FOCUS ACADEMY

Kg to 12

English&Gujarati Medium

BRANCH 1- 19-B MUSLIM SOC, B/H FIRDOS MASJID DANILIMDA AHMEDABAD	BRANCH2-2ND 3RD AND 4TH FLOOR,UNIQUE APT. JUHAPURA CROSS ROAD, AHMEDABAD

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Ex 14.1 Class 10 Maths Question 1.

A survey was conducted by a group of students as a part of their environment awareness programme, in which they collected the following data regarding the number of plants in 20 houses in a locality. Find the mean number of plants per house.

No. of plants	No. of houses
0 – 2	1
2 – 4	2
4 – 6	1
6 – 8	5
8 – 10	6
10 – 12	2
12 – 14	3

Which method did you use for finding the mean, and why?

Solution:

Number of plants	Class mark (x_i)	Number of houses (f_i)	$f_i x_i$
0 – 2	1	1	01
2 – 4	3	2	06
4 – 6	5	1	05
6 – 8	7	5	35
8 – 10	9	6	54
10 – 12	11	2	22
12 – 14	13	3	39
Total		$\Sigma f_i = 20$	$\Sigma f_i x_i = 162$

We have, Mean $(\bar{x}) = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{162}{20} = 8.1$ plants. The mean of the data is 8.1.

Since the values of x_i and f_i are small, so we have used direct method to find the mean.

Ex 14.1 Class 10 Maths Question 2.
Consider the following distribution of daily wages of 50 workers of a factory.

Daily wages (in ₹)	No. of workers
100 – 120	12
120 – 140	14
140 – 160	8
160 – 180	6
180 – 200	10

Find the mean daily wages of the workers of the factory by using an appropriate method.
Solution:
In this case, we can use step-deviation method because the sata is large.
Here, a = 150 and h = 20

Class interval	Frequency (f_i)	Class marks (x_i)	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
100–120	12	110	–2	–24
120–140	14	130	–1	–14
140–160	8	150 = a	0	0
160–180	6	170	1	6
180–200	10	190	2	20
	$\Sigma f_i = 50$			$\Sigma f_i u_i = -12$

$$\therefore \text{Mean, } \bar{x} = a + h\left(\frac{\sum f_i u_i}{\sum f_i}\right)$$

$$= 150 + 20\left(\frac{-12}{50}\right) = 150 - \frac{240}{50}$$

$$= 150 - \frac{24}{5} = \frac{750 - 24}{5}$$

$$= \frac{726}{5} = 145.20.$$

Hence, mean daily wages of the workers are ₹ **145.20**.

Ex 14.1 Class 10 Maths Question 3.
The following distribution shows the daily pocket allowance of children of a locality. The mean pocket allowance is ₹ 18. Find the missing frequency f.

Daily pocket allowances (in ₹)	No. of children
11 – 13	7
13 – 15	6
15 – 17	9
17 – 19	13
19 – 21	f
21 – 23	5
23 – 25	4

Solution:

Daily pocket allowance (in ₹)	Class mark (x_i)	Number of children (f_i)	$d_i = x_i - 18$	$f_i d_i$
11 – 13	12	7	–6	–42
13 – 15	14	6	–4	–24
15 – 17	16	9	–2	–18
17 – 19	18 = a (Let)	13	0	0
19 – 21	20	f	2	2f
21 – 23	22	5	4	20
23 – 25	24	4	6	24
Total		$\Sigma f_i = 44 + f$		$\Sigma f_i d_i = 2f - 40$

We have, $\text{Mean} = a + \frac{\Sigma f_i d_i}{\Sigma f_i}$

$\Rightarrow \quad 18 = 18 + \frac{2f - 40}{44 + f}$ [$\because$ Mean = 18 (given)]

$\Rightarrow \quad 0 = \frac{2f - 40}{44 + f} \Rightarrow 2f - 40 = 0 \Rightarrow 2f = 40 \Rightarrow f = \frac{40}{2} = 20$

Ex 14.1 Class 10 Maths Question 4.
Thirty women were examined in a hospital by a doctor and the number of heart beats per minute were recorded and summarised as follows. Find the mean heart beats per minute for these women, choosing a suitable method

Number of heart beats per minute	No. of women
65 – 68	2
68 – 71	4
71 – 74	3
74 – 77	8
77 – 80	7
80 – 83	4
83 – 86	2

Solution:

Let us find the mean of the data by direct method.

Class interval	Frequency (f_i)	Class marks (x_i)	$f_i x_i$
65 – 68	2	66.5	133
68 – 71	4	69.5	278
71 – 74	3	72.5	217.5
74 – 77	8	75.5	604
77 – 80	7	78.5	549.5
80 – 83	4	81.5	326
83 – 86	2	84.5	169
	$\Sigma f_i = 30$		$\Sigma f_i x_i = 2277$

$$\therefore \text{Mean of data} = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{2277}{30} = \mathbf{75.9}.$$

Ex 14.1 Class 10 Maths Question 5.

In a retail market, fruit vendors were selling mangoes kept in packing boxes. These boxes contained varying number of mangoes. The following was the distribution of mangoes according to the number of boxes.

No. of mangoes	No. of boxes
50 – 52	15
53 – 55	110
56 – 58	135
59 – 61	115
62 – 64	25

Find the mean number of mangoes kept in a packing box. Which method of finding the mean did you choose?
Solution:

Here h = 3

Number of mangoes	Class mark (x_i)	Number of boxes (f_i)	$u_i = \frac{x_i - 57}{3}$	$f_i u_i$
50 – 52	51	15	–2	–30
53 – 55	54	110	–1	–110
56 – 58	57 = a (Let)	135	0	0
59 – 61	60	115	1	115
62 – 64	63	25	2	50
Total		$\Sigma f_i = 400$		$\Sigma f_i u_i = 25$

We have, $\text{Mean} = a + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h = 57 + \frac{25 \times 3}{400}$

$= 57 + 0.19 = 57.19$ mangoes.

Step deviation method.

Ex 14.1 Class 10 Maths Question 6.
The table below shows the daily expenditure on food of 25 households in a locality.

Daily expenditure (in ₹)	No. of households
100 – 150	4
150 – 200	5
200 – 250	12
250 – 300	2
300 – 350	2

Find the mean daily expenditure on food by a suitable method.

Solution:

Here, a = 225 and h = 50

Class interval	Frequency (f_i)	Class marks(x_i)	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
100–150	4	125	–2	–8
150–200	5	175	–1	–5
200–250	12	$225 = a$	0	0
250–300	2	275	1	2
300–350	2	325	2	4
	$\Sigma f_i = 25$			$\Sigma f_i u_i = -7$

$$\therefore \text{Mean, } \bar{x} = a + h\left(\frac{\Sigma f_i u_i}{\Sigma f_i}\right) = 225 + 50\left(\frac{-7}{25}\right)$$

$$= 225 - 14 = 211.$$

Hence, the mean daily ecpenditure on food is ₹ 211.

Ex 14.1 Class 10 Maths Question 7.

To find out the concentration of SO2 in the air (in parts per million, i.e. ppm), the data was collected for 30 localities in a certain city and is presented below:

Concentration of SO_2 (in ppm)	Frequency
0.00 – 0.04	4
0.04 – 0.08	9
0.08 – 0.12	9
0.12 – 0.16	2
0.16 – 0.20	4
0.20 – 0.24	2

Find the mean concentration of SO2 in the air.

Solution:

Here h = 0.04

Concentration of SO_2 (in ppm)	Class mark (x_i)	Frequency (f_i)	$u_i = \frac{x_i - 0.10}{0.04}$	$f_i u_i$
0.00 – 0.04	0.02	4	–2	–8
0.04 – 0.08	0.06	9	–1	–9
0.08 – 0.12	0.10 = a (Let)	9	0	0
0.12 – 0.16	0.14	2	1	2
0.16 – 0.20	0.18	4	2	8
0.20 – 0.24	0.22	2	3	6
Total		$\Sigma f_i = 30$		$\Sigma f_i u_i = -1$

We have, $$\text{Mean} = a + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h$$

$$= 0.10 + \frac{(-1) \times 0.04}{30} = 0.10 - 0.001 = 0.099 \text{ ppm.}$$

Ex 14.1 Class 10 Maths Question 8.

A class teacher has the following absentee record of 40 students of a class for the whole term. Find the mean number of days a student was absent.

No. of days	No. of students
0 – 6	11
6 – 10	10
10 – 14	7
14 – 20	4
20 – 28	4
28 – 38	3
38 – 40	1

Solution:

Class interval	Frequency (f_i)	Class marks (x_i)	$f_i x_i$
0 – 6	11	3	33
6 – 10	10	8	80
10 – 14	7	12	84
14 – 20	4	17	68
20 – 28	4	24	96
28 – 38	3	33	99
38 – 40	1	39	39
	$\Sigma f_i = 40$		$\Sigma f_i x_i = 499$

$$\therefore \text{Mean number of days} = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{499}{40}$$

$$= \mathbf{12.48 \text{ days}}.$$

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Ex 14.1 Class 10 Maths Question 9.
The following table gives the literacy rate (in percentage) of 35 cities. Find the mean literacy rate.

Literacy rate (in %)	No. of cities
45 – 55	3
55 – 65	10
65 – 75	11
75 – 85	8
85 – 95	3

Solution:
Here h = 10

Literacy rate (in%)	Class mark (x_i)	Number of cities (f_i)	$u_i = \frac{x_i - 70}{10}$	$f_i u_i$
45 – 55	50	3	– 2	– 6
55 – 65	60	10	– 1	– 10
65 – 75	70 = a (Let)	11	0	0
75 – 85	80	8	1	8
85 – 95	90	3	2	6
Total		$\Sigma f_i = 35$		$\Sigma f_i u_i = -2$

$$\text{Mean} = a + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h = 70 + \frac{(-2) \times 10}{35} = 70 - 0.57 = 69.43\%$$

Ex 14.2 Class 10 Maths Question 1.
The following table shows the ages of the patients admitted in a hospital during a year.

Age (in years)	No. of patients
5 – 15	6
15 – 25	11
25 – 35	21
35 – 45	23
45 – 55	14
55 – 65	5

Find the mode and the mean of the data given above. Compare and interpret the two measures of central tendency.
Solution:

For Mode:

Age (in years)	5–15	15–25	25–35	35–45	45–55	55–65
Number of patients	6	11	21	23	14	5

$\because$ Maximum frequency = 23

$\therefore$ Modal class = 35 – 45

Here, $l = 35, f_1 = 23, f_0 = 21, f_2 = 14, h = 10$

$$\text{Mode} = l + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times h = 35 + \left[\frac{23 - 21}{46 - 21 - 14}\right] \times 10 = 35 + \frac{2}{11} \times 10$$

$$= 35 + \frac{20}{11} = 36.8 \text{ years}$$

For Mean:

Age (in years)	Class mark (x_i)	Number of patients (f_i)	$u_i = \frac{x_i - 30}{10}$	$f_i u_i$
5 – 15	10	6	–2	–12
15 – 25	20	11	–1	–11
25 – 35	30 = a (Let)	21	0	0
35 – 45	40	23	1	23
45 – 55	50	14	2	28
55 – 65	60	5	3	15
Total		$\Sigma f_i = 80$		$\Sigma f_i u_i = 43$

Here, $a = 30, \Sigma f_i u_i = 43, \Sigma f_i = 80, h = 10$

We have, $\text{Mean} = a + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h = 30 + \frac{43 \times 10}{80} = 30 + 5.37 = 35.37$ years

We conclude that the maximum number of patients in the hospital are of the age 36.8 years. While on an average the age of patient admitted to the hospital is 35.37 years.

Ex 14.2 Class 10 Maths Question 2.

The following data gives information on the observed lifetimes (in hours) of 225 electrical components:

Life times (in hours)	Frequency
0 – 20	10
20 – 40	35
40 – 60	52
60 – 80	61
80 – 100	38
100 – 120	29

Determine the modal lifetimes of the components.

Solution:

Modal class is 60 – 80, as 61 is maximum frequency.

Here, $l = 60, f_m = 61, f_1 = 52, f_2 = 38$, and $h = 20$.

$$\therefore \text{Mode} = l + \left(\frac{f_m - f_1}{2f_m - f_1 - f_2}\right) \times h$$

$$= 60 + \left(\frac{61 - 52}{122 - 52 - 38}\right) \times 20$$

$$= 60 + \frac{9 \times 20}{32} = 60 + \frac{45}{8}$$

$$= 60 + 5.63 = \mathbf{65.63\ hr}.$$

Ex 14.2 Class 10 Maths Question 3.

The following data gives the distribution of total monthly household expenditure of 200 families of a village. Find the modal monthly expenditure of the families. Also, find the mean monthly expenditure:

Expenditure (in ₹)	Number of families
1000 – 1500	24
1500 – 2000	40
2000 – 2500	33
2500 – 3000	28
3000 – 3500	30
3500 – 4000	22
4000 – 4500	16
4500 – 5000	7

Solution:

Here, Maximum frequency = 40

$\therefore$ Modal class = 1500 – 2000 and $l = 1500, f_0 = 24, f_1 = 40, f_2 = 33$

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h = 1500 + \left(\frac{40 - 24}{80 - 24 - 33}\right) \times 500$$

$$= 1500 + \frac{16}{23} \times 500 = 1500 + 347.83 = ₹\ 1847.83$$

For Mean

Expenditure (in ₹)	Class mark (x_i)	Number of families (f_i)	$u_i = \frac{x_i - 2750}{500}$	$f_i u_i$
1000 – 1500	1250	24	–3	–72
1500 – 2000	1750	40	–2	–80
2000 – 2500	2250	33	–1	–33
2500 – 3000	2750 = a (Let)	28	0	0
3000 – 3500	3250	30	1	30
3500 – 4000	3750	22	2	44
4000 – 4500	4250	16	3	48
4500 – 5000	4750	7	4	28
Total		$\Sigma f_i = 200$		$\Sigma f_i u_i = -35$

Here, $a = 2750, \Sigma f_i = 200, \Sigma f_i u_i = -35, h = 500$

$\therefore$ $$\text{Mean} = a + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h$$

$$= 2750 + \frac{(-35)}{200} \times 500 = 2750 - \frac{175}{2}$$

$$= 2750 - 87.50 = ₹\ 2662.50$$

Ex 14.2 Class 10 Maths Question 4.

The following distribution gives the state-wise teacher- student ratio in higher secondary schools of India. Find the mode and mean of this data. Interpret the two measures.

Number of students per teacher	Number of states/UT
15 – 20	3
20 – 25	8
25 – 30	9
30 – 35	10
35 – 40	3
40 – 45	0
45 – 50	0
50 – 55	2

Solution:

Here, h = 5.

Class interval	Frequency f_i	Class marks x_i	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
15 – 20	3	17.5	–3	–9
20 – 25	8	22.5	–2	–16
25 – 30	9 (f_1)	27.5	–1	–9
30 – 35	10 (f_m)	32.5 = a	0	0
35 – 40	3 (f_2)	37.5	1	3
40 – 45	0	42.5	2	0
45 – 50	0	47.5	3	0
50 – 55	2	52.5	4	8
	$\Sigma f_i = 35$			$\Sigma f_i u_i$ = –23

Since the maximum frequency is 10, so the modal class is (30 – 35).

Here, $l = 30, f_m = 10, f_1 = 9, f_2 = 3, h = 5$ and $a = 32.5$

$$\therefore \textbf{Mode} = l + \left(\frac{f_m - f_1}{2f_m - f_1 - f_2}\right) \times h$$

$$= 30 + \left(\frac{10 - 9}{2 \times 10 - 9 - 3}\right) \times 5$$

$$= 30 + \frac{5}{20 - 12} = 30 + 0.63$$

$$= \textbf{30.63}.$$

$$\textbf{Mean} = a + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h = 32.5 + \frac{(-23)}{35} \times 5$$

$$= 32.5 - 3.28 = \textbf{29.22}.$$

Ex 14.2 Class 10 Maths Question 5.

The given distribution shows the number of runs scored by some top batsmen of the world in one-

day international cricket matches.

Runs scored	Number of batsmen
3000 – 4000	4
4000 – 5000	18
5000 – 6000	9
6000 – 7000	7
7000 – 8000	6
8000 – 9000	3
9000 – 10000	1
10000 – 11000	1

Find the mode of the data.
Solution:

Runs scored	Number of batsmen (f_i)
3000 – 4000	4
4000 – 5000	18
5000 – 6000	9
6000 – 7000	7
7000 – 8000	6
8000 – 9000	3
9000 – 10000	1
10000 – 11000	1

Maximum frequency = 18,

$\therefore$ Modal class = 4000 – 5000; Here, $l = 4000, f_0 = 4, f_1 = 18, f_2 = 9$

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h = 4000 + \left(\frac{18 - 4}{36 - 4 - 9}\right) \times 1000$$

$$= 4000 + \frac{14000}{23} = 4000 + 608.7 = 4608.7 \text{ runs}$$

Ex 14.2 Class 10 Maths Question 6.
A student noted the number of cars passing through a spot on a road for 100 periods each of 3 minutes and summarised it in the table given below. Find the mode of the data:

Number of cars	Frequency
0 – 10	7
10 – 20	14
20 – 30	13
30 – 40	12
40 – 50	20
50 – 60	11
60 – 70	15
70 – 80	8

Solution:

Ex 14.3 Class 10 Maths Question 1.

The following frequency distribution gives the monthly consumption of electricity of 68 consumers of a locality. Find the median, mean and mode of the data and compare them.

Monthly consumption (in units)	65 – 85	85 – 105	105 – 125	125 – 145	145 – 165	165 – 185	185 – 205
No. of consumers	4	5	13	20	14	8	4

Solution:

Monthly consumption (in units)	Number of consumers (f_i)	Cumulative frequency (cf)	Class mark (x_i)	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
65 – 85	4	4	75	–3	–12
85 – 105	5	9	95	–2	–10
105 – 125	13	22	115	–1	–13
125 – 145	20	42	135 = a (Let)	0	0
145 – 165	14	56	155	1	14
165 – 185	8	64	175	2	16
185 – 205	4	68	195	3	12
Total	$\Sigma f_i = 68$				$\Sigma f_i u_i = 7$

We have, $\text{Mean} = a + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h = 135 + \frac{7}{68} \times 20 = 135 + \frac{35}{17}$

$= 135 + 2.06 = 137.06$ units

Here, $n = 68, \frac{n}{2} = \frac{68}{2} = 34,$

$\therefore$ Median class = 125 – 145

Here, $l = 125, n = 68, f = 20, cf = 22, h = 20$

$$\text{Median} = l + \left(\frac{\frac{n}{2} - cf}{f}\right) \times h = 125 + \left(\frac{34 - 22}{20}\right) \times 20$$

$= 125 + 12 = 137$ units

Maximum frequency = 20

Modal class = 125 – 145 Here, $l = 125, f_0 = 13, f_1 = 20, f_2 = 14$

$\therefore$ $$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h = 125 + \left(\frac{20 - 13}{40 - 13 - 14}\right) \times 20$$

$$= 125 + \frac{7 \times 20}{13} = 125 + \frac{140}{13} = 125 + 10.76 = 135.76 \text{ units}$$

Mean > Median > Mode

Ex 14.3 Class 10 Maths Question 2.
If the median of the distribution given below is 28.5, find the values of x and y.

Class-interval	Frequency
0 – 10	5
10 – 20	x
20 – 30	20
30 – 40	15
40 – 50	y
50 – 60	5
Total	60

Solution:

Class interval	Frequency	Cumulative frequency
0 – 10	5	5
10 – 20	x	$5 + x$(c)
20 – 30	20(f)	$25 + x$
30 – 40	15	$40 + x$
40 – 50	y	$40 + x + y$
50 – 60	5	$45 + x + y$
Total	$n = 60$	

We have $45 + x + y = 60$ ...(i) [Given]

$\because n = 60 \quad \therefore \frac{n}{2} = \frac{60}{2} = 30$

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

Hence, $l = 20, f = 20, cf = 5 + x$ and $h = 10$.

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

$$\Rightarrow \quad 28.5 = 20 + \left(\frac{30 - 5 - x}{20}\right) \times 10$$

$$\Rightarrow \quad 28.5 = 20 + \left(\frac{25 - x}{2}\right)$$

$$\Rightarrow \quad 57 = 40 + 25 - x \Rightarrow 25 - x = 57 - 40$$

$$\Rightarrow 25 - x = 17 \Rightarrow \boldsymbol{x = 25 - 17 = 8.}$$

Putting $x = 8$ in equation (i), we get:

$$\Rightarrow \quad 45 + 8 + y = 60 \Rightarrow \boldsymbol{y = 60 - 53 = 7.}$$

Ex 14.3 Class 10 Maths Question 3.
A life insurance agent found the following data for distribution of ages of 100 policy holders. Calculate the median age, if policies are given only to persons having age 18 years onwards but less than 60 years.

Age (in years)	Number of policy holders
Below 20	2
Below 25	6
Below 30	24
Below 35	45
Below 40	78
Below 45	89
Below 50	92
Below 55	98
Below 60	100

Solution:

Age (in years)	Number of policy holders	Cumulative frequency
0 – 20	2	2
20 – 25	6 – 2 = 4	6
25 – 30	24 – 6 = 18	24
30 – 35	45 – 24 = 21	45
35 – 40	78 – 45 = 33	78
40 – 45	89 – 78 = 11	89
45 – 50	92 – 89 = 3	92
50 – 55	98 – 92 = 6	98
55 – 60	100 – 98 = 2	100
Total	100	

Here, $\frac{n}{2} = \frac{100}{2} = 50$

$\therefore$ Median class = 35 – 40, So, $l = 35, cf = 45, h = 5, f = 33$

We have, $\text{Median} = l + \left(\frac{\frac{n}{2} - cf}{f}\right) \times h = 35 + \left(\frac{50 - 45}{33}\right) \times 5 = 35 + \frac{25}{33}$

$= 35 + 0.76 = 35.76$ years

Ex 14.3 Class 10 Maths Question 4.
The lengths of 40 leaves of a plant are measured correct to nearest millimetre, and the data obtained is represented in the following table:

Length (in mm)	Number of leaves
118 – 126	3
127 – 135	5
136 – 144	9
145 – 153	12
154 – 162	5
163 – 171	4
172 – 180	2

Find the median length of the leaves.
Solution:

Class interval	Frequency	Cumulative frequency
117.5 – 126.5	3	3
126.5 – 135.5	5	8
135.5 – 144.5	9	17 (c)
144.5 – 153.5	12 (f)	29
153.5 – 162.5	5	34
162.5 – 171.5	4	38
171.5 – 180.5	2	40
	$n = 40$	

$\because n = 40 \quad \therefore \frac{n}{2} = \frac{40}{2} = 20.$

Since 12 is the maximum frequency, so the median class is (144.5 – 153.5).

Here, $l = 144.5, f = 12, cf = 17$ and $h = 9$

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

$$= 144.5 + \left(\frac{20 - 17}{12}\right) \times 9$$

$$= 144.5 + \frac{9}{4}$$

$$= 144.5 + 2.25 = 146.75 \text{ mm}.$$

Hence, the median length of leaves is **146.75 mm**.

Ex 14.3 Class 10 Maths Question 5.
The following table gives the distribution of the lifetime of 400 neon lamps:

Life time (in hours)	Number of lamps
1500 – 2000	14
2000 – 2500	56
2500 – 3000	60
3000 – 3500	86
3500 – 4000	74
4000 – 4500	62
4500 – 5000	48

Find the median lifetime of a lamp.
Solution:

Lifetime (in hours)	Number of lamps	*cf*
1500 – 2000	14	14
2000 – 2500	56	70
2500 – 3000	60	130
3000 – 3500	86	216
3500 – 4000	74	290
4000 – 4500	62	352
4500 – 5000	48	400
Total	400	

Here, $\frac{n}{2} = \frac{400}{2} = 200$

$\therefore$ Median class = 3000 – 3500

So, $f = 86, cf = 130, h = 500$

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

$= 3000 + \left(\frac{200 - 130}{86}\right) \times 500$

$= 3000 + \frac{35000}{86} = 3000 + 406.98 = 3406.98$ hours

Ex 14.3 Class 10 Maths Question 6.
100 surnames were randomly picked up from a local telephone directory and the frequency distribution of the number of letters in the English alphabet in the surnames was obtained as follows:

Number of letters	Number of surnames
1 – 4	6
4 – 7	30
7 – 10	40
10 – 13	16
13 – 16	4
16 – 19	4

Determine the median number of letters in the surnames. Find the mean number of letters in the surnames. Also, find the modal size of the surnames.

Solution:

Here, $h = 3$.

Class interval	Frequency (f_i)	Cumulative frequency (cf)	Class marks (x_i)	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
1 – 4	6	6	2.5	–2	–12
4 – 7	30(f_1)	36(c)	5.5	–1	–30
7 – 10	40(f_m)	76	8.5 = a	0	0
10 – 13	16(f_2)	92	11.5	1	16
13 – 16	4	96	14.5	2	8
16 – 19	4	100	17.5	3	12
			$n = 100$		$\Sigma f_i u_i = -6$

$\because \quad n = 100$

$\therefore \quad \frac{n}{2} = \frac{100}{2} = 50$

Since 40 is the maximum frequency, so the median class is (7 – 10).

Here, $l = 7, f_m = 40, cf = 36$ and $h = 3$.

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

$$= 7 + \left(\frac{50 - 36}{40}\right) \times 3 = 7 + \frac{14}{40} \times 3$$

$$= 7 + \frac{21}{20} = 7 + \frac{10.5}{10}$$

$$= 7 + 1.05 = \textbf{8.05}$$

$$\textbf{Mean} = a + \frac{\sum f_i u_i}{\sum f_i} \times h = 8.5 + \frac{(-6)}{100} \times 3$$

$$= 8.5 + \frac{(-18)}{100} = 8.50 - 0.18 = \textbf{8.32}.$$

Now since the maximum number of letters in surnames = 40

$\therefore$ Modal class = 7 – 10

$$\therefore \textbf{Mode} = l + \left(\frac{f_m - f_1}{2f_m - f_1 - f_2}\right) \times h$$

$$= 7 + \left(\frac{40 - 30}{80 - 30 - 16}\right) \times 3$$

$$= 7 + \frac{10}{34} \times 3 = 7 + \frac{30}{34} = 7 + 0.88$$

$$= \textbf{7.88}.$$

Ex 14.3 Class 10 Maths Question 7.
The distribution below gives the weight of 30 students of a class. Find the median weight of the students.

Weight (in kg)	Number of students
40 – 45	2
45 – 50	3
50 – 55	8
55 – 60	6
60 – 65	6
65 – 70	3
70 – 75	2

Solution:

Weight (in kg)	Number of students (f_i)	cf
40 – 45	2	2
45 – 50	3	5
50 – 55	8	13
55 – 60	6	19
60 – 65	6	25
65 – 70	3	28
70 – 75	2	30
Total	30	

Here, $\frac{n}{2} = \frac{30}{2} = 15,$

$\therefore$ Median class $= 55 - 60,$

So, $l = 55, f = 6, cf = 13, h = 5$

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

$$= 55 + \left(\frac{15 - 13}{6}\right) \times 5 = 55 + \frac{5}{3}$$

$$= 55 + 1.67 = 56.67 \text{ kg}$$

Since 20 is the maximun frequency, so modal class is (40 – 50).

Here, $l = 40, f_m = 20, f_1 = 12, f_2 = 11$ and $h = 10.$

$$\therefore \textbf{Mode} = l + \left(\frac{f_m - f_1}{2f_m - f_1 - f_2}\right) \times h$$

$$= 40 + \left(\frac{20 - 12}{2 \times 20 - 12 - 11}\right) \times 10$$

$$= 40 + \frac{80}{17} = 40 + 4.7 = \textbf{44.7 cars}.$$

Ex 14.4 Class 10 Maths Question 1.
The following distribution gives the daily income of 50 workers of a factory.

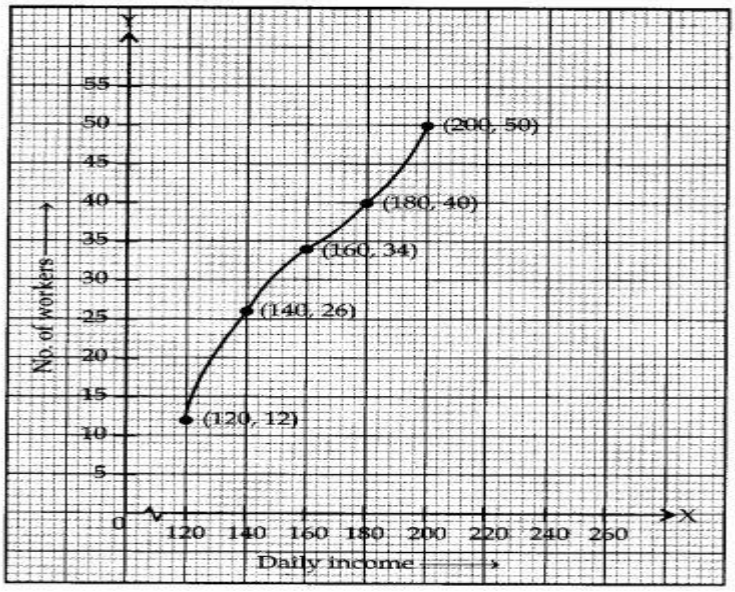
Daily income (in ₹)	No. of workers
100 – 120	12
120 – 140	14
140 – 160	8
160 – 180	6
180 – 200	10

Convert the distribution above to a less than type cumulative frequency distribution, and draw its ogive.

Solution:

Daily income (in ₹)	No. of workers	Cumulative frequency
Less than 120	12	12
Less than 140	14	26
Less than 160	8	34
Less than 180	6	40
Less than 200	10	50
	$n = 50$	

Now, we plot the points (120, 12), (140, 26), (160, 34), (180, 40) and (200, 50) to get the required ogive as shown alongside.

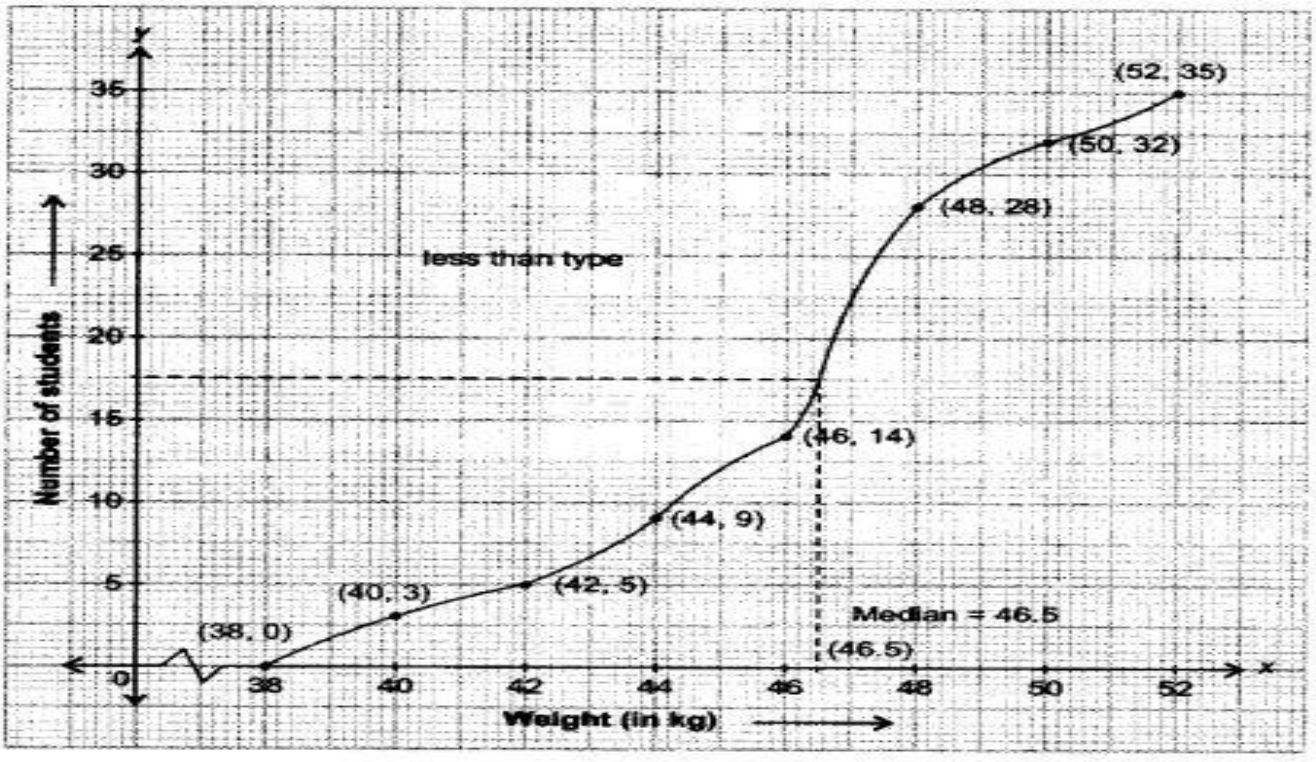


Ex 14.4 Class 10 Maths Question 2.
During the medical check-up of 35 students of a class, their weights were recorded as follows:

Weight (in kg)	Number of students
Less than 38	0
Less than 40	3
Less than 42	5
Less than 44	9
Less than 46	14
Less than 48	28
Less than 50	32
Less than 52	35

Draw a less than type ogive for the given data. Hence obtain the median weight from the graph and verify the result by using the formula.
Solution:

Weight in (kg)	Number of students
less than 38	0
less than 40	3
less than 42	5
less than 44	9
less than 46	14
less than 48	28
less than 50	32
less than 52	35



Median by formula:

Class interval	Frequency	*cf*
Below 38	0	0
38 – 40	3	3
40 – 42	2	5
42 – 44	4	9
44 – 46	5	14
46 – 48	14	28
48 – 50	4	32
50 – 52	3	35

$n = 35$ So, $\frac{n}{2} = \frac{35}{2} = 17.5$

Now, Median class is 46 – 48, so, $l = 46, cf = 14, f = 14, h = 2$.

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

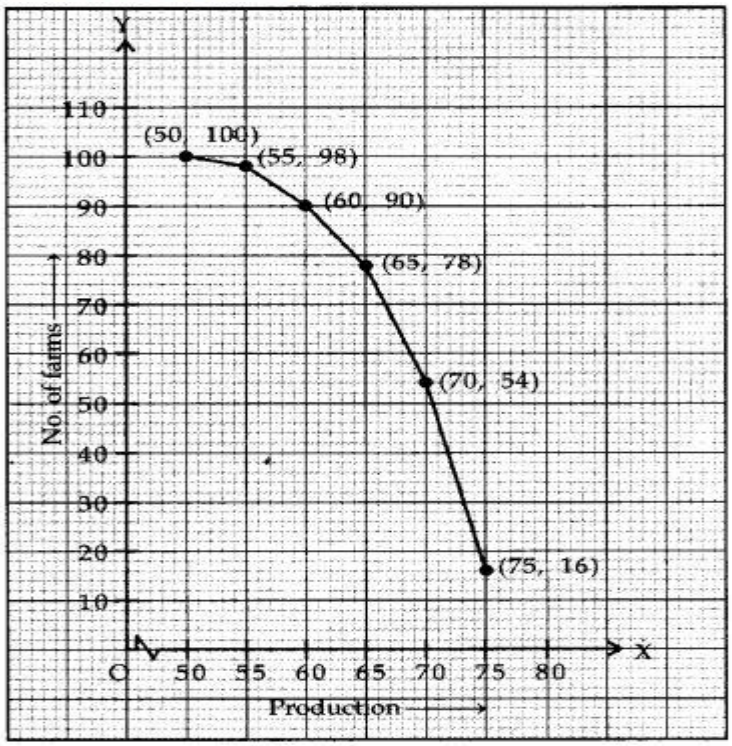
l = Lower limit of class, n = number of observations.
cf = Cumulative frequency of class preceding the median class.
f = Frequency of median class.
h = Class size.

$$\text{Median} = 46 + \left(\frac{17.5 - 14}{14}\right) \times 2 = 46 + \frac{3.5}{14} \times 2 = 46 + \frac{35}{14} \times \frac{2}{10} = 46 + 0.5 = 46.5$$

Ex 14.4 Class 10 Maths Question 3.
The following table gives production yield per hectare of wheat of 100 farms of a village.

Production yield (in kg/ha)	No. of farms
50 – 55	2
55 – 60	8
60 – 65	12
65 – 70	24
70 – 75	38
75 – 80	16

Change the distribution to a more than type distribution, and draw its ogive.
Solution:

Production yield (in kg/ha)	No. of farms (frequency)	Cumulative frequency
More than or equal to 50	2	100
More than or equal to 55	8	100 – 2 = 98
More than or equal to 60	12	98 – 8 = 90
More than or equal to 65	24	90 – 12 = 78
More than or equal to 70	38	78 – 24 = 54
More than or equal to 75	16	54 – 38 = 16
	$n = 100$	

Now, we plot the points (50, 100), (55, 98), (60, 90), (65, 78), (70, 54) and (75, 16) to get the required ogive as shown below.