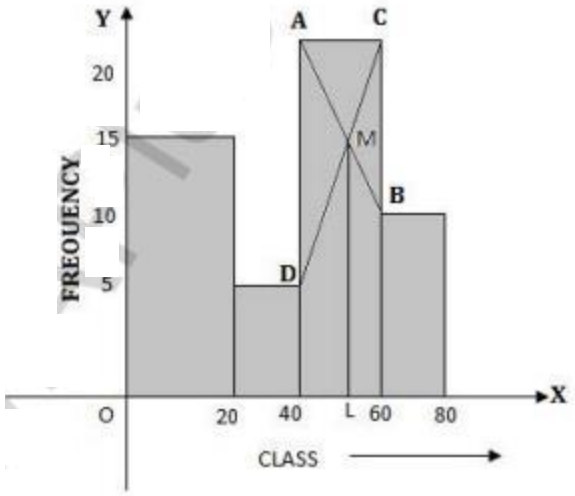
$\therefore$ Modal class is 20-29.

Q11. Find the mode of the following distribution by drawing a histogram:

Classes	0-20	20-40	40-60	60-80
Frequency	15	6	18	10

Sol.

Class	Frequency
0-20	15
20-40	6
40-60	18
60-80	0

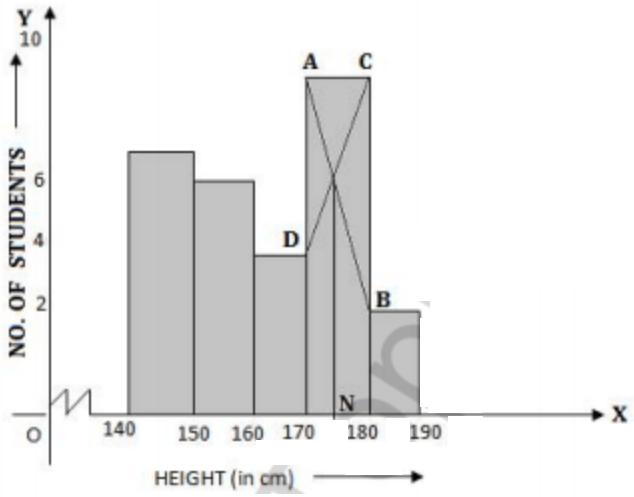


Present the classes on x-axis and frequency on y-axis, we draw a histogram as shown.
From the point AB and CD intersecting each other at M. and from ML ⊥ to x-axis
∴ L is the median which is 52.

Q12. Find the modal height of the following distribution by drawing a histogram:

Height (in cm)	140-150	150-160	160-170	170-180	180-190
No. of students	7	6	4	10	2

Sol.



Height (in cm)	No. of students
140-150	7
150-160	6
160-170	4
170-180	10
180-190	2

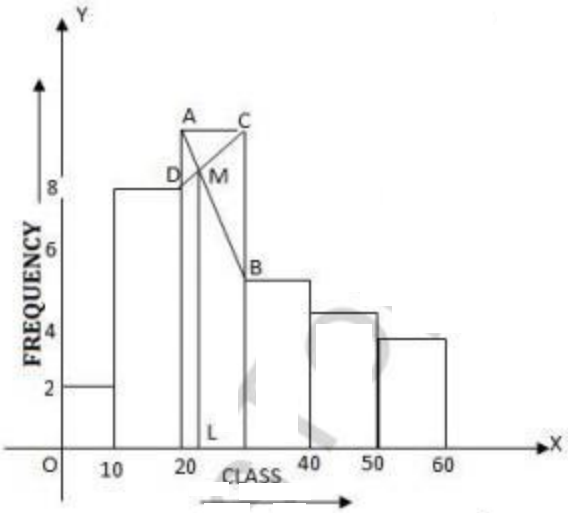
Now present the height on x-axis and no. of students (frequency) on Y-axis and draw a histogram as shown. In the histogram join OB and CD intersecting at M. From M, draw MN to x-axis. N shows the mode.

∴ Hence mode = 174 cm.

Q13. Draw a histogram and estimate the mode for the following frequency distribution:

Classes	0–10	10–20	20–30	30–40	40–50	50–60
Frequency	2	8	10	5	4	3

Sol.



Classes	Frequency
0–10	2
10–20	8
20–30	10
30–40	5
40–50	4
50–60	3

Representing the classes on x-axis and frequency on y-axis, we draw a histogram as shown. In the histogram join AB and CD intersecting at M. From M, draw ML $\perp^{lar}$ to x-axis. L shows the mode.

∴ Hence mode = 23.

Q14. IQ of 50 students was recorded as follows:

IQ score	80-90	90-100	100-110	110-120	120-130	130-140
No. of students	6	9	16	13	4	2

Draw a histo gram for the above data and estimate the mode.

Sol.

IQ Score No. of	students
80-90	6
90-100	9
100-110	16
110-120	13
120-130	4
130-140	2

Representing the IQ scale on x-axis and no. of students on y-axis, we draw a histogram as shown. join AB and CD intersecting each other at M. from M draw ML $\perp^{ar}$ to x-axis.

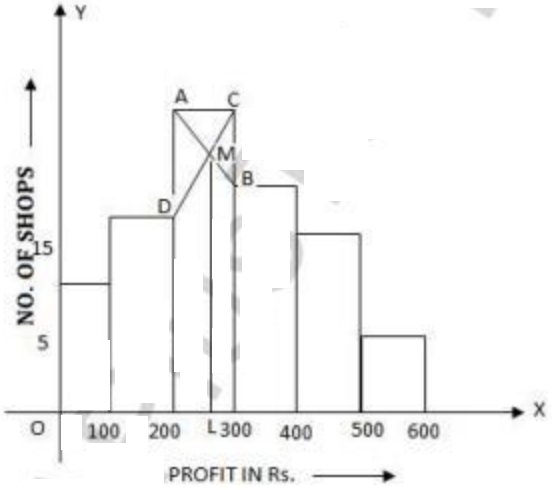
L is the mode which is 107

Q15. The daily profits in Rs. of 100 shops in a market are distributed as follows :

Profit per shop (in Rs)	0-100	100-200	200-300	300-400	400-500	500-600
No. of shops	12	18	27	20	17	6

Draw a histogram of the data given above, on graph paper and estimate the mode.

Sol.



Profit per shop (in Rs.)	No. of shops
0-100	12
100-200	18
200-300	27
300-400	20
400-500	17
500-600	6

Representing profit per shop on x-axis and no. of shops on y-axis, we draw a histogram as shown.
join AB and CD intersecting each other at M. from M. draw ML $\perp^{ar}$ to x-axis. L is the mode which is Rs. 260.

Q16. Draw a histogram for the following distribution:

Wt.(in kg)	40-44	45-49	50-54	55-59	60-64	65-69
No. of students	2	8	12	10	6	4

Hence estimate the modal weight.

Sol. We write the given distribution in continuous form:

Wt. In kg.	No. of students
39.5- 44.5	2
44.5- 49.5	8
49.5- 54.5	12
54.5- 59.5	10
59.5- 64.5	6
64.5- 69.5	4

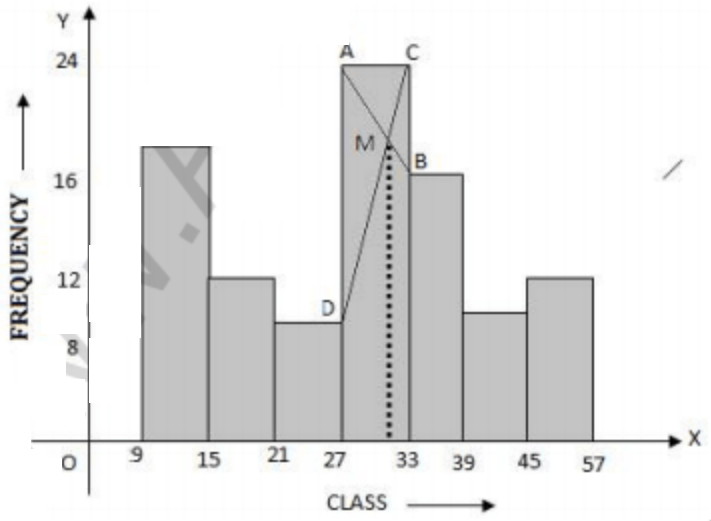
Representing the weight (in kg) on x-axis and no. of students on y-axis. We draw a histogram as shown. Now join AB and CD intersecting each other at M. from M. draw ML $\perp^{ar}$ to x-axis. L is the mode which is 51.5 kg.

Q17. Find the mode of the following distribution by drawing a histogram.

Mid value	12	18	24	30	36	42	48
Frequency	20	12	8	24	16	8	12

Also State the Modal class.

Sol.



Mid value	Class	Frequency
12	9–15	20
18	15–21	12
24	21–27	8
30	27–33	24
36	33–39	16
42	39–45	8
48	45–51	12

Representing class on x-axis and frequency on y-axis, we draw a histogram as shown. join AB and CD intersecting eachother at M. from M, draw ML $\perp^{ar}$ to x-axis. L shows the mode which is 30·5 and class is 27–33.