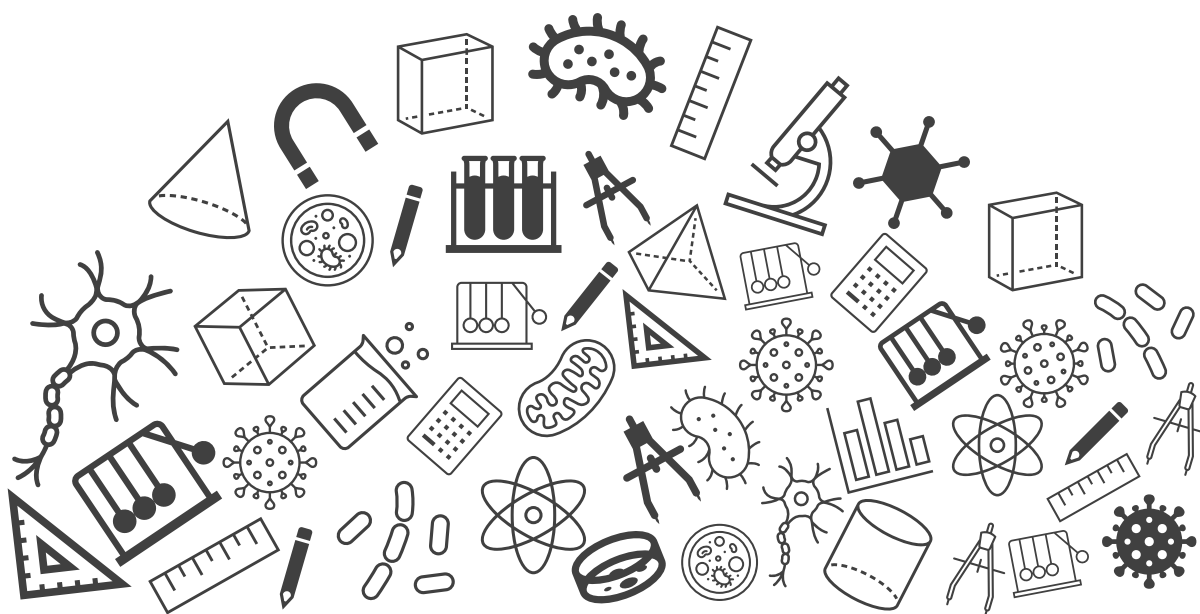




Grade 10

Mathematics

Exam Important Questions



Topic : Exam Important Questions

1. The lengths of 40 leaves of a plant are measured correct to the nearest millimeter, and the data obtained is represented in the following table:

Length (in mm)	Number of leaves f_i
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.
(5 marks)

The given data does not have continuous class intervals. We can observe that difference between two class intervals is 1. So, we have to add and subtract $\frac{1}{2} = 0.5$ from upper-class limits and lower class limits respectively.

Now, continuous class intervals with respective cumulative frequencies can be represented as below:

Length (in mm)	Number of leaves f_i	Cumulative frequency
117.5 – 126.5	3	3
126.5 – 135.5	5	3 + 5 = 8
135.5 – 144.5	9	8 + 9 = 17
144.5 – 153.5	12	17 + 12 = 29
153.5 – 162.5	5	29 + 5 = 34
162.5 – 171.5	4	34 + 4 = 38
171.5 – 180.5	2	38 + 2 = 40

(2 marks)

From the table, we observe that cumulative frequency just greater than $\frac{n}{2}$ (i.e. $\frac{40}{2} = 20$) is 29, belonging to class interval 144.5 - 153.5.

Median class = 144.5 - 153.5 (1 mark)

Lower limit l of median class = 144.5

Class size $h = 9$

Frequency f of median class = 12

$$\begin{aligned}
 \text{Cumulative frequency } cf \text{ of class preceding median class} &= 17, \text{ Median} = l + \left(\frac{\frac{n}{2} - cf}{f} \right) \times h \\
 &= 144.5 + \left(\frac{20 - 17}{12} \right) \times 9 \\
 &= 144.5 + \frac{9}{4} = 146.75
 \end{aligned}$$

So, median length of leaves is 146.75 mm. (2 marks)

2. Identify the modal class, the upper limit of the modal class and the lower limit of the modal class for the given data.

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

[2 Marks]

The class with the maximum frequency is the modal class.
For the given data, class 35-45 has the highest frequency of 23.
So, 35-45 is the modal class.

[1 Mark]

The lower limit of the modal class is 35 and the upper limit is 45.

[1 Mark]

3. The following table gives the distribution of the life time of 400 neon lamps:

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

Find the median life time of a lamp.

(5 Marks)

We can find the cumulative frequencies with their respective class intervals as below:

<i>Life time</i>	<i>Number of lamps (f_i)</i>	<i>Cumulative frequency</i>
1500 – 2000	14	14
2000 – 2500	56	$14 + 56 = 70$
2500 – 3000	60	$70 + 60 = 130$
3000 – 3500	86	$130 + 86 = 216$
3500 – 4000	74	$216 + 74 = 290$
4000 – 4500	62	$290 + 62 = 352$
4500 – 5000	48	$352 + 48 = 400$
<i>Total (n)</i>	400	

(1 Mark)

Now, we may observe that cumulative frequency just greater than $\frac{n}{2}$ (i.e., $\frac{400}{2} = 200$) is 216 belonging to class interval 3000 - 3500.

Median class = 3000 - 3500

Lower limit l of median class = 3000

Frequency f of median class = 86

Cumulative frequency c_f of class preceding median class = 130 Class size $h = 500$ (2 marks)

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

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

$$= 3000 + \frac{70 \times 500}{86}$$

$$= 3000 + 406.98$$

$$= 3406.98$$

So, median life time of lamps is 3406.98 hours. (2 marks)

4. If the median of the distribution given below is 28.5, find the values of x and y .

<i>Class interval</i>	<i>Frequency</i>
0 – 10	5
10 – 20	x
20 – 30	20
30 – 40	15
40 – 50	y
50 – 60	5
<i>Total</i>	60

(5 Marks)

We may find the cumulative frequency for the given data as following:

<i>Class interval</i>	<i>Frequency</i>	<i>Cumulative frequency</i>
0 – 10	5	5
10 – 20	x	$5 + x$
20 – 30	20	$25 + x$
30 – 40	15	$40 + x$
40 – 50	y	$40 + x + y$
50 – 60	5	$45 + x + y$
<i>Total</i> (n)	60	

(1 Mark)

It is clear that, $n = 60$

$$45 + x + y = 60$$

$$x + y = 15 \quad (1)$$

Median of data is given as 28.5 which lies in interval 20 - 30.

So, median class = 20 - 30

Lower limit l of median class = 20

Cumulative frequency c_f of class preceding the median class = $5 + x$

Frequency f of median class = 20

Class size $h = 10$ __ (2 marks)

$$\text{Now, median} = l + \left(\frac{\frac{n}{2} - c_f}{f} \right) \times h$$

$$28.5 = 20 + \left[\frac{\frac{60}{2} - (5+x)}{20} \right] \times 10$$

$$8.5 = \left(\frac{25-x}{2} \right)$$

$$17 = 25 - x$$

$$x = 8$$

From equation (1)

$$8 + y = 15$$

$$y = 7$$

Hence, values of x and y are 8 and 7 respectively. __ (2 marks)

5. A survey was conducted on 20 families in a locality by a group of students. What will be the mode of the data?

Age of family member	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100
Number of students	7	8	2	2	1

[2 Marks]

We know,

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

[1 Mark]

Here, modal class is 20-40 since it is the class with the highest frequency.

$$f_1 = 8, f_0 = 7, f_2 = 2, l = 20, h = 20$$

$$\therefore \text{Mode} = 20 + \left[\frac{8-7}{2 \times 8 - 7 - 2} \right] \times 20 = 22.86$$

[1 Mark]

6. The following data shows monthly savings of 100 families . Calculate the mode of the given frequency distribution.

Monthly savings(Rs)	Number of families
1000 – 2000	14
2000 – 3000	15
3000 – 4000	21
4000 – 5000	27
5000 – 6000	25

[2 marks]

Modal class is 4000-5000 within

$$f_1 = 27, f_0 = 21, f_2 = 25, l = 4000, h = 1000$$

$$\text{Mode} = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h \text{ (1 mark)}$$

$$\text{Mode} = 4000 + \frac{6}{8} \times 1000$$

$$= 4750 \text{ (1 mark)}$$

7. The following distribution shows the daily pocket allowance of children of a locality. The mean pocket allowance is Rs.18. Find the missing frequency f .

Daily pocket allowance (in Rs)	11 – 13	13 – 15	15 – 17	17 – 19	19 – 21	21 – 23	23 – 25
Number of workers	7	6	9	13	f	5	4

[3 marks]

We may find class mark x_i for each interval by using the relation:

$$x_i = \frac{\text{Upper class limit} + \text{lower class limit}}{2}$$

Given that mean pocket allowance $x_i = \text{Rs.18}$

Now taking 18 as assured mean a we may calculate d_i and $f_i d_i$ as following.

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

(1.5 marks)

From the table we may obtain:

$$\sum f_i = 44 + f$$

$$\sum f_i d_i = 2f - 40$$

$$\bar{x} = a + \frac{\sum f_i d_i}{\sum f_i}$$

$$18 = 18 + \left(\frac{2f - 40}{44 + f} \right)$$

$$2f - 40 = 0$$

$$2f = 40$$

$$f = 20$$

Hence, the missing frequency ' f ' is 20.

(1.5 marks)

8. 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.

Number of plants	0 – 2	2 – 4	4 – 6	6 – 8	8 – 10	10 – 12	12 – 14
Number of Houses	1	2	1	5	6	2	3

(3 marks)

Let us find class marks (x_i) for each interval by using the relation:

$$\text{Class Mark } (x_i) = \frac{\text{Upper class limit} + \text{lower class limit}}{2}$$

Now we may compute x_i and $f_i x_i$ as following

Number of plants	Number of Houses (f_i)	x_i	$f_i x_i$
0 – 2	1	1	$1 \times 1 = 1$
2 – 4	2	3	$2 \times 3 = 6$
4 – 6	1	5	$1 \times 5 = 5$
6 – 8	5	7	$5 \times 7 = 35$
8 – 10	6	9	$6 \times 9 = 54$
10 – 12	2	11	$2 \times 11 = 22$
12 – 14	3	13	$3 \times 13 = 39$
<i>Total</i>	20		162

(2 marks)

From the table we may observe that:

$$\text{Mean } (\bar{x}) = \frac{\sum f_i x_i}{\sum f_i} = \frac{162}{20} = 8.1$$

So, mean number of plants per house is 8.1. (1 mark)

We have used the direct method as values of class marks (x_i) and f_i are small.

9. The marks obtained by 40 students in class X of a certain school in a math paper of 50 marks total are presented in the table. Find the mean using direct method.

<i>Class Interval</i>	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
<i>Number of students</i>	3	4	13	15	5

[3 Marks]

Class mark for first class interval = 5

Similarly the class mark for each class interval can be found. Look at the table.

<i>Class Interval</i>	<i>Number of students (f_i)</i>	<i>Classmark (x_i)</i>	<i>$f_i x_i$</i>
0 – 10	3	5	15
10 – 20	4	15	60
20 – 30	13	25	325
30 – 40	15	35	525
40 – 50	5	45	225
<i>Total</i>	$\sum f_i = 40$		$\sum f_i x_i = 1150$

[2 Marks]

$$\therefore \text{Mean} = \frac{\sum f_i x_i}{\sum f_i}$$

$$= \frac{5 \times 3 + 15 \times 4 + 25 \times 13 + 35 \times 15 + 45 \times 5}{40}$$

$$= \frac{1150}{40}$$

$$= 28.75$$

[1 Mark]

10. Find the median

Find the mode of the following data.

x_i	10	14	18	21	25
f_i	10	15	7	9	9

[4 marks]

$\sum f_i = 50$ i.e there are 50 observations.

So the median is the average of the 25th and 26th observations.

The 25th observation is 14 and the 26th observation is 18.

Thus, the median is $\frac{(14+18)}{2} = 16$.

[2 marks]

Mode of a given data is the number repeated more number of times. In the given data highest frequency (15) is for $x_i = 14$.

\therefore mode = 14

[2 marks]