

MATHEMATICS
WORKSHEET (ANSWERS)_141125
CHAPTER 13 STATISTICS

SUBJECT: MATHEMATICS
CLASS : X

MAX. MARKS : 40
DURATION : 1½ hrs

General Instructions:

- (i). All questions are compulsory.
- (ii). This question paper contains 20 questions divided into five Sections A, B, C, D and E.
- (iii). **Section A** comprises of 10 MCQs of 1 mark each. **Section B** comprises of 4 questions of 2 marks each. **Section C** comprises of 3 questions of 3 marks each. **Section D** comprises of 1 question of 5 marks each and **Section E** comprises of 2 Case Study Based Questions of 4 marks each.
- (iv). There is no overall choice.
- (v). Use of Calculators is not permitted

SECTION – A

Questions 1 to 10 carry 1 mark each.

1. In a continuous frequency distribution with usual notations, if $l = 32.5$, $f_1 = 15$, $f_0 = 12$, $f_2 = 8$ and $h = 8$, then the mode of the data is:

- (a) 32.5 (b) 33.5 (c) 33.9 (d) 34.9

Ans. (d) 34.9

$$\text{Mode} = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h \Rightarrow \text{Mode} = 32.5 + \frac{15 - 12}{30 - 12 - 8} \times 8 = 32.5 + \frac{3}{10} \times 8 = 32.5 + 2.5 = 34.9$$

2. For the following distribution:

Height (in cm)	Below 140	Below 145	Below 150	Below 155	Below 160	Below 165
No. of Students	4	11	29	40	46	51

the upper limit of the modal class is

- (a) 165 (b) 160 (c) 155 (d) 150

Ans.

Height (in cm)	135 – 140	140 – 145	145 – 150	150 – 155	155 – 160	160 – 165
No. of Students	4	7	18	11	6	5

Highest frequency is 18 which belong to 145 – 150. Hence, Modal class is 145 – 150

∴ Upper limit of the modal class is 150

3. Consider the following frequency distribution of the heights (in cm) of 60 students of a class:

Class	150 – 155	155 – 160	160 – 165	165 – 170	170 – 175	175 – 180
Frequency	15	13	10	8	9	5

The upper limit of the median class in the given data is:

- (a) 165 (b) 155 (c) 160 (d) 170

Ans. (a) 165

Class	150 – 155	155 – 160	160 – 165	165 – 170	170 – 175	175 – 180
Frequency	15	13	10	8	9	5
cf	15	28	38	46	55	60

Here, $n = 60 \Rightarrow n/2 = 30$

Median class is 160 – 165

Hence, upper limit is 165

4. If mode of some data is 7 and their mean is also 7 then their median is

- (a) 10 (b) 9 (c) 8 (d) 7

Ans. (d) 7

By Empirical Formula, $3 \text{ Median} = \text{Mode} + 2 \text{ Mean}$

Given Mode = 7, Mean = 7

$$\Rightarrow 3 \text{ Median} = 7 + 2 \times 7$$

$$\Rightarrow 3 \text{ Median} = 7 + 14 \Rightarrow 3 \text{ Median} = 21 \Rightarrow \text{Median} = 7$$

5. The mean and median of a distribution are 14 and 15, respectively. The value of the mode is:

(a) 16 (b) 17 (c) 18 (d) 13

Ans. (b) 17

Using empirical formula we have $3 \text{ Median} = \text{Mode} + 2 \text{ Mean}$

$$\Rightarrow \text{Mode} = 3 \text{ Median} - 2 \text{ Mean} = 3(15) - 2(14) = 45 - 28 = 17$$

6. If the value of each observation of a statistical data is increased by 3, then the mean of the data
(a) remains unchanged (b) increases by 3 (c) increases by 6 (d) increases by $3n$

Ans. (b) increases by 3

If each value of observation is increased by 3, then mean is also increased by 3.

7. Consider the following distribution:

Marks Obtained	No. of Students
More than or equal to 0	63
More than or equal to 10	58
More than or equal to 20	55
More than or equal to 30	51
More than or equal to 40	48
More than or equal to 50	42

The frequency of the class 30–40 is:

(a) 3 (b) 4 (c) 48 (d) 51

Ans. (a) 3

Marks Obtained	No. of Students
0 – 10	5
10 – 20	3
20 – 30	4
30 – 40	3
40 – 50	6
50 – 60	42

Hence the frequency of class interval 30 – 40 is 3.

8. Consider the following frequency distribution of the heights (in cm) of 60 students of a class:

Class	150 – 155	155 – 160	160 – 165	165 – 170	170 – 175	175 – 180
Frequency	16	12	9	7	10	6

The sum of the lower limit of the modal class and the upper limit of the median class is

(a) 310 (b) 315 (c) 320 (d) 330

Ans. (b) 315

Class	150 – 155	155 – 160	160 – 165	165 – 170	170 – 175	175 – 180
Frequency	16	12	9	7	10	6
cf	16	28	37	44	54	60

The class having the maximum frequency is the modal class.

So, the modal class is 150 – 155 and its lower limit is 150.

$$\text{Also, } n = 60 \Rightarrow n/2 = 30$$

Median class is 160 – 165 whose upper limit is 165

$$\therefore \text{Required sum} = (150 + 165) = 315$$

In the following questions 9 and 10, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
 (c) Assertion (A) is true but reason (R) is false.
 (d) Assertion (A) is false but reason (R) is true.

9. Assertion (A): If the value of mode and median is 50.5 and 45.5 respectively, then the value of 2 mean is 86.

Reason (R): Median = (Mode + 2 Mean)

Ans. (c) Assertion (A) is true but reason (R) is false.

We know that, Mode = 3 Median – 2 Mean

$$(50.5) = 3 (45.5) - 2 \text{ Mean}$$

$$2 \text{ Mean} = 136.5 - 50.5 = 86$$

10. Assertion (A): Consider the following frequency distribution:

Class Interval	10 – 15	15 – 20	20 – 25	25 – 30	30 – 35
Frequency	5	9	12	6	8

The modal class is 10 – 15.

Reason (R): The class having maximum frequency is called the modal class.

Ans. (d) Assertion (A) is false but reason (R) is true.

The maximum frequency is 12, which lies in the interval 20 – 25.

So, the modal class is 20 – 25.

SECTION – B

Questions 11 to 14 carry 2 marks each.

11. If mode of the following frequency distribution is 55 then find the value of x.

Class	0 – 15	15 – 30	30 – 45	45 – 60	60 – 75	75 – 90
Frequency	10	7	x	15	10	12

Ans: Since the mode is 55 which belongs to 45 – 60, therefore modal class is 45 – 60

Here, $l = 45, f_0 = x, f_1 = 15, f_2 = 10, h = 15$

$$\text{Mode} = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h \Rightarrow 55 = 45 + \frac{15 - x}{30 - x - 10} \times 15$$

$$\Rightarrow 10 = \frac{15 - x}{20 - x} \times 15 \Rightarrow 2 = \frac{15 - x}{20 - x} \times 3 \Rightarrow 40 - 2x = 45 - 3x$$

$$\Rightarrow 30 - 2x = 45 - 40 \Rightarrow x = 5$$

12. The mode of a grouped frequency distribution is 75 and the modal class is 65-80. The frequency of the class preceding the modal class is 6 and the frequency of the class succeeding the modal class is 8. Find the frequency of the modal class.

Ans. Here, $l = 65, f_0 = 6, f_1 = x, f_2 = 8, h = 15$

$$\text{Mode} = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h \Rightarrow 75 = 65 + \frac{x - 6}{2x - 6 - 8} \times 15$$

$$\Rightarrow 10 = \frac{x - 6}{2x - 14} \times 15 \Rightarrow 2 = \frac{x - 6}{2x - 14} \times 3 \Rightarrow 4x - 28 = 3x - 18$$

$$\Rightarrow 4x - 3x = 28 - 18 \Rightarrow x = 10$$

13. If the mean of the following frequency distribution is 62.8, then find the missing frequency x :

Class	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100	100 – 120
Frequency	5	8	x	12	7	8

Ans.

Class	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100	100 – 120	
Frequency	5	8	x	12	7	8	x + 40
x	10	30	50	70	90	110	

<i>fx</i>	50	240	50 <i>x</i>	840	630	880	50 <i>x</i> + 2640
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Here, $\sum f = x + 40$ and $\sum fx = 50x + 2640$

$$\text{Mean}, \bar{x} = \frac{\sum fx}{\sum f} \Rightarrow 62.8 = \frac{50x + 2640}{x + 40} \Rightarrow 2512 + 62.8x = 50x + 2640$$

$$\Rightarrow 62.8x - 50x = 2640 - 2512 \Rightarrow 12.8x = 128 \Rightarrow x = 10$$

\therefore Missing frequency, $x = 10$

14. Calculate median marks of the following data:

Marks	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	Total
No. of Students	8	16	36	34	6	100

Ans.

Marks	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	Total
No. of Students	8	16	36	34	6	100
<i>cf</i>	8	24	60	94	100	

Here, $n = 100 \Rightarrow n/2 = 50$

\Rightarrow Median class is 20 – 30

$l = 20$, $cf = 24$, $f = 36$, $h = 10$

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

$$\Rightarrow \text{Median} = 20 + \left(\frac{50 - 24}{36} \right) \times 10 = 20 + \frac{26 \times 10}{36} = 20 + \frac{65}{9} = 20 + 7.22 = 27.22$$

SECTION – C

Questions 15 to 17 carry 3 marks each.

15. The arithmetic mean of the following frequency distribution is 53. Find the value of k .

Class	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100
Frequency	12	15	32	k	13

Ans.

Class	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100	Total
Frequency	12	15	32	k	13	$k + 72$
x	10	30	50	70	90	
u	–3	–2	–1	0	1	
fu	–36	–30	–32	0	13	–85

Here, $\sum f = k + 72$ and $\sum fu = -85$, $h = 20$, $a = 70$

$$\text{Mean}, \bar{x} = a + \left(\frac{\sum fu}{\sum f} \times h \right) \Rightarrow 53 = 70 + \left(\frac{-85}{k + 72} \times 20 \right) \Rightarrow -17 = \frac{-85 \times 20}{k + 72} \Rightarrow 1 = \frac{100}{k + 72}$$

$$\Rightarrow k + 72 = 100 \Rightarrow k = 100 - 72 = 28$$

16. The below table shows the ages of persons who visited a museum on a certain day. Find the median age of the person visiting the museum.

Age (in years)	Less than 10	Less than 20	Less than 30	Less than 40	Less than 50	Less than 60
No. of persons	3	10	22	40	54	71

Ans.

Age (in years)	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
No. of persons	3	7	12	18	14	17
<i>cf</i>	3	10	22	40	54	71

Here, $n = 71 \Rightarrow n/2 = 35.5$

\Rightarrow Median class is 30 – 40
 $l = 30, cf = 22, f = 18, h = 10$

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

$$\Rightarrow \text{Median} = 30 + \left(\frac{35.5 - 22}{18} \right) \times 10 = 30 + \frac{13.5 \times 10}{18} = 30 + \frac{135}{18} = 30 + 7.5 = 37.5$$

The median age of the person visiting the museum is 37.5 years.

17. Heights of 50 students in class X of a school are recorded and following data is obtained:

Height (in cm)	130 – 135	135 – 140	140 – 145	145 – 150	150 – 155	155 – 160
No. of students	4	11	12	7	10	6

Find the median height of the students.

Ans.

Height (in cm)	130 – 135	135 – 140	140 – 145	145 – 150	150 – 155	155 – 160
No. of students	4	11	12	7	10	6
cf	4	15	27	34	44	50

Here, $n = 50 \Rightarrow n/2 = 25$

\Rightarrow Median class is 140 – 145

$l = 140, cf = 15, f = 12, h = 5$

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

$$\text{Median} = 140 + \left(\frac{25 - 15}{12} \right) \times 5 = 140 + \frac{10 \times 5}{12} = 140 + \frac{25}{6} = 140 + 4.16 = 144.16$$

\therefore Median height of the students = 144.16 cm.

SECTION – D

Questions 18 carry 5 marks.

18. The distribution below gives the marks of 40 students of a class, if the median marks are 32.5, find the frequencies f_1 and f_2

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70	Total
No. of students	f_1	5	9	12	f_2	3	2	40

Ans.

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70	Total
No. of students	f_1	5	9	12	f_2	3	2	40
cf	f_1	$5 + f_1$	$14 + f_1$	$26 + f_1$	$26 + f_1 + f_2$	$29 + f_1 + f_2$	$31 + f_1 + f_2$	

Here, $n = 40 \Rightarrow 31 + f_1 + f_2 = 40$

$\Rightarrow f_1 + f_2 = 9 \dots$ (i)

Given, median = 32.5, which lies in the class interval 30-40.

So, median class is 30-40.

$\therefore l = 30, h = 10, f = 12, n = 40$ and c.f. of preceding class, $cf = f_1 + 14$

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

$$\Rightarrow 32.5 = 30 + \left(\frac{20 - f_1 - 14}{12} \right) \times 10 \Rightarrow 2.5 = \left(\frac{6 - f_1}{12} \right) \times 10$$

$$\Rightarrow 30 = (6 - f_1) \times 10 \Rightarrow 3 = 6 - f_1 \Rightarrow f_1 = 3$$

$$\Rightarrow f_2 = 9 - 3 = 6$$

OR

The mean of the following data is 42. Find the missing frequencies x and y if the sum of frequencies is 100.

Class	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	7	10	x	13	y	10	14	9

Ans.

Class	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	Total
Frequency	7	10	x	13	y	10	14	9	100
x	5	15	25	35	45	55	65	75	
u	-2	-1	0	1	2	3	4	5	
fu	-14	-10	0	13	$2y$	30	56	45	$2y + 120$

$$\text{Here, } \sum f = 100 = x + y + 63 \Rightarrow x + y = 37$$

$$\text{and } \sum fu = 2y + 120, h = 10, a = 25$$

$$\text{Mean, } \bar{x} = a + \left(\frac{\sum fu}{\sum f} \times h \right) \Rightarrow 42 = 25 + \left(\frac{2y + 120}{100} \times 10 \right) \Rightarrow 17 = \frac{2y + 120}{10} \Rightarrow 170 = 2y + 120$$

$$\Rightarrow 2y = 170 - 120 = 50 \Rightarrow y = 25$$

$$\Rightarrow x = 37 - 25 = 12$$

SECTION – E (Case Study Based Questions)

Questions 19 to 20 carry 4 marks each.

- 19.** India meteorological department observe seasonal and annual rainfall every year in different subdivisions of our country.



It helps them to compare and analyse the results. The table given below shows sub-division wise seasonal (monsoon) rainfall (mm) in 2018 :

Rainfall (in mm)	Number of Sub-divisions
200 – 400	2
400 – 600	4
600 – 800	7
800 – 1000	4
1000 – 1200	2
1200 – 1400	3
1400 – 1600	1
1600 – 1800	1

Based on the above information, answer the following questions.

- Write the modal class.
- Find the median of the given data.

OR

Find the mean rainfall in this season.

(c) If sub-division having at least 1000 mm rainfall during monsoon season, is considered good rainfall sub-division, then how many sub-divisions had good rainfall?

Ans.

Rainfall (in mm)	Number of Sub-divisions	<i>cf</i>
200 – 400	2	2
400 – 600	4	6
600 – 800	7	13
800 – 1000	4	17
1000 – 1200	2	19
1200 – 1400	3	22
1400 – 1600	1	23
1600 – 1800	1	24

(a) Here, maximum class frequency is 7 and class corresponding to this frequency is 600-800, so the modal class is 600 – 800.

(b) Here, $n/2 = 24/2 = 12$

⇒ Median class is 600 – 800

∴ $l = 600, cf = 6, f = 7, h = 200$

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

$$\text{Median} = 600 + \left(\frac{12 - 6}{7} \right) \times 200 = 600 + \frac{6 \times 200}{7} = 600 + 171.429 = 771.43(\text{approx})$$

So, the median of the given data is 771.43

OR

Rainfall (in mm)	Number of Sub-divisions	x	u	fu
200 – 400	2	300	-3	-6
400 – 600	4	500	-2	-8
600 – 800	7	700	-1	-7
800 – 1000	4	900	0	0
1000 – 1200	2	1100	1	2
1200 – 1400	3	1300	2	6
1400 – 1600	1	1500	3	3
1600 – 1800	1	1700	4	4
Total	24			-6

Here, $\sum f = 24$ and $\sum fu = -6, h = 200, a = 900$

$$\text{Mean, } \bar{x} = a + \left(\frac{\sum fu}{\sum f} \times h \right) = 900 + \left(\frac{-6}{24} \times 200 \right) = 900 + (-50) = 850$$

So, mean rainfall in the season is 850 mm.

(c) Number of sub-division having good rainfall

$$= 2 + 3 + 1 + 1 = 7$$

20. 'Swachh Bharat Abhiyan' is a country-wide campaign initiated by our Honourable Prime Minister of India, Mr. Narendra Singh Modi in the year 2014 to eliminate open defecation, to improve solid waste management and to accelerate the efforts to achieve universal sanitation.



As part of the 'Swachh Bharat Abhiyan', some houses of a locality in Agra decided to clean up and beautify a Primary School of their locality by planting a number of plants. They involved the school kids and the local community in doing so.

The data indicating the number of plants contributed by different houses is tabulated below:

Number of plants contributed	Number of houses
1 – 3	10
4 – 6	8
7 – 9	x
10 – 12	7
13 – 15	12
16 – 18	4

- (a) If the mean number of plants contributed is 8.9, then how many houses contributed 7 to 9 plants?
 (2)
 (b) What is the median class? (1)
 (c) Find the median number of plants contributed. (1)

Ans. (a)

Number of plants contributed	Number of houses	x	u	fu
0.5 – 3.5	10	2	-2	-20
3.5 – 6.5	8	5	-1	-8
6.5 – 9.5	x	8	0	0
9.5 – 12.5	7	11	1	7
12.5 – 15.5	12	14	2	24
15.5 – 18.5	4	17	3	12
Total	$x + 41$			15

Here, $\sum f = x + 41$ and $\sum fu = 15$, $h = 3$, $a = 8$

$$\text{Mean}, \bar{x} = a + \left(\frac{\sum fu}{\sum f} \times h \right) \Rightarrow 8.9 = 8 + \left(\frac{15}{x+41} \times 3 \right) \Rightarrow 0.9 = \frac{45}{x+41}$$

$$\Rightarrow x + 41 = 50 \Rightarrow x = 9$$

(b)

Number of plants contributed	Number of houses	cf
0.5 – 3.5	10	10
3.5 – 6.5	8	18
6.5 – 9.5	9	27
9.5 – 12.5	7	34
12.5 – 15.5	12	46
15.5 – 18.5	4	50

Here, $n/2 = 50/2 = 25$

\Rightarrow Median class is $6.5 - 9.5$

(c) Here, $l = 6.5$, $cf = 18$, $f = 9$, $h = 3$

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

$$\text{Median} = 6.5 + \left(\frac{25 - 18}{9} \right) \times 3 = 6.5 + \frac{7}{3} = 6.5 + 2.33 = 8.83$$

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