RS Aggarwal Class 9 Mathematics Solution

Statistics

Exercise 14A

▣ Lets find the class mark of the first class of the given table.

$$\text{Class Mark} = \frac{\text{Upper Limit}(25) + \text{Lower Limit}(10)}{2}$$

$$= \frac{35}{2} = 17.5$$

Similarly, we can all the other Class Marks and derive this following table:

C.I.	No. of students(f)	C.M (x)	fx
10-25	2	17.5	35.0
25-40	3	32.5	97.5
40-55	7	47.5	332.5
55-70	6	32.5	375.0
70-85	6	77.5	465.0
85-100	6	92.5	555.0
Total	$\Sigma f=30$		$\Sigma fx=1860.0$

Now,

$$\text{mean} = \frac{\Sigma fx}{\Sigma f}$$

$$= \frac{1860}{30}$$

$$= 62$$

Question 1:

Statistics is a branch of science which deals with the collection, presentation, analysis and interpretation of numerical data.

Question 2:

Fundamental characteristics of statistics :

(i) It deals only with the numerical data.

(ii) Qualitative characteristic such as illiteracy, intelligence, poverty etc cannot be measured numerically

(iii) Statistical inferences are not exact.

Question 3:

Primary data: Primary data is the data collected by the investigator himself with a definite plan in his mind. These data are very accurate and reliable as these being collected by the investigator himself.

Secondary Data: Secondary data is the data collected by a person other than the investigator.

Secondary Data is not very reliable as these are collected by others with purpose other than the investigator and may not be fully relevant to the investigation.

Question 4:

(i) Variate : Any character which can assume many different values is called a variate.

(ii) Class Interval :Each group or class in which data is condensed is called a class interval.

(iii) Class-Size : The difference between the true upper limit and the true lower limit of a class is called class size.

(iv) Class-mark : The average of upper and lower limit of a class interval is called its class mark.

i.e Class mark = $\dfrac{upper\ \ limit\ \ +\ \ lower\ \ limit}{2}$

(v) Class limit: Class limits are the two figures by which a class is bounded . The figure on the left side of a class is called lower lower limit and on the right side is called its upper limit.

(vi) True class limits : In the case of exclusive form of frequency distribution, the upper class limits and lower class limits are the true upper limits and the true lower limits. But in the case of inclusive form of frequency distribution , the true lower limit of a class is obtained by subtracting 0.5 from the lower limit of the class. And the true upper limit of the class is obtained by adding 0.5 to the upper limit.
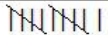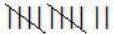
(vii) Frequency of a class : The number of observations falling in a class determines its frequency.

(viii) Cumulative frequency of a class: The sum of all frequencies up to and including that class is called , the cumulative frequency of that class.

Question 5:

Minimum observation is 0 and maximum observation is 6. The classes of equal size covering the given data are : (0-2), (2-4), (4-6) and (6-8).

Thus , the frequency distribution may be given as under:

No of children	Tally marks	Frequency
0 – 2	𝖭𝖭𝖭𝖭 𝖨	11
2 – 4	𝖭𝖭𝖭𝖭 𝖨𝖨	17
4 – 6	𝖭𝖭 𝖨𝖨𝖨𝖨	9
6 – 8	𝖨𝖨𝖨	3
	Total	40

Question 6:

S Aggarwal Class 9 Mathematics Solution

Minimum observation is 1 and minimum observation is 24. The classes of equal size converging the given data are : (0-5), (5-10), (10-15), (15-20), (20-25)

Thus, the frequency distribution may be given as under :

Marks	Tally Marks	Frequency
0 – 5	𝍸𝍸 I	6
5 – 10	𝍸𝍸 𝍸𝍸	10
10 – 15	𝍸𝍸 III	8
15 – 20	𝍸𝍸 III	8
20 – 25	𝍸𝍸 III	8
	Total	40

Question 7:

Minimum observation is 6 and maximum observation is 23 .So the range is 23-6=17

The classes of equal size covering the given data are : (6-9), (9-12) , (12-15) , (15-18), (18-21), (21-24) ,

Thus the frequency distribution may be given as under :

Class interval (age)	Tally Marks	No. of students Frequency
6 – 9	𝍸𝍸	5
9 – 12	IIII	4
12 – 15	IIII	4
15 – 18	𝍸𝍸 II	7
18 – 21	III	3
21 – 24	𝍸𝍸 II	7
	Total	30

Question 8:

Minimum observation is 210 and maximum observation =320

So the range is (320-210)=110

The classes of equal size covering the given data are :

(210-230), (230-250), (250-270) , (270-290), (290-310), (310-330)

Thus the frequency distribution may be given as under :

Class interval (Monthly wages)	Tally Marks	No. of workers Frequency
210 – 230	IIII	4
230 – 250	IIII	4
250 – 270	𝍸𝍸	5
270 – 290	III	3
290 – 310	𝍸𝍸 II	7
310 – 330	𝍸𝍸	5
	Total	28

Question 9:

Minimum observation is 30 and maximum observation is 110

So, range is 100-30=80

The classes of equal size covering the given data are :

(30-40) ,(40-50) , (50-60) ,(60-70) , (70-80), (80-90),(90-100),(100-110), (110-120)

Thus , the frequency and cumulative frequency table may be given as under :

Class intervals (weight in g.)	Tally Marks	No. of oranges	Cumulative frequency
30 – 40	IIII	4	4
40 – 50	IHJ I	6	10
50 – 60	III	3	13
60 – 70	IHJ	5	18
70 – 80	IHJ IIII	9	27
80 – 90	IHJ I	6	33
90 – 100	II	2	35
100 – 110	III	3	38
110 – 120	II	2	40
	Total	40	

Question 10:

Minimum observations is 804 and maximum observation is 898 So, range is 898-804 =94

The class es of equal size covering the given data are :

(800-810), (810-820) , (820-830),(840-850), (850-860), (860-870), (870-880) ,(880-890), (890-900)

Thus the frequency table may be given as under :

Class intervals Weekly wages	Tally marks	No. of workers Frequency
800 – 810	III	3
810 – 820	II	2
820 – 830	I	1
830 – 840	IHJ III	8
840 – 850	IHJ	5
850 – 860	I	1
860 – 870	III	3
870 – 880	I	1
880 – 890	I	1
890 – 900	IHJ	5
	Total	30

Question 11:

Minimum observation 52 and maximum observation is 130

So , The range is 130-52=78

The classes of equal size covering the given data are :

(50-60), (60-70), (70-80), (80-90), (90-100), (100-110), (110-120), (120-130),(130-140)

Thus , the frequency table may be given as under :

Class interval (in Rupees)	Tally Marks	No. house frequency
50 – 60	||	2
60 – 70	𝚰𝚰𝚰𝚰 𝚰	6
70 – 80	|||	3
80 – 90	𝚰𝚰𝚰𝚰 |||	8
90 – 100	𝚰𝚰𝚰𝚰	5
100 – 110	𝚰𝚰𝚰𝚰 ||	7
110 – 120	||||	4
120 – 130	||||	4
130 – 140	|	1
	Total	40

Question 12:

Age (in years)	Number of Patients (Frequency)	Cumulative Frequency
10 – 20	90	90
20 – 30	50	140
30 – 40	60	200
40 – 50	80	280
50 – 60	50	330
60 – 70	30	360
Total	360	

Question 13:

Marks(below)	Number of students (Cumulative Frequency)	Class Intervals	Frequency
10	5	0 – 10	5
20	12	10 – 20	12 – 5 = 7
30	32	20 – 30	32 – 12 = 20
40	40	30 – 40	40 – 32 = 8

50	45	40 – 50	45 – 40 = 5
60	48	50 – 60	48 – 45 = 3
		Total	48

Question 14:

Marks(below)	Number of students (Cumulative Frequency)	Class Intervals	Frequency
10	17	0 – 10	17
20	22	10 – 20	22 – 17 = 5
30	29	20 – 30	29 – 22 = 7
40	37	30 – 40	37 – 29 = 8
50	50	40 – 50	50 – 37 = 13
60	60	50 – 60	60 – 50 = 10
		Total	60

Question 15:

Marks(below)	Number of students (Cumulative Frequency)	Class Intervals	Frequency
More than 60	0	More than 60	0
More than 50	16	50 – 60	16-0=16
More than 40	40	40 – 50	40-16=24
More than 30	75	30 – 40	75-40=35

S Aggarwal Class 9 Mathematics Solution

| More than 20	87	20 – 30	87-75=12
More than 10	92	10 – 20	92-87=5
More than 0	100	0 – 10	100-92=8
		Total	100

Exercise 14B

Question 1:

Take the various types of games along the x-axis and the number of students along the y-axis.

Along the y-axis, take 1 small square=3 units.

All the bars should be of same width and same space should be left between the consecutive bars.

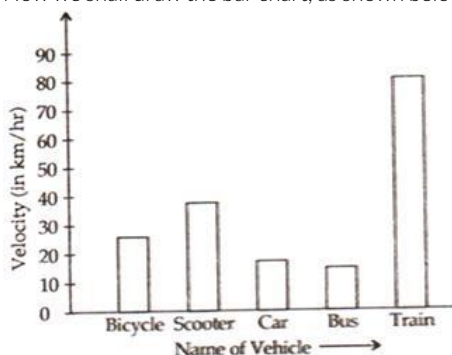Now we shall draw the bar chart, as shown below:
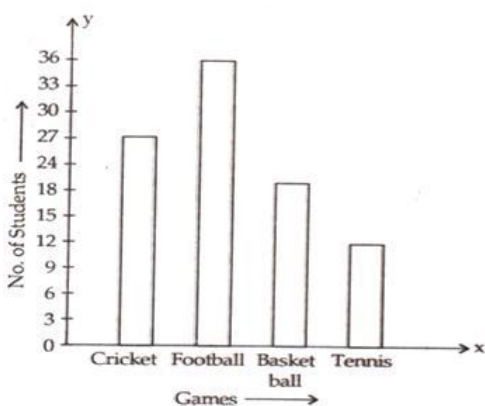
Question 2:

Take the timings along the x-axis and the temperatures along the y-axis.

Along the y-axis, take 1 small square=5 units.

All the bars should be of same width and same space should be left between the consecutive bars.
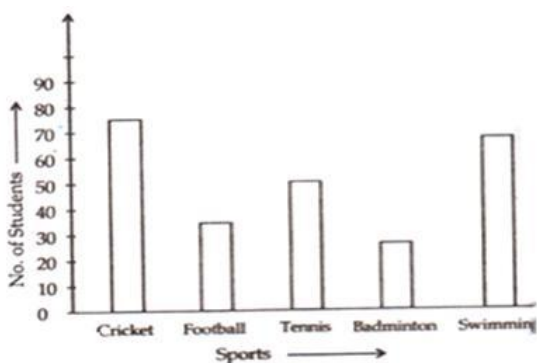
Now we shall draw the bar chart, as shown below:
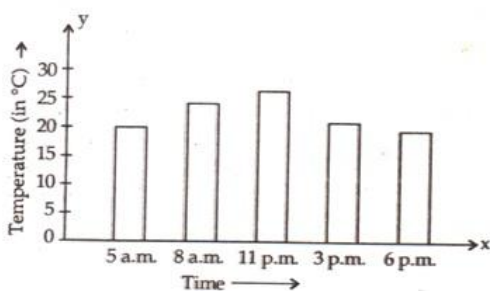
Question 3:

Take the modes of transport along the x-axis and the velocities along the y-axis.

Along the y-axis, take 1 small square=10 units.

All the bars should be of same width and same space should be left between the consecutive bars.

Now we shall draw the bar chart, as shown below:

Question 4:

Take the various types of sports along the x-axis and the number of students along the y-axis.

Along the y-axis, take 1 small square=10 units.

All the bars should be of same width and same space should be left between the consecutive bars.

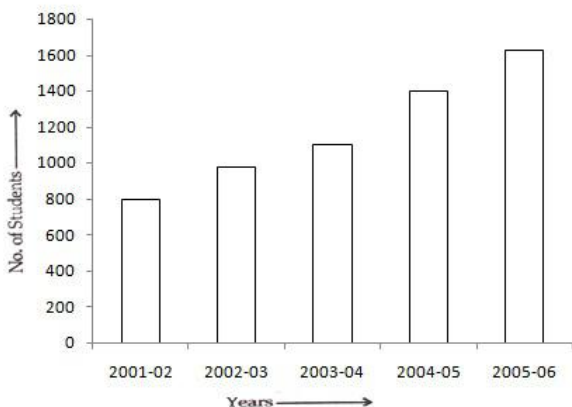Now we shall draw the bar chart, as shown below:

Question 5:

Take the academic year along the x-axis and the number of students along the y-axis.

Along the y-axis, take 1 big division =200 units.

All the bars should be of same width and same space should be left between the consecutive bars.
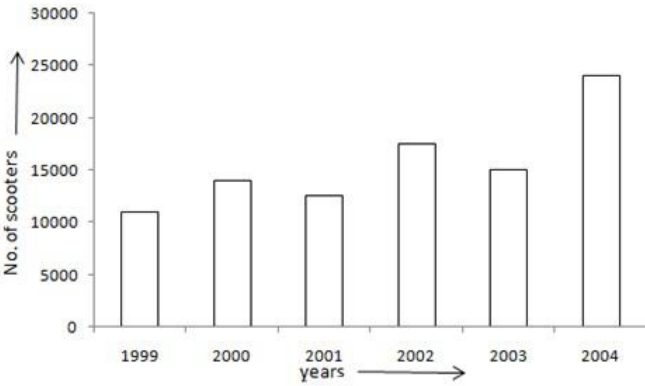
Now we shall draw the bar chart, as shown below:

Question 6:

Take the years along the x-axis and the number of scooters along the y-axis.

Along the y-axis, take 1 big division =5000 units.

All the bars should be of same width and same space should be left between the consecutive bars.

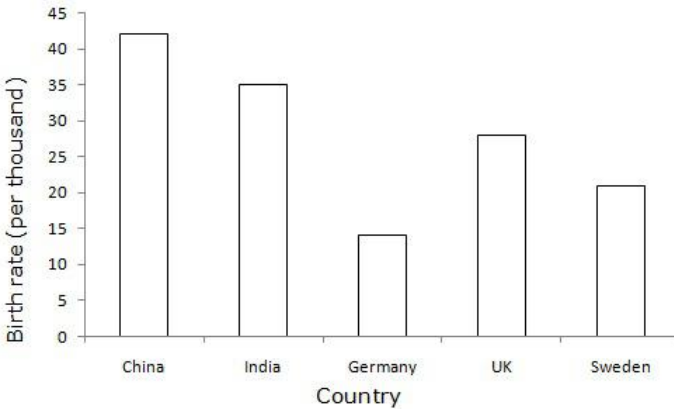Now we shall draw the bar chart, as shown below:

Question 7:

Take the countries along the x-axis and the birth rate (per thousand) along the y-axis.

Along the y-axis, take 1 big division = 5 units.

All the bars should be of same width and same space should be left between the consecutive bars.

Now we shall draw the bar chart, as shown below:

Question 8:

Take the years along the x-axis and the Interest (in Thousand Crore Rupees) along the y-axis.

Along the y-axis, take 1 big division =20 units.

All the bars should be of same width and same space should be left between the consecutive bars.

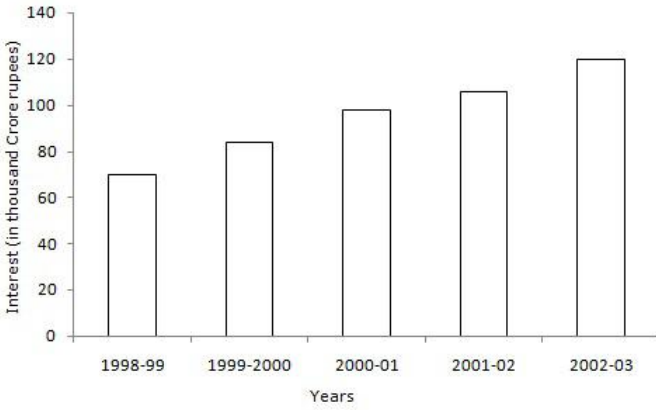Now we shall draw the bar chart, as shown below:

Question 9:

Take city along the x-axis and distance from Delhi (in Km) along the y-axis.

Along the y-axis, take 1 big division =200 units.

All the bars should be of same width and same space should be left between the

consecutive bars.

Now we shall draw the bar chart, as shown below:

Question 10:

Take Country along the x-axis and Life expectancy (in years) along the y-axis.

Along the y-axis, take 1 big division =10 units.

All the bars should be of same width and same space should be left between the

consecutive bars.

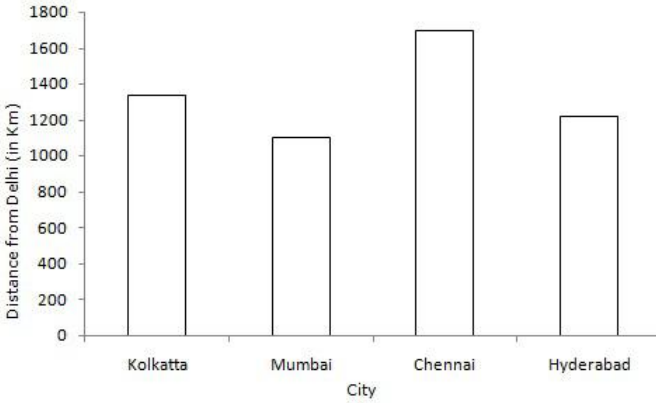Now we shall draw the bar chart, as shown below:

Question 11:

Take the number of week along the x-axis and rate per 10gm (in Rs.) along the y-axis.

Along the y-axis, take 1 big division =1000 units.

All the bars should be of same width and same space should be left between the consecutive bars.

Now we shall draw the bar chart, as shown below:

Question 12:

Take themode of transport along the x-axis and the number of students along the y-axis.

Along the y-axis, take 1 big division = 100 units.

All the bars should be of same width and same space should be left between the consecutive bars.

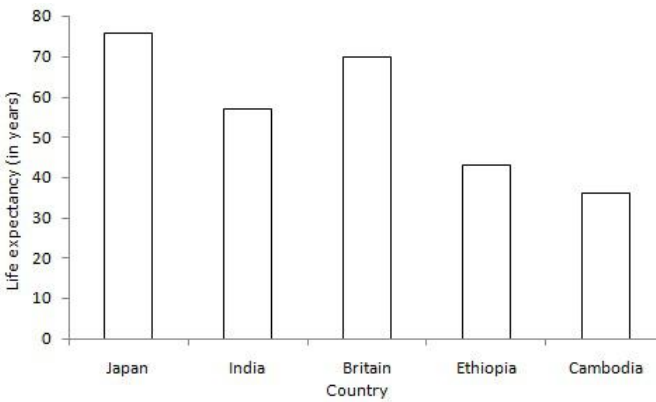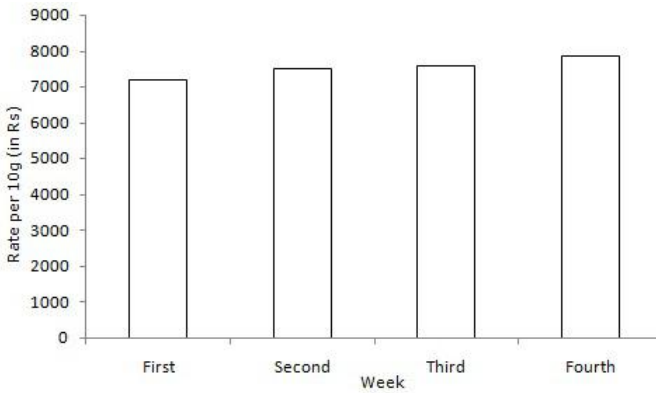Now we shall draw the bar chart, as shown below:
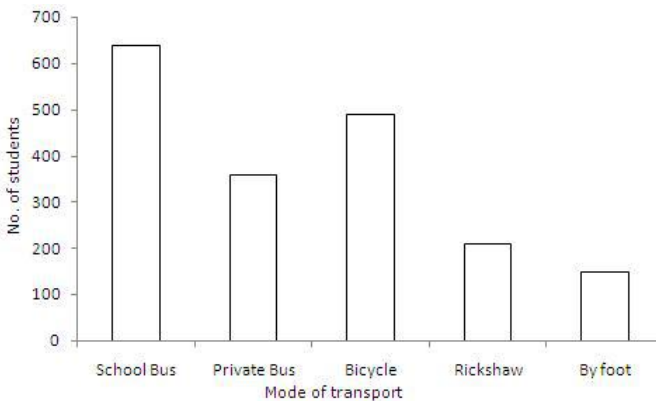
Question 13:

(i) The bar graph shows the marks obtained by a student in various subject in an examination.

(ii) The student is very good in mathematics.

(iii) He is poor in Hindi

(iv) Average marks = $\frac{(60+35+75+50+60)}{5} = \frac{280}{5} = 56$

Exercise 14C

Question 1:

Given frequency distribution is as below :

Daily wages (in Rs)	140-180	180-220	220-260	260-300	300-340	340-380
No. of						

| workers | 16 | 9 | 12 | 2 | 7 | 4 |

In the class intervals, if the upper limit of one class is the lower limit of the next class, it is known as the exclusive method of classification.
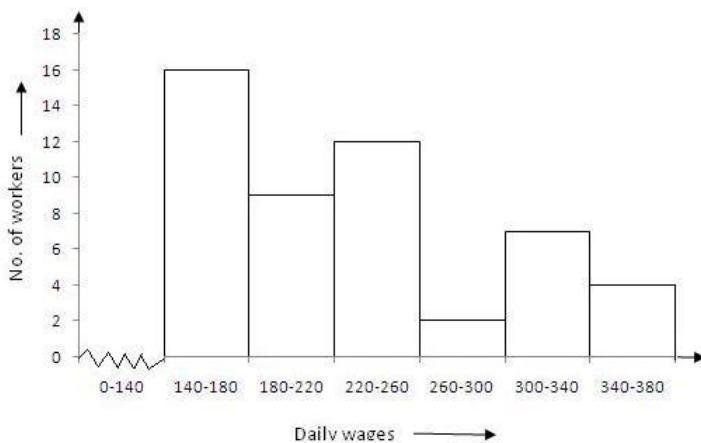
Clearly, the given frequency distribution is in the exclusive form.

To draw the required histogram , take class intervals , i.e. daily wages (in Rs.) along x-axis and frequencies i.e.no. of workers along y-axis and draw rectangles . So , we get the required histogram .

Since the scale on X-axis starts at 140, a kink(break) is indicated near the origin to show that the graph is drawn to scale beginning at 140.

Question 2:

Given frequency distribution is as below :

Daily earnings (in Rs)	600-650	650-700	700-750	750-800	800-850	850-900
No of stores	6	9	2	7	11	5

In the class intervals, if the upper limit of one class is the lower limit of the next class, it is known as the exclusive method of classification.

Clearly, the given frequency distribution is in the exclusive form.

We take class intervals, i.e. daily earnings (in Rs .) along x-axis and frequencies i.e. number of stores along y-axis. So , we get the required histogram .

Since the scale on X-axis starts at 600, a kink(break) is indicated near the origin to show that the graph is drawn to scale beginning at 600.

Question 3:

Give frequency distribution is as below :

Height (in cm)	130-136	136-142	142-148	148-154	154-160	160-166
No. of students	9	12	18	23	10	3

In the class intervals, if the upper limit of one class is the lower limit of the next class, it is known as the exclusive method of classification.

Clearly, the given frequency distribution is in the exclusive form.

We take class intervals, i.e. height (in cm) along x-axis and frequencies i.e. number of student s along y-axis . So we get the required histogram.

Since the scale on X-axis starts at 130, a kink(break) is indicated near the origin to show that the graph is drawn to scale beginning at 130.

Question 4:
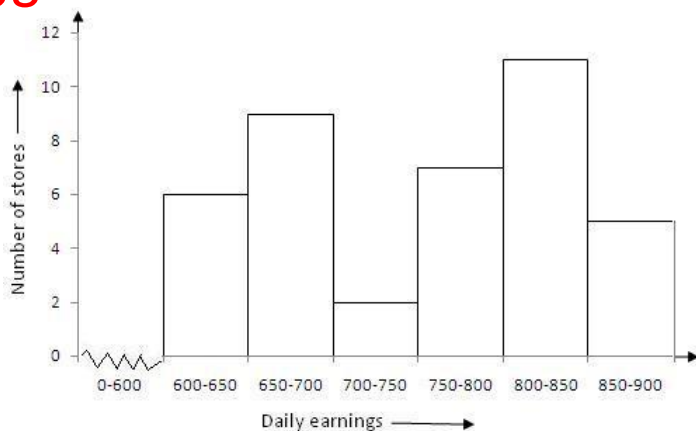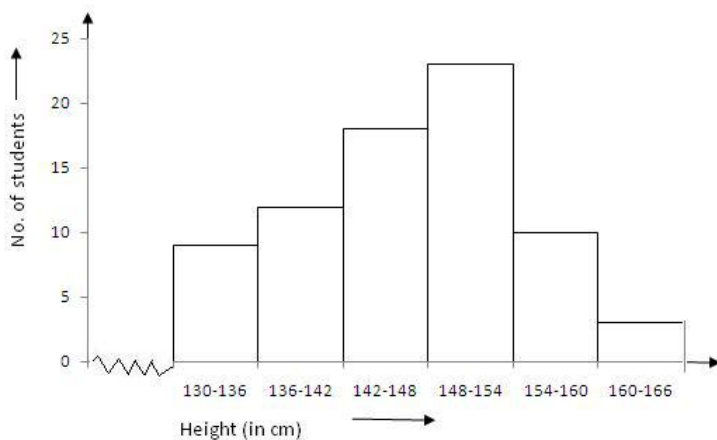
Give frequency distribution is as below :

Class Interval	8-13	13-18	18-23	23-28	28-33	33-38	38-43

Frequency	320	780	160	540	260	100	80

In the class intervals, if the upper limit of one class is the lower limit of the next class, it is known as the exclusive method of classification.

Clearly, the given frequency distribution is in the exclusive form.

We take class intervals along x-axis and frequency along y-axis . So , we get the required histogram.

Since the scale on X-axis starts at 8, a kink(break) is indicated near the origin to show that the graph is drawn to scale beginning at 8.
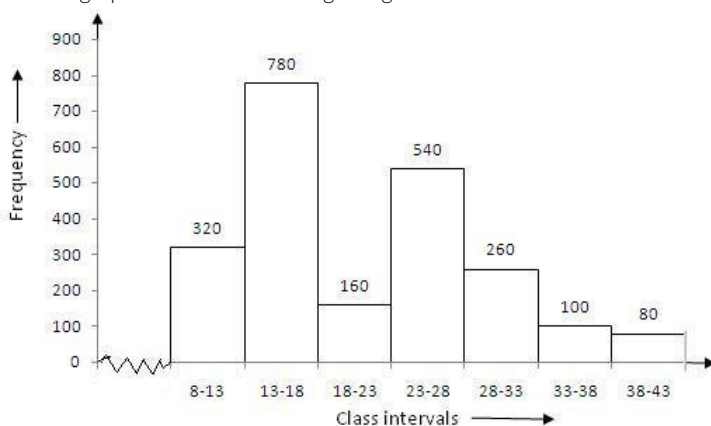
Question 5:

Histogram is the graphical representation of a frequency distribution in the form of rectangles, such that there is no gap between any two successive rectangles.

Clearly the given frequency distribution is in inclusive form, that is there is a gap between the upper limit of a class and the lower limit of the next class.

Therefore, we need to convert the given frequency distribution into exclusive form, as shown below:

Class Interval	4.5-12.5	12.5-20.5	20.5-28.5	28.5-36.5	36.5-44.5	44.5-52.5
Frequency	6	15	24	18	4	9

To draw the required histogram , take class intervals, along x-axis and frequencies along y-axis and draw rectangles . So, we get the required histogram .

Since the scale on X-axis starts at 4.5, a kink(break) is indicated near the origin to show that the graph is drawn to scale beginning at 4.5.

S Aggarwal Class 9 Mathematics Solution

Question 6:
Given frequency distribution is as below :

Age group (in years)	10-16	17-23	24-30	31-37	38-44	45-51	52-58
No. of Illiterate persons	175	325	100	150	250	400	525

Histogram is the graphical representation of a frequency distribution in the form of rectangles, such that there is no gap between any two successive rectangles.
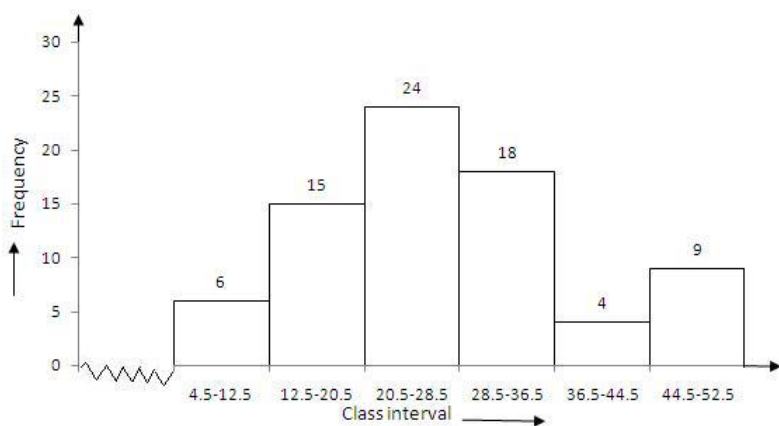Clearly the given frequency distribution is in inclusive form, that is there is a gap between the upper limit of a class and the lower limit of the next class.
Therefore, we need to convert the frequency distribution in exclusive form, as shown below:

Age group(in years)	9.5-16.5	16.5-23.5	23.5-30.5	30.5-37.5	37.5-44.4	44.5-51.5	51.5-58.5
No of Illiterate persons	175	325	100	150	250	400	525

To draw the required histogram , take class intervals, that is age group, along x-axis and frequencies, that is number of illiterate persons along y-axis and draw rectangles . So , we get the required histogram.
Since the scale on X-axis starts at 9.5, a kink(break) is indicated near the origin to show that the graph is drawn to scale beginning at 9.5.
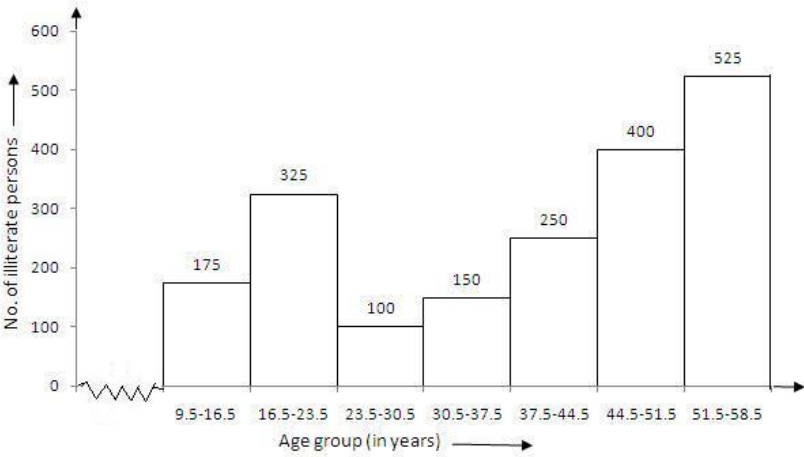
Question 7:

Given frequency distribution is as below :

Class Interval	10-14	14-20	20-32	32-52	52-80
Frequency	5	6	9	25	21

In the above table , class intervals are of unequal size, so we calculate the adjusted frequency by using the following formula :

$$Adjusted \quad Frequency = \frac{Minimum \quad class \quad size \quad \times \quad its \quad frequency}{Class \quad size \quad of \quad this \quad class}$$

Thus , the adjusted frequency table is

Class Intervals	Frequency	Adjusted Frequency
10 – 14	5	$\frac{4}{4} \times 5 = 5$
14 – 20	6	$\frac{4}{6} \times 6 = 4$
20 – 32	9	$\frac{4}{12} \times 9 = 3$
32 – 52	25	$\frac{4}{20} \times 25 = 5$
52 – 80	21	$\frac{4}{28} \times 21 = 3$

Now take class intervals along x-axis and adjusted frequency along y-axis and constant rectangles having their bases as class-size and heights as the corresponding adjusted frequencies.
Thus, we obtain the histogram as shown below:
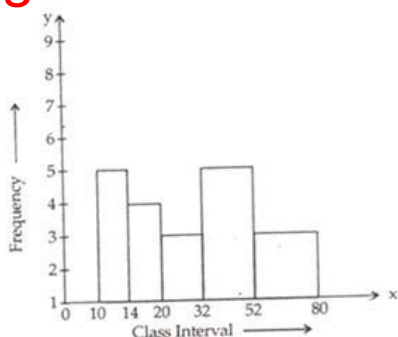
Question 8:

The given frequency distribution is as below:

Age in years	10-20	20-30	30-40	40-50	50-60	60-70
No of patients	2	5	12	19	9	4

In order to draw, frequency polygon, we require class marks.

The class mark of a class interval is: $\dfrac{upper\ \ limit\ \ +\ \ lower\ \ limit}{2}$

The frequency distribution table with class marks is given below:

Class Intervals	Class Marks	Frequency
0 – 10	5	0
10 – 20	15	2
20 – 30	25	5
30 – 40	35	12
40 – 50	45	19
50 – 60	55	9
60 – 70	65	4
70 – 80	75	0

In the above table, we have taken imaginary class intervals 0-10 at beginning and 70-80 at the end, each with frequency zero . Now take class marks along x-axis and the corresponding frequencies along y-axis.

Plot points (5,0), (15,2), (25, 5), (35, 12), (45, 19), (55, 9), (65, 4) and (75, 0) and draw line segments.
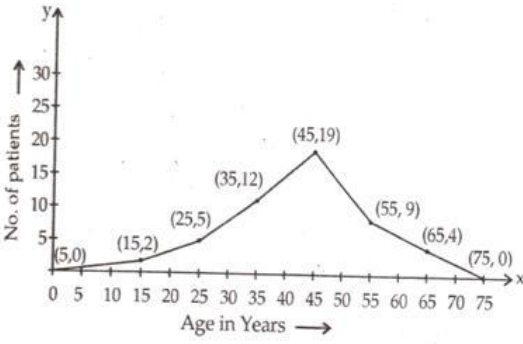
Question 9:

The given frequency distribution is as below

Age in years	10-20	20-30	30-40	40-50	50-60	60-70
Numbers of patients	90	40	60	20	120	30

Take class intervals i.e age in years along x-axis and number of patients of width equal to the size of the class intervals and height equal to the corresponding frequencies.
Thus we get the required histogram.
In order to draw frequency polygon, we take imaginary intervals 0-10 at the beginning and 70-80 at the end each with frequency zero and join the mid-points of top of the rectangles.
Thus, we obtain a complete frequency polygon, shown below:
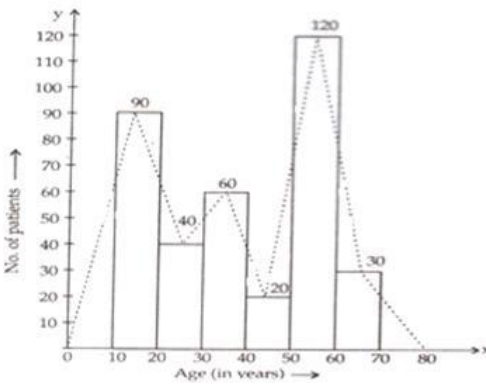
Question 10:

The given frequency distribution is as below :

Class Intervals	20-25	25-30	30-35	35-40	40-45	45-50
Frequency	30	24	52	28	46	10

Take class intervals along x-axis and frequencies along y-axis and draw rectangle s of width equal to the size of the class intervals and heights equal to the corresponding frequencies.

Thus we get required histogram.

Now take imaginary class intervals 15-20 at the beginning and 50-55 at the end , each with frequency zero and join the mid points of top of the rectangles to get the required frequency polygon.
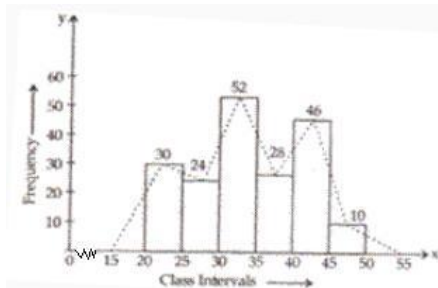
Question 11:

The given frequency distribution table is given below :

Class Interval	600-640	640-680	680-720	720-760	760-800	800-840
Frequency	18	45	153	288	171	63

Take class intervals along x-axis and frequencies along y-axis and draw rectangles of width equal to to size of class intervals and height equal to their corresponding frequencies.

Thus we get the required histogram.

Take imaginary class intervals 560-600 at the beginning and 840-880 at the end, each with frequency zero.

Now join the mid points of the top of the rectangles to get the required frequency polygon.

Question 12:
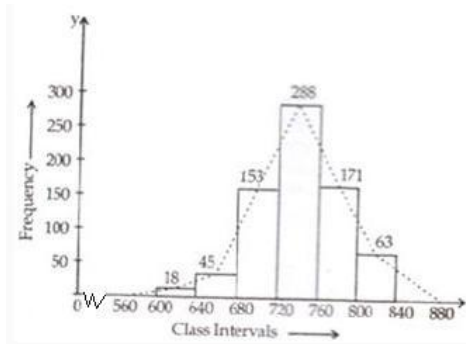
The given frequency distribution table is as below:

Class Intervals	1-10	11-20	21-30	31-40	41-50	51-60

S Aggarwal Class 9 Mathematics Solution

Frequency	8	3	6	12	2	7

This table has inclusive class intervals and so these are to be converted into exclusive class intervals (i.e true class limits).

These are (0.5-10.5), (10.5-20.5), (20.5-30.5), (30.5-40.5), (40.5-50.5), and (50.5-60.5)

In order to draw a frequency polygon, we need to determine the class marks. Class marks of a class interval = $\dfrac{upper \quad limit \quad + \quad lower \quad limit}{2}$

Take imaginary class interval (-9.5-0.5) at the beginning and (60.5-70.5) at the end , each with frequency zero. So we have the following table

Class Intervals	True class Intervals	Class marks	Frequency
(-9)-0	(-9.5)-0.5	-4.5	0
1-10	0.5-10.5	5.5	8
11-20	10.5-20.5	15.5	3
21-30	20.5-30.5	25.5	6
31-40	30.5-40.5	35.5	12
41-50	40.5-50.5	45.5	2
51-60	50.5-60.5	55.5	7
61-70	60.5-70.5	65.5	0

Now, take class marks along x-axis and their corresponding frequencies along y-axis. Mark the points and join them.

Thus, we obtain a complete frequency polygon as shown below:

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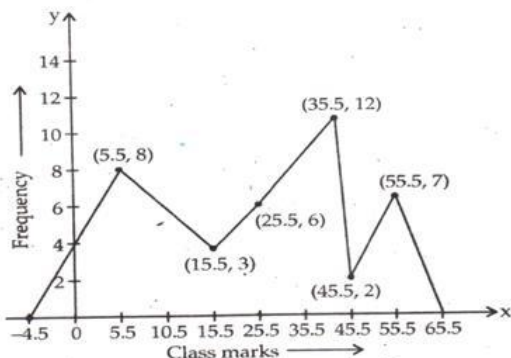
Exercise 14D

Mean, Median, Mode and Range

Mean
Add all the numbers then divide by the amount of numbers

9, 3, 1, 8, 3, 6

$9 + 3 + 1 + 8 + 3 + 6 = 30$

$30 \div 6 = 5$

The mean is 5

Median
Order the set of numbers, the median is the middle number

9, 3, 1, 8, 3, 6

1, 3, (3, 6,) 8, 9

The median is 4.5

Mode
The most common number

9, 3, 1, 8, 3, 6

The mode is 3

Range
The difference between the highest number and lowest number

9, 3, 1, 8, 3, 6

$9 - 1 = 8$

The range is 8

Question 1:

(i) first eight natural numbers are:

1,2,3,4,5,6,7and 8

$\therefore$ Mean $= \dfrac{\text{Sum of numbers}}{\text{Total numbers}}$

$= \dfrac{(1+2+3+4+5+6+7+8)}{8}$

$= \dfrac{36}{8} = 4.5$

$\therefore$ Mean $= 4.5$

(ii) First ten odd numbers are:

1,3,5,7,9,11,13,15, 17, and 19

$\therefore$ $\dfrac{\text{Sum of numbers}}{\text{Total numbers}} = \dfrac{(1+3+5+7+9+11+13+15+17+19)}{10}$

$= \dfrac{100}{10} = 10$

$\therefore$ Mean $= 10$

(iii) First five prime numbers are: 2, 3, 5, 7, 11

$\therefore$ Mean $= \dfrac{\text{Sum of numbers}}{\text{Total numbers}}$

$= \dfrac{(2+3+5+7+11)}{5}$

$= \dfrac{28}{5} = 5.6$

$\therefore$ Mean $= 5.6$

(iv) First six even numbers are: 2,4,6,8,10,12

$\therefore$ Mean $= \dfrac{\text{Sum of numbers}}{\text{Total numbers}}$

$= \dfrac{(2+4+6+8+10+12)}{6} = \dfrac{42}{6} = 7$

$\therefore$ Mean $= 7$.

(v) First seven multiples of 5 are: 5,10,15, 20, 25, 30, 35

$\therefore$ Mean $= \dfrac{\text{Sum of numbers}}{\text{Total numbers}}$

$= \dfrac{(5+10+15+20+25+30+35)}{7}$

$= \dfrac{140}{7} = 20$

Therefore, Mean $= 20$

(vi) Factors of 20 are: 1,2,4,5,10,20

$\therefore$ Mean $= \dfrac{\text{Sum of numbers}}{\text{Total numbers}}$

$= \dfrac{(1+2+4+5+10+20)}{6} = \dfrac{42}{6} = 7$

S Aggarwal Class 9 Mathematics Solution

Question 2:

$$\therefore \quad \text{Mean} = \frac{\text{Sum of numbers}}{\text{Total numbers}}$$

$$= \frac{(2+4+3+4+2+0+3+5+1+6)}{10}$$

$$= \frac{30}{10} = 10$$

$$\therefore \quad \text{Mean} = 3$$

Question 3:

$$\therefore \quad \text{Mean} = \frac{\text{Sum of numbers}}{\text{Total numbers}}$$

$$= \frac{(105+216+322+167+273+405+346)}{7}$$

$$= \frac{1834}{7} = 262$$

$$\therefore \text{Average number} = 262$$

Question 4:

$$\text{Mean temperature} = \frac{\text{Sum of temperatures}}{\text{Numbers of days}}$$

$$= \frac{(35.5+30.8+27.3+32.1+23.8+29.9)}{6}$$

$$= \frac{179.4}{6} = 29.9$$

$$\therefore \text{Mean temperature} = 29.9°F.$$

Question 5:

$$\therefore \text{Mean} = \frac{\text{sum of the marks}}{\text{numbers of students}}$$

$$= \frac{(64+36+47+23+0+19+81+93+72+35+3+1)}{12}$$

$$= \frac{474}{12} = 39.5$$

$$\therefore \text{Mean percentage of marks} = 39.5.$$

Question 6:

mean of the given number $= \dfrac{(7+9+11+13+x+21)}{6}$

$\left[\because \text{Mean} = \dfrac{\text{Sum of the observation}}{\text{Number of observation}}\right]$

$= \dfrac{(61+x)}{6}$

But   mean $=13$(given)

$\therefore \dfrac{61+x}{6} = 13$

$\Rightarrow \quad 61+x=78$

$\Rightarrow \quad x=78-61=17$

$\therefore$ the value of $x = 17$

Question 7:

Let the given numbers be $x_1, x_2 \ldots \ldots x_{24}$

$\Rightarrow \quad \text{Mean} = \dfrac{(x_1 + x_2 + \ldots \ldots + x_{24})}{24}$

$\therefore \dfrac{x_1 + x_2 + \ldots \ldots + x_{24}}{24} = 35$

$\Rightarrow x_1 + x_2 + \ldots \ldots x_{24} = 840 \ldots \ldots (i)$

The new numbers are $(x_1 + 3), (x_2 + 3) \ldots \ldots (x_{24} + 3)$

$\therefore$ Mean of the new numbers

$= \dfrac{(x_1 + 3) + (x_2 + 3) + \ldots \ldots + (x_{24} + 3)}{24} = \dfrac{840 + 72}{24}$ [using(i)]

$= \dfrac{912}{24} = 38$

$\therefore$ The new mean$=38$

Question 8:

Let the given numbers be $x_1, x_2 \ldots \ldots x_{20}$

Then , the mean of these numbers $=$

$\therefore \dfrac{x_1 + x_2 + \ldots \ldots + x_{20}}{20} = 43$

$\Rightarrow \qquad x_1 + x_2 + \ldots \ldots + x_{20} = 860 \qquad \ldots(i)$

The new number are $(x_1 - 6) + x_2 - 6) \ldots (x_{20} - 6)$

$\therefore$ The mean of the new numbers

$= \dfrac{(x_1 - 6) + (x_2 - 6) + \ldots + (x_{20} - 6)}{20}$

$= \dfrac{860 - 120}{20}$ $\ldots \ldots$[using (i)]

$= \dfrac{740}{20} = 37$

$\therefore$ The new mean$=37$

Question 9:

Let the given numbers be $x_1, x_2 \ldots \ldots \ldots x_{15}$

Then , the mean of these numbers $=$

$\therefore \dfrac{(x_1 + x_2 + \ldots \ldots x_{15})}{15} = 27$

$\Rightarrow \qquad x_1 + x_2 + \ldots \ldots x_{15} = 405$

The new numbers are $(x_1 \times 4) + (x_2 \times 4) \ldots (x_{15} \times 4)$

$\therefore$ Mean of the new numbers $= \dfrac{(x_1 \times 4) + (x_2 \times 4) \ldots (x_{15} \times 4)}{15}$

$= \dfrac{405 \times 4}{15} = \dfrac{1620}{15} = 108$

$\therefore$ The   new mean $= 108$

S Aggarwal Class 9 Mathematics Solution

Question 10:

Let the given number be $x_1, x_2, \ldots x_{12}$

Then the mean of these numbers = 40

$\therefore$ $\dfrac{(x_1 + x_2 + \ldots + x_{12})}{12} = 40$

$\Rightarrow$ $x_1 + x_2 + \ldots + x_{12} = 480$

The new numbers = $\dfrac{(x_1 \div 8) + (x_1 \div 8) + \ldots + (x_{12} \div 8)}{12}$

$= \dfrac{480 \div 8}{12} = \dfrac{60}{12} = 5$

$\therefore$ the new mean = 5

Question 11:

Let the given numbers be $x_1, x_2, \ldots, x_{20}$

Let $\overline{X}$ be the mean of these numbers

$\therefore \overline{X} = \dfrac{x_1 + x_2 + \ldots + x_{20}}{20} = 18$

$\Rightarrow x_1 + x_2 + \ldots + x_{20} = 18 \times 20 = 360 \ldots (1)$

But it is given that 3 is added to each
of the first ten numbers.

Therefore, the first new ten numbers are

$(x_1 + 3), (x_2 + 3), \ldots, (x_{10} + 3)$

Let $\overline{X'}$ be the mean of new numbers

$(x_1 + 3), (x_2 + 3), \ldots, (x_{10} + 3), x_{11}, \ldots, x_{20}$.

$\therefore \overline{X'} = \dfrac{(x_1 + 3) + (x_2 + 3) + \ldots + (x_{10} + 3) + x_{11} + \ldots + x_{20}}{20}$

$= \dfrac{(x_1 + x_2 + \ldots + x_{20}) + 3 \times 10}{20}$

From (1), we know that $x_1 + x_2 + \ldots + x_{20} = 360$

$\therefore$ Mean of the new set of 20 numbers

$= \dfrac{360 + 30}{20} = \dfrac{390}{20} = 19.5$

$\therefore$ Mean of the new set of 20 numbers = 19.5

Question 12:

Mean weight of the boys = 48 kg

Therefore , Mean weight = $\frac{Sum\,of\,the\,weight\,of\,six\,boys}{6} = 48$

Sum of the weight of 6 boys = (48×6)kg = 288kg

Sum of the weights of 5 boys = (51+45+49+46+44)kg = 235kg

Weight of the sixth boy = (sum of the weights of 6 boys) – (sum of the weights of 5 boys)

= (288-235) = 53kg.

$\therefore$ weight of the sixth boy = 53kg

Question 13:

Calculated mean marks of 50 students = 39

calculated sum of these marks = (39x 50) = 1950

Corrected sum of these marks

= [1950-(wrong number)+(correct number)]

= (1950-23+43) = 1970

$\therefore$ correct mean = $\frac{1970}{50} = 39.4$

Question 14:

calculated mean of 100 items = 64

sum of 100 items, as calculated = (100×64) = 6400

Correct sum of these items =[6400-(wrong items)+(correct items)]

=[6400-(26+9)+(36+90)]

=[6400-35+126]=6491

∴ Correct mean = $\frac{6491}{100} = 64.91$

Question 15:

Mean of 6 numbers = 23

Sum of 6 numbers =(23×6)=138

Again , mean of 5 numbers =20

Sum of 5 numbers=(20x 5) =100

The excluded number= (sum of 6 numbers)-(sum of 5 numbers)

=(138-100) =38

∴ The excluded number=38.

Exercise 14E

Question 1:

Mean marks of 7 students = 226

Sum of marks of seven students =(226×7)=1582

Marks obtained by 6 students = (340+180+260+56+275+307)

=1418

∴ Marks obtained by seventh student

= [(Sum of marks of 7 students)-(marks obtained by 6 students)]

=(1582-1418)=164

∴ Marks obtained by seventh student=164

Question 2:

Mean weight of 34 students = 46.5 kg

Total weight of 34 students =(34×46.5)kg =1581 kg

Mean weight of 34 students and the teacher =(46.5+0.5)kg=47kg (since 500 g = 0.5 kg)

∴ Total weight of 34 students and the teacher

=(47×35)kg =1645kg

∴ Weight of the teacher =(1645-1581)kg= 64kg

Question 3:

Mean weight of 36 students = 41 kg

Total weight of 36 students = 41x 36 kg = 1476kg

One student leaves the class mean is decreased by 200 g.

∴ New mean =(41-0.2)kg = 40.8 kg (since 200 g = 0.2 kg)

Total weight of 35 students = 40.8×35 kg = 1428 kg.

∴ the weight of the student who left =(1476-1428)kg =48 kg.

Question 4:

Mean weight of 39 students =40 kg

Total weight of 39 students = 40x 39) = 1560 kg

One student joins the class mean is decreased by 200 g.

∴ New mean =(40-0.2)kg = 39.8 kg (since 200 g = 0.2 kg)

Total weight of 40 students =(39.8×40)kg=1592 kg.

∴ the weight of new student

= Total weight of 40 students – Total weight of 39 students

= 1592-1560 = 32 kg

Question 5:

S Aggarwal Class 9 Mathematics Solution

Mean salary of 20 workers =Rs.7650

Total salary of 20 workers =Rs(7650x 20)=Rs. 153000.

Now if managers salary is added mean becomes Rs. 8200

∴ Total salary of 20 workers + manager's salary= Rs.(8200×21)

=Rs. 172200

∴ Manager's salary per month

= Total salary of 20 workers and the Manager – Total salary of 20 workers

=Rs(172200-153000)

=Rs.19200

Question 6:

Mean monthly wage of 10 persons =Rs.9000

Total monthly wage of 10 persons=Rs(9000×10)

=Rs. 90000

New mean monthly wage

$$= \frac{[(\text{total monthly wage of 10 persons}) - (\text{wages of worker who left}) + (\text{wages of worker who joined})]}{10}$$

$$= \frac{\text{Rs. } 90000 - \text{Rs. } 8100 + \text{Rs. } 7200)}{10}$$

$$= \text{Rs.} \left(\frac{89100}{10} \right) = 8910$$

∴ The new monthly average wage = Rs.8910

Question 7:

Mean consumption of petrol for the first 7 months=330 litres

Total consumption of petrol for the first 7 months=(330×7)liters=2310 litres

Mean consumption of petrol for the next five 5 months=270 litres

Total consumption of petrol for the next five 5 months=(270×5)=1350 litres

Total consumption of petrol in one year

=(2310+1350) litres

=3660 litres.

∴ Mean consumption of petrol = $\frac{3660}{12}$ = 305 litres per month

Question 8:

Mean of 15 numbers=18

Total sum of 15 numbers=(18×15)=270

Remaining numbers = 25 – 15 = 10

Mean of 10 numbers=13

Total sum of 10 numbers=(13x 10)=130

∴ Total sum of 25 numbers=(270+130)=400

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

Question 9:

Mean weight of 60 students = 52.75 kg

Sum of weight of 60 students = 60×52.75 kg

Mean weight of 25 students = 51

Sum of weight of 25 students = 25×51 kg

Remaining students = 60 – 25 = 35

Total weight of the remaining 35 students

= Sum of weight of 60 students – Sum of weight of 25 students

= (60×52.75 – 25×51)kg

=(3165-1275)=1890 kg

∴ Mean weight of remaining students = $\frac{1890}{35}$ = 54 kg

Question 10:

The increase in the average of 10 oarsmen = 1.5 kg

Total weight increased =(1.5×10) kg=15 kg

Since the man weighing 58 kg has been replaced,

Weight of the new man =(58+15)kg =73kg.

Question 11:

Mean of 8 numbers=35

∴ Total sum of 8 numbers = 35×8 = 280

Since One number is excluded, New mean = 35 – 3 = 32

∴ Total sum of 7 numbers = 32×7 = 224

the excluded number = Sum of 8 numbers – Sum of 7 numbers

= 280 – 224 = 56

Question 12:

Mean of 150 items = 60

Total Sum of 150 items = 150×60 = 9000

∴ Correct sum of items =[(sum of 150 items)-(sum of wrong items)+(sum of right items)]

= [9000 – (52 + 8) + (152 + 88)]

= [9000-(52+8)+(152+88)]

= 9180

∴ Correct mean = $\frac{9180}{150}$ = 61.2

Question 13:

Mean of 31 results=60

Total sum of 31 results = 31×60 = 1860

Mean of the first 16 results =16×58=928

Total sum of the first 16 results=16×58=928

Mean of the last 16 results=62

Total sum of the last 16 results=16×62=992

∴ The 16th result = 928 + 992 – 1860

= 1920 – 1860 = 60

∴ The 16th result = 60.

Question 14:

Mean of 11 numbers = 42

Total sum of 11 numbers = 42×11 = 462

Mean of the first 6 numbers = 37

Total sum of first 6 numbers = 37×6 = 222

Mean of the last 6 numbers = 46

Total sum of last 6 numbers = 6×46 = 276

∴ The 6th number= 276 + 222 – 462

= 498 – 462 = 36

∴ The 6th number = 36

Question 15:

Mean weight of 25 students = 52kg

Total weight of 25 students = 52×25 kg=1300 kg

Mean of the first 13 students = 48 kg

Total weight of the first 13 students = 48×13 kg = 624kg

Mean of the last 13 students = 55 kg

Total weight of the last 13 students = 55×13 kg = 715 kg

∴ The weight of 13th student

= Total weight of the first 13 students + Total weight of the last 13 students – Total weight of 25 students

= 624+715-1300 kg

= 39 kg.

Therefore, the weight of 13th student is 39 kg.

Question 16:

Mean score of 25 observations = 80

Total score of 25 observations = 80×25 = 2000

Mean score of 55 observations = 60

Total score of 55 observations = 60×55 =3300

Total no. of observations = 25+55 =80 observations

∴ Total score = 2000+3300 = 5300

∴ Mean score = $\dfrac{5300}{80}$ = 66.25

Question 17:

Average marks of 4 subjects = 50

Total marks of 4 subjects = 50×4 = 200

∴ 36 + 44 + 75 + x = 200

⇒ 155 + x = 200

⇒ x = 200 – 155 = 45

∴ The value of x = 45

Question 18:

Mean monthly salary of 75 workers = Rs. 5680

So, Total monthly salary of 75 workers = Rs. 5680×75 = Rs. 426000

Mean monthly salary of 25 workers = Rs. 5400

So, Total monthly salary of 25 workers = Rs. 5400×25 = Rs. 135000

Mean monthly salary of 30 workers = Rs. 5700

So, Total monthly salary of 30 workers = Rs. 5700×30 = Rs. 171000

Remaining workers = 75 – 55 = 20 workers

Total salary of remaining 20 workers

=Rs. [426000 – (135000 + 171000)]

= Rs. [426000 – 306000]

=Rs. 120000

∴ Mean salary of the remaining 20 workers= Rs. $\dfrac{120000}{20}$ = Rs. 6000

Question 19:

Let the distance of mark from the staring point be x km.

Then , time taken by the ship reaching the marks= $\left(\dfrac{x}{15}\right)$ hours (since time = $\dfrac{distance}{speed}$

Time taken by the ship reaching the starting point from the marks = $\left(\dfrac{x}{10}\right)$ hours

Total time taken = $\dfrac{x}{15} + \dfrac{x}{10} = \dfrac{x}{6}$ hours

Total distance covered =x+x=2x km.

∴ average speed of whole journey = 2x ÷ $\dfrac{x}{6}$ = $\dfrac{2x \times 6}{x}$ = 12 km/hour

Question 20:

Total number of students = 50

Total number of girls = 50-40 = 10

Average weight of the class = 44 kg

Total weight of 50 students= 44x 50 kg = 2200kg

Average weight of 10 girls = 40 kg

Total weight of 10 girls = 40×10 kg = 400 kg

∴ Total weight of 40 boys = 2200-400 kg =1800 kg

∴ the average weight of the boys = $\dfrac{1800}{40}$ = 45 kg

Exercise 14F

Question 1:

For calculating the mean , we prepare the following table :

Daily wages (in Rs) (X$_i$)	No of workers (f$_i$)	f$_i$x$_i$
90	12	1080
110	14	1540
120	13	1560
130	11	1430
150	10	1500
	$\sum f_i = 60$	7110

$$\text{Mean} = \frac{\sum f_i x_i}{\sum f_i} = \frac{7110}{60} = 118.5$$

∴ mean of daily wages of 60 workers = Rs. 118.50

Question 2:

For calculating the mean , we prepare the following frequency table :

Weight (in kg) (X$_i$)	No of workers (f$_i$)	f$_i$X$_i$
60	4	240
63	3	189

66	2	132
69	2	138
72	1	72
	$\sum f_i = 12$	771

$\text{Mean} = \dfrac{\sum f_i x_i}{\sum f_i} = \left(\dfrac{771}{12}\right) \text{kg} = 64.25 \text{kg}$

∴ mean weight of the workers = 64.25kg

Question 3:

For calculating the mean, we prepare the following frequency table:

Age (in years) (X_i)	Frequency (f_i)	$f_i X_i$
15	3	45
16	8	128
17	9	153
18	11	198
19	6	114
20	3	60
	$\sum f_i = 40$	698

$\text{Mean} = \dfrac{\sum f_i x_i}{\sum f_i} = \dfrac{698}{40} = 17.45$

∴ mean age of the students = 17.45 years.

Question 4:

For calculating the mean, we prepare the following frequency table:

Variable	Frequency	

(X$_i$)	(f$_i$)	f$_i$X$_i$
10	7	70
30	8	240
50	10	500
70	15	1050
89	10	890
	$\sum f_i = 50$	$\sum f_i x_i = 2750$

$$\text{Mean} = \frac{\sum f_i x_i}{\sum f_i} = \frac{2750}{50} = 55.$$

Question 5:

We prepare the following frequency table :

(X$_i$)	(f$_i$)	f$_i$X$_i$
3	6	18
5	8	40
7	15	105
9	P	9P
11	8	88
13	4	52
	$\sum f_i = 41 + p$	$\sum f_i x_i = 303 + 9p$

$$\text{Mean} = \frac{\sum f_i x_i}{\sum f_i} = \frac{303 + 9P}{41 + P}$$

Butmean = 8(given)

$$\therefore \quad \frac{303 + 9P}{41 + p} = 8$$

⇒ 303 + 9p = 8(41+p)

⇒ 303 + 9p= 328 + 8p

⇒ 9p – 8p = 328 -303

⇒ P=25

∴ the value of P=25

Question 6:

We prepare the following frequency distribution table:

(X$_i$)	(f$_i$)	f$_i$X$_i$
15	8	120
20	7	140
25	P	25p
30	14	420
35	15	525
40	6	240
	$\sum f_i = 50 + p$	$\sum f_i x_i = 1445 + 25p$

$$\text{Mean} = \frac{\sum f_i x_i}{\sum f_i} = \frac{1445 + 25p}{50 + p}$$

But mean = 28.25 given

$$\therefore \quad \frac{1445+25p}{50+p} = 28.25$$

⇒ 1445 + 25p = (28.25)(50+p)

⇒ 1445 + 25p = 1412.50 + 28.25p

⇒ -28.25p + 25p = -1445 + 1412.50

⇒ -3.25p = -32.5

⇒ $\frac{32.5}{3.25}$ = 10

∴ the value of p=10

Question 7:

We prepare the following frequency distribution table:

(X$_i$)	(f$_i$)	f$_i$X$_i$
8	12	96
12	16	192
15	20	300
P	24	24p

20	16	320
25	8	200
30	4	120
	$\sum f_i = 100$	$\sum f_i x_i = 1228 + 24p$

$$\therefore \text{Mean} = \frac{\sum f_i x_i}{\sum f_i} = \frac{1228 + 24p}{100}$$

But mean = 16.6 (given)

$$\therefore \frac{1228 + 24p}{100} = 16.6$$

$\Rightarrow 1228 + 24p = 1660$

$\Rightarrow 24p = 1660 - 1228$

$\Rightarrow 24p = 432$

$\Rightarrow \frac{432}{24} = 18$

$\therefore$ the value of p = 18

Question 8:

Let f_1 and f_2 be the missing frequencies.

We prepare the following frequency distribution table.

(X$_i$)	(f$_i$)	f$_i$x$_i$
10	17	170
30	f_1	$30f_1$
50	32	1600
70	f_2	$70f_2$
90	19	1710
Total	120	$3480 + 30f_1 + 70f_2$

Here,

$\sum f_i = 68 + f_1 + f_2$

But $68 + f_1 + f_2 = 120$ (Given)

Therefore,

$68 + f_1 + f_2 = 120$

$\Rightarrow f_1 + f_2 = 120 - 68 = 52$

Thus, $f_2 = 52 - f_1$.......(1)

Also,

$$\text{Mean} = \frac{\sum f_i x_i}{\sum f_i} = \frac{3480 + 30f_1 + 70f_2}{120}$$

$$= \frac{3480 + 30f_1 + 70(52-f_1)}{120} \quad \text{using equation 1}$$

$$= \frac{3480 + 30f_1 + 3640 - 70f_1}{120}$$

$$= \frac{7120 - 40f_1}{120}$$

But mean = 50 (given)

Therefore, we have,

$$50 = \frac{7120 - 40f_1}{120}$$

$$6000 = 7120 - 40f_1$$

$$40f_1 = 1120$$

$$f_1 = \frac{1120}{40} = 28$$

Substituting the value of f1 in equation 1, we have,

f2 = 52 − 28 = 24

Thus, the missing frequencies are f1 = 28 and f2 = 24 respectively.

Question 9:

Let the assumed mean (A) = 900

Weekly wages (X$_i$)	No of workers (f$_i$)	d$_i$=(x$_i$-A) =x$_i$-900	f$_i$ x d$_i$
800	7	-100	-700
820	14	-80	-1120
860	19	-40	-760
900	25	0	0
920	20	20	400
980	10	80	800
1000	5	100	500
	$\sum f_i = 100$		-880

Let $\bar{X}$ be the mean. Using formula,

$$\bar{X} = A + \frac{\sum f_i \times d_i}{\sum f_i}$$

$$= \left[900 + \left(\frac{-880}{100}\right)\right]$$

$$= 900 - 8.80$$

$$= 891.20$$

∴ mean weekly wages = Rs. 891.20

S Aggarwal Class 9 Mathematics Solution

Question 10:

Let the assumed mean be A = 67

Height in cm (X_i)	No of plants (f_i)	$d_i=(x_i-A)$ $=(x_i-67)$	f_i d_i
61	5	-6	-30
64	18	-3	-54
67	42	0	0
70	27	3	81`
73	8	6	48
		100	$\sum f_i d_i = 45$

Let $\bar{x}$ be the mean.
Therefore,

Mean, $\bar{x} = A + \dfrac{\sum f_i \times d_i}{\sum f_i}$, where A is the assumed mean

$= 67 + \dfrac{45}{100}$

$= 67 + 0.45$

$= 67.45$

Therefore, mean height of the plants is 67.45 cm.

Question 11:

Clearly , h=1. Let the assumed mean A=21

(X_i)	(f_i)	$u_i = \frac{x_i-21}{1}$	$f_i u_i$
18	170	-3	-510
19	320	-2	-640
20	530	-1	-530
21	700	0	0
22	230	1	230
23	140	2	280
24	110	3	330

Total	$\sum f_i = 2200$		$\sum f_i u_i = -840$

Let $\overline{x}$ be the mean.
Using formula,

Mean, $\overline{x} = A + h \times \dfrac{\sum f_i u_i}{\sum f_i}$

$= 21 + 1 \times \left(\dfrac{-840}{2200}\right)$

$= 21 + (-0.38)$

$= 20.62$

Thus the mean is 20.62

Question 12:

Clearly, h= (x2- x1)

=(600-200)=400

Let assumed mean A =1000

Height (in m) (Xᵢ)	No of villages (fᵢ)	$u_i = \frac{x_i - 1000}{400}$	fᵢxuᵢ
200	142	-2	-284
600	265	-1	-265
1000	560	0	0
1400	271	1	271
1800	89	2	178
2200	16	3	48
Total	$\sum f_i = 1343$		$\sum f_i u_i = -52$

Let $\overline{x}$ be the mean.

Using formula,

Mean, $\overline{x} = A + h \times \dfrac{\sum f_i u_i}{\sum f_i}$

$= 1000 + 400 \times \left(\dfrac{-52}{1343}\right)$

$= 1000 + 400 \times (-0.0387)$

$= 1000 + (-15.488)$

$= 984.51$

Thus, the mean height is 984. 51 m

Exercise 14G

S Aggarwal Class 9 Mathematics Solution

Question 1:

(i) Arranging the data in accending order, we have

2,2,3, 5, 7, 9, 9, 10, 11

Here n = 9, which is odd

$$median = \frac{1}{2}(n+1)th \ term$$
$$= \frac{(9+1)}{2}th \ term$$
$$= value \ of \ the \ 5th \ term$$
$$= 7$$
$$\therefore median = 7$$

(ii) Arranging the data in ascending order , we have

6, 8, 9, 15, 16, 18, 21, 22, 25

Here n = 9, which is odd

$$median = \frac{1}{2}(n+1)th \ term$$
$$= \frac{(9+1)}{2}th \ term$$
$$= value \ of \ the \ 5th \ term$$
$$= 16$$
$$\therefore median = 16$$

(iii) Arranging data in ascending order:

6, 8, 9, 13, 15, 16, 18, 20, 21, 22, 25

Here n = 11 odd

$$median = \frac{1}{2}(n+1)th \ term$$
$$= \frac{(11+1)}{2}th \ term$$
$$= value \ of \ the \ 6th \ term$$
$$= 16$$

Therefore, median = 16

(iv) Arranging the data in ascending order , we have

0, 1, 2, 2, 3, 4, 4, 5, 5, 7, 8, 9, 10

Here n = 13, which is odd

$$median = \frac{1}{2}(n+1)th \ term$$
$$= \frac{(13+1)}{2}th \ term$$
$$= value \ of \ the \ 7th \ term$$
$$= 4$$
$$\therefore median = 4$$

Question 2:

(i) Arranging the data in ascending order , we have

9, 10, 17, 19, 21, 22, 32, 35

Here n = 8, which is even

$$median = \frac{1}{2}\left[\left[\left(\frac{n}{2}\right)\right]th \ term + \left(\frac{n}{2}+1\right)th \ term\right]$$
$$= \frac{(1)}{2}[(4th \ term + 5th \ term)][\because n = 8]$$
$$= \frac{1}{2}(19+21)$$
$$= \left(\frac{1}{2}\times40\right) = 20$$
$$\therefore median = 20$$

(ii) Arranging the data in ascending order , we have

29, 35, 51, 55, 60, 63, 72, 82, 85, 91

Here n = 10, which is even

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

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

$$= \frac{1}{2}(60 + 63)$$

$$= \left(\frac{1}{2} \times 123\right) = 61.5$$

$$\therefore \quad \text{median} = 61.5$$

(iii) Arranging the data in ascending order , we have

3, 4, 9, 10, 12, 15, 17, 27, 47, 48, 75, 81 Here n = 12, which is even

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

$$= \frac{1}{2}\left[(6\text{th term} + 7\text{th term})\right][\because n = 12]$$

$$= \frac{1}{2}(15 + 17)$$

$$= \left(\frac{1}{2} \times 32\right) = 16$$

$$\therefore \quad \text{median} = 16$$

Question 3:

Arranging the data in ascending order , we have

17, 17, 19, 19, 20, 21, 22, 23, 24, 25, 26, 29, 31, 35, 40

Here n = 15, which is odd

$$\text{Median} = \frac{1}{2}(n + 1)\text{th term}$$

$$= \frac{1}{2}(15 + 1)\text{th term}$$

$$= \text{value of 8th term}$$

$$= 23$$

$$\therefore \text{Median} = 23$$

Thus, the median score is 23.

Question 4:

Arranging the heights of 9 girls in ascending order , we have

143.7, 144.2, 145, 146.5, 147.3, 148.5, 149.6, 150, 152.1

Here n = 9, which is odd

$$\therefore \text{median} = \frac{1}{2}(n + 1)\text{th term}$$

$$= \frac{(9 + 1)}{2}\text{th term}$$

$$= \text{value of 5th term}$$

$$= 147.3$$

$$\therefore \text{median height} = 147.3 \text{ cm}$$

Question 5:

Arranging the weights of 8 children in ascending order, we have

9.8, 10.6, 12.7, 13.4, 14.3, 15, 16.5, 17.2

Here , n= 8 , which is even

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

$$= \frac{1}{2}\left[(4\text{th term} + 5\text{th term})\right][\because n = 8]$$

$$= \frac{1}{2}(13.4 + 14.3)$$

$$= \left(\frac{1}{2} \times 27.7\right) = 13.85$$

$\therefore$ median weight $= 13.85$ kg

Question 6:

Arranging the ages of teachers in ascending order , we have

32, 34, 36, 37, 40, 44, 47, 50, 53, 54

Here, n = 10, which is even

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

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

$$= \frac{1}{2}(40 + 44)$$

$$= \left(\frac{1}{2} \times 84\right) = 42$$

$\therefore$ median age $= 42$ years

Question 7:

The ten observations in ascending order:

10, 13, 15, 18, x+1, x+3, 30, 32, 35, 41

Here, n = 10, which is even

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

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

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

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

$$= x + 2$$

$\therefore$ median $= x + 2$

But median $= 24$ (given)

$\therefore \quad x + 2 = 24$

$\Rightarrow \quad\quad x = 24 - 2$

$\therefore \quad\quad x = 22$

Question 8:

Let us now prepare the cumulative frequency table.

Weight (in kg)	No. of students	Cumulative frequency
45	8	8
46	5	13
48	6	19
50	9	28
52	7	35
54	4	39
55	2	41

Total n =41, which is odd

$$\text{median weight} = \left(\frac{n+1}{2}\right)\text{th term}$$

$$= \left(\frac{41+1}{2}\right)\text{th term}$$

$$= \text{value of 21st term}$$

∴ median weight = weight of the 21st student

But the above table shows that each one of the students from 20th to 28th has 50 kg as his weight.

∴ the weight of the 21st student will be 50kg.

Hence median weight = 50 kg.

Question 9:

Arrange the terms in an ascending order, we have

Variate	15	17	20	22	25	30
Frequency	3	5	9	4	6	10

Now preparing the cumulative frequency , we have

Variate	Frequency	Cumulative Frequency
15	3	3
17	5	8
20	9	17
22	4	21
25	6	27
30	10	37

Here n =37, which is odd

$\therefore$ median $= \left(\dfrac{n+1}{2}\right)$ th term

$= \left(\dfrac{37+1}{2}\right)$ th term

= 19th term

= frequency of the 19th variate

But the above table shows that the frequency of variates from 18th term to 21st term is 22

So the frequency of 19th term will be 22

$\therefore$ Median = 22

Question 10:

Arrange the terms in an ascending order, we have

Marks	9	20	25	40	50	80
No. of students	4	6	16	8	7	2

Now preparing the cumulative frequency , we have

Marks	No of students(Frequency)	Cumulative Frequency
9	4	4
20	6	10
25	16	26
40	8	34
50	7	41
80	2	43

Here, number of students = 43, which is odd

median $= \left(\dfrac{n+1}{2}\right)$ nd term

$= \left(\dfrac{43+1}{2}\right)$ nd term

= 22nd term

= marks of 22nd student

But the above table shows that each one of the students from 11th to 26th gets 25 marks.

So the 22nd student gets 25 marks

$\therefore$ median of marks = 25

S Aggarwal Class 9 Mathematics Solution

Question 11:

Arranging the terms in an ascending order, we have

Height(in cm)	151	152	153	154	155	156	157
No. of students	6	3	12	4	10	8	7

Now preparing the cumulative frequency , we have

Height (in cm)	No of students Frequency	Cumulative Frequency
151	6	6
152	3	9
153	12	21
154	4	25
155	10	35
156	8	43
157	7	50

Here , n=50 , which is even

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

$$= \frac{1}{2}\left[(25\text{th term} + 26\text{th term})\right][\because n = 50]$$

$$= \left(\frac{154+155}{2}\right)$$

$$= \frac{309}{2}$$

$$= 154.5$$

∴ median height =154.5 cm

Question 12:

Arrange the terms in an ascending order, we have

Variate	16	18	20	23	25	26	28	30
Frequency	9	8	13	4	4	6	11	5

Now preparing the cumulative frequency , we have

Variate	Frequency	Cumulative Frequency
16	9	9
18	8	17
20	13	30
23	4	34
25	4	38
26	6	44
28	11	55
30	5	60

Here, n = 60, which is even.

$$\therefore \quad \text{median} = \frac{1}{2}\left[\left(\frac{n}{2}\right)\text{th term} + \left(\frac{n}{2}+1\right)\text{th term}\right]$$

$$= \frac{1}{2}\left[(30\text{th term} + 31\text{th term})\right][\because n = 60]$$

$$= \frac{1}{2}(20 + 23)$$

$$= \left(\frac{1}{2} \times 43\right)$$

$$= 21.5$$

$$\therefore \quad \text{median} = 21.5$$

Exercise 14H

Question 1:

Arrange the given data in ascending order we have

0, 0, 1, 2, 3, 4, 5, 5, 6, 6, 6, 6

Let us prepare the following table:

Observations(x)	0	1	2	3	4	5	6
Frequency	2	1	1	1	1	2	4

As 6 ocurs the maximum number of times i.e. 4, mode = 6

Question 2:

Arranging the given data in ascending order , we have:

15, 20, 22, 23, 25, 25, 25, 27, 40

The frequency table of the data is :

Observations(x)	15	20	22	23	25	27	40
Frequency	1	1	1	1	3	1	1

As 25 ocurs the maximum number of times i.e. 3, mode = 25

Question 3:

Arranging the given data in ascending order , we have:

1, 1, 2, 3, 3, 4, 5, 5, 6, 6, 7, 8, 9, 9, 9, 9, 9,

The frequency table of the data is :

Observations(x)	1	2	3	4	5	6	7	8	9
Frequency	2	1	2	1	2	2	1	1	5

As 9, occurs the maximum number of times i.e. 5, mode = 9

Question 4:

Arranging the given data in ascending order , we have:

9, 19, 27, 28, 30, 32, 35, 50, 50, 50, 50, 60

The frequency table of the data is :

Observations(x)	9	19	27	28	30	32	35	50	60
Frequency	1	1	1	1	1	1	1	4	1

As 50, ocurs the maximum number of times i.e. 4, mode = 50

Thus, the modal score of the cricket player is 50.

Question 5:

Arranging the given data in ascending order , we have:

10, 10, 11, 11, 12, 12, 13, 14, 15, 17

We may prepare the table, given below:

Item(x)	Frequency(f)	Cumulative Frequency	f x
10	2	2	20

S Aggarwal Class 9 Mathematics Solution

11	2	4	22
12	2	6	24
13	1	7	13
14	1	8	14
15	1	9	15
17	1	10	17
	N=10		$\sum f \times x = 125$

Here, N = 10 which is even

$$\therefore \text{median} = \frac{1}{2}\left[\left[\left(\frac{n}{2}\right)\right]\text{th term} + \left(\frac{n}{2}+1\right)\text{th term}\right]$$
$$= \frac{1}{2}\left[(5\text{th term} + 6\text{th term})\right][\because n = 10]$$
$$= \frac{1}{2}(12 + 12)$$
$$= 12$$

Now, $\sum f \times x = 125$ and $f = 10$

$$\therefore \quad \text{mean} = \frac{\sum f \times x}{\sum f} = \frac{125}{10} = 12.5$$

$$\text{Mode} = 3(\text{Median}) - 2(\text{Mean})$$
$$= 3(12) - 2(12.5)$$
$$= 36 - 25 = 11$$

Thus, Mode = 11

Question 6:

S Aggarwal Class 9 Mathematics Solution

We may prepare the table, given below:

Marks(x)	No of students (f)	Cumulative Frequency	f × x
10	3	3	30
11	5	8	55
12	4	12	48
13	5	17	65
14	2	19	28
16	3	22	48
19	2	24	38
20	1	25	20
	N=25		$\sum f \times x = 332$

Here, N = 25 which is odd

$\therefore$ median $= \left(\dfrac{N+1}{2}\right)$ th term

$\qquad = \left(\dfrac{25+1}{2}\right)$ th term

$\qquad$ = value of the 13th term

$\qquad$ = 13

Now, $\sum f \times x = 332$ and $\sum f = 25$

$\therefore \quad$ mean $= \dfrac{\sum f \times x}{\sum f} = \dfrac{332}{25} = 13.28$

Mode = 3(median) − 2(mean)

$\qquad$ = (3x 13) − (2x13.28)

$\qquad$ = 39 − 26.56

$\qquad$ = 12.44

Thus mode = 12.4

Question 7:

We may prepare the table, given below:

Item(x)	Frequency(f)	Cumulative Frequency	f × x
5	6	6	30
7	5	11	35
9	3	14	27
12	6	20	72
14	5	25	70
17	3	28	51
19	2	30	38
21	4	34	84
	$N = \sum f = 34$		$\sum f \times x = 407$

Here, N = 34, which is even.

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

$$= \frac{1}{2}\left[(17\text{th term} + 18\text{th term})\right] [\because n = 34]$$

$$= \frac{1}{2}(12 + 12) = \left(\frac{1}{2} \times 24\right) = 12$$

Now, $\sum f \times x = 407$ and $\sum f = 34$

$$\therefore \quad \text{mean} = \frac{\sum f \times x}{\sum f} = \frac{407}{34} = 11.97$$

Mode = 3(median)-2(mean)

      = (3×12)-(2×11.97)

      = 36-23.94

      = 12.06

Thus, mode = 12.06

Question 8:

S Aggarwal Class 9 Mathematics Solution

We may prepare the table, given below:

(x)	Frequency(f)	Cumulative Frequency	$f \times x$
18	6	6	108
20	7	13	140
25	3	16	75
30	7	23	210
34	7	30	238
38	5	35	190
40	5	40	200
	$\sum f = 40$		$\sum f \times x = 1161$

Here, N = 40, which is even .

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

$$= \frac{1}{2}\left[(20\text{th term} + 21\text{st term})\right][\because n = 40]$$

$$= \frac{1}{2}(30+30) = \left(\frac{1}{2} \times 60\right) = 30$$

Now, $\sum f \times x = 1161$ and $\sum f = 40$

$$\therefore \quad \text{mean} = \frac{\sum f \times x}{\sum f} = \frac{1161}{40} = 29.025$$

Mode = 3(median)-2(mean)

= (3×30)-(2×29.025)

= (90-58.05)=31.95.

Thus, mode = 32.

Question 9:

We may prepare the table, given below:

Weight (in kg)	No of persons(f)	Cumulative Frequency	$f \times x$
42	3	3	126
47	8	11	376
52	6	17	312
57	8	25	456
62	11	36	682
67	5	41	335
72	9	50	648
	$\sum f = N = 50$		$\sum f \times x = 2935$

Here, $\sum f \times x = 2935$, and $\sum f = 50$

mean $= \dfrac{\sum f \times x}{\sum f} = \dfrac{2935}{50} = 58.7$

$\therefore$ mean weight = 58.7kg

Here, N = 50 which is even.

$\therefore$ median $= \dfrac{1}{2}\left[\left[\left(\dfrac{n}{2}\right)\right]\text{th term} + \left(\dfrac{n}{2}+1\right)\text{th term}\right]$

$= \dfrac{1}{2}\left[(25\text{th term} + 26\text{th term})\right][\because n = 50]$

$= \dfrac{1}{2}(57 + 62)$

$= \left(\dfrac{1}{2}\times 119\right) = 59.5$

$\therefore$ median weight = 59.5kg

We know that,

mode = 3 (median) – 2(mean)

$= (3 \times 59.5) - 2(58.7)$

$= 178.5 - 117.4 = 61.1$

mode weight = 61.1 kg

Thus we have,

mean = 58.7 kg, median = 59.5 kg

and mode = 61.1 kg

Question 10:

We may prepare the table, given below:

Marks (x)	No of students (f)	Cumulative Frequency	f × x
4	8	8	32
12	10	18	120
20	16	34	320
28	24	58	672
36	15	73	540
44	7	80	308
	$\sum f = N = 80$		$\sum f \times x = 1992$

Here, n = 80, which is even.

$\therefore$ median $= \dfrac{1}{2}\left[\left[\left(\dfrac{n}{2}\right)\right]\text{th term} + \left(\dfrac{n}{2}+1\right)\text{th term}\right]$

$= \dfrac{1}{2}\left[(40\text{th term} + 41\text{st term})\right][\because n = 80]$

$= \dfrac{1}{2}(28 + 28)$

$= \left(\dfrac{1}{2}\times 56\right) = 28$

Now, $\sum f \times x = 1992$ and $\sum f = 80$

$\therefore$ mean $= \dfrac{\sum f \times x}{\sum f} = \dfrac{1992}{80} = 24.9$

$\therefore$ mode = 3(median) – 2(mean)

$= (3 \times 28) - (2 \times 24.9)$

$= 84 - 49.8 = 34.2$

$\therefore$ modal marks = 34.2

Question 11:

S Aggarwal Class 9 Mathematics Solution

We may prepare the table, given below:

Age (in years) (x)	No. of persons (f)	Cumulative Frequency	f × x
19	13	13	247
21	15	28	315
23	16	44	368
25	18	62	450
27	16	78	432
29	15	93	435
31	13	106	403
	$\Sigma f = N = 106$		$\Sigma f \times x = 2650$

Here, $\Sigma f \times x = 2650$, and $\Sigma f = 106$

$$\text{mean} = \frac{\Sigma f \times x}{\Sigma f} = \frac{2650}{106} = 25$$

$\therefore$ mean = 25

Here, N = 106 which is even

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

$\qquad = \frac{1}{2}\left[(53\text{th term} + 54\text{th term})\right][\because n = 106]$

$\qquad = \frac{1}{2}(25+25)$

$\qquad = \left(\frac{1}{2} \times 50\right) = 25$

$\therefore$ median = 25

$\therefore$ mode = 3 (median) – 2(mean)

$\qquad = (3 \times 25) - (2 \times 25)$

$\qquad = 75 - 50 = 25$

Thus, mean = 25, median = 25 and mode = 25

Question 12:

RS Aggarwal Class 9 Mathematics Solutions

We may prepare the table, given below:

Weight (in kg) (x)	No of students (f)	Cumulative Frequency	$f \times x$
47	4	4	188
50	3	7	150
53	2	9	106
56	2	11	112
60	4	15	240
	$\Sigma f = N = 15$		$\Sigma f \times x = 796$

Here, $\Sigma f \times x = 796$, and $\Sigma f = 15$

∴ mean $= \dfrac{\Sigma f \times x}{\Sigma f} = \dfrac{796}{15} = 53.06$

∴ mean $= 53.06$

Here, N $= 15$ which is odd

∴ median $= \left(\dfrac{n+1}{2}\right)$ th term

$= \left(\dfrac{15+1}{2}\right)$ th term = 8th term

value of the 8th term $= 53$

∴ median $= 53$

∴ mode $= 3$ (median) $- 2$(mean)

$= (3 \times 53) - (2 \times 53.06)$

$= 159 - 106.12 = 52.88$

Thus, mean $= 53.06$, median $= 53$ and mode $= 52.88$