



CREST Mathematics Olympiad (CMO) **Worksheet** *for* **Class 10**



Topic
Statistics



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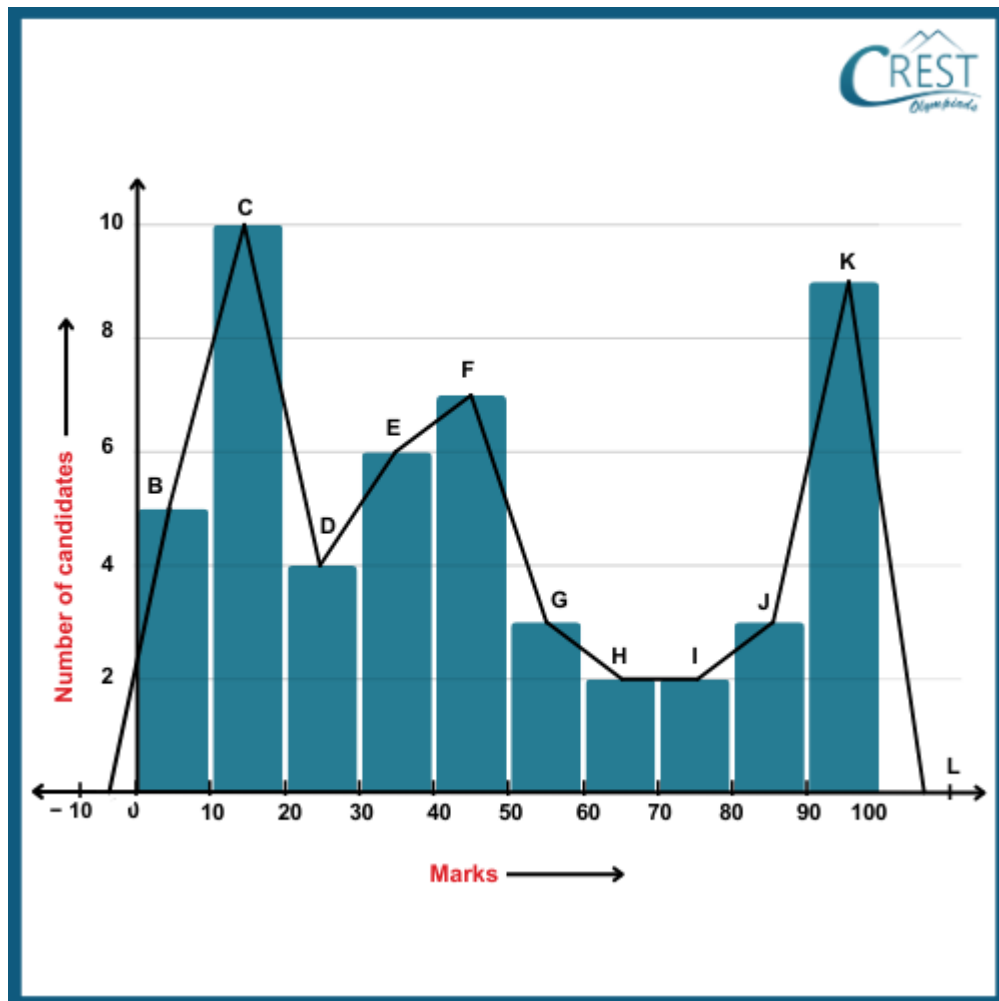
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Worksheet on Statistics

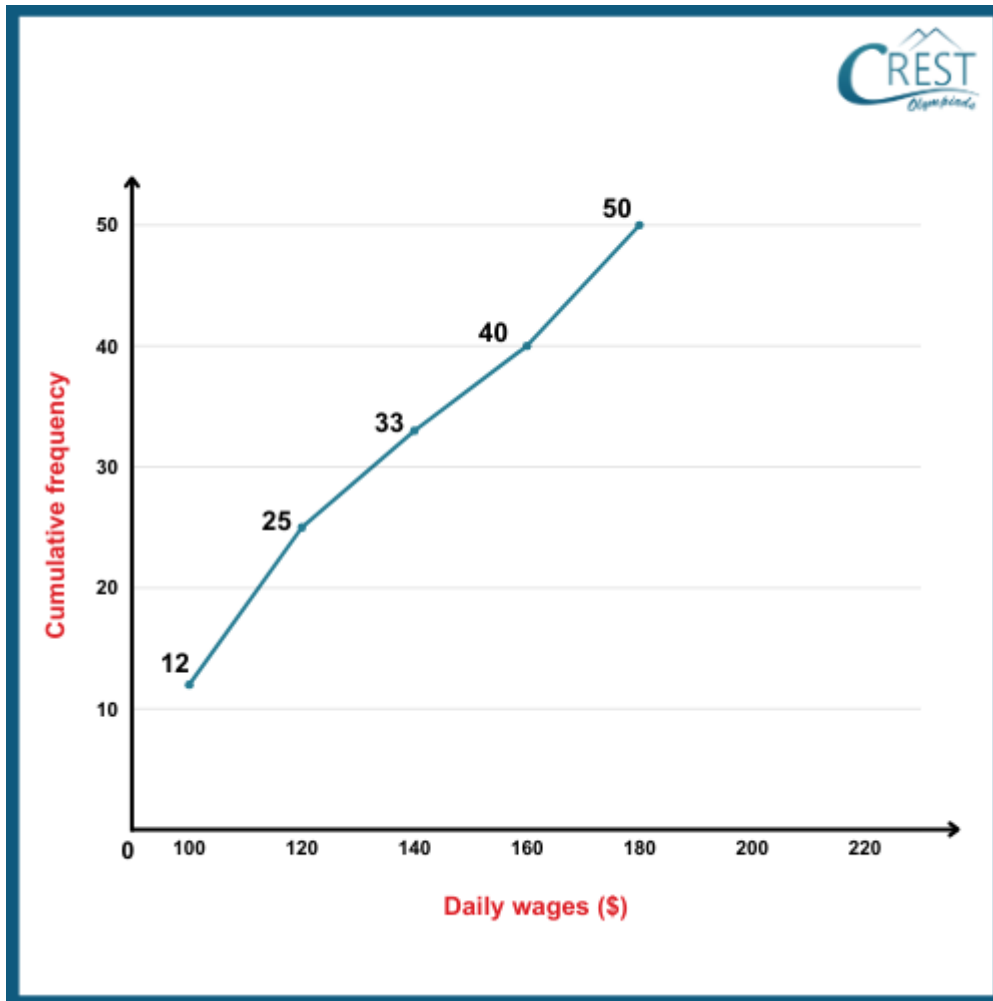
1. Consider the given frequency polygon representing the marks obtained by students of a class in a test.



What percentage of students scored more than 40 but less than 90?

- a. 33.75%
- b. 33.67%
- c. 33.5%
- d. 33.33%

2. Consider the given ogive or cumulative frequency curve representing the daily income of 50 workers of a factory.



What is the percentage of workers earning less than \$140?

- a. 52%
- b. 55%
- c. 55%
- d. 51%

3. Consider the given data:

x	5	10	15	20	25	30	35
f	11	20	14	10	8	15	7

What is the mean of the given data using the direct method?

- a. 18.357
- b. 18.353
- c. 18.358
- d. 18.355

4. The weights of 35 students in a class are given below.

Weight (in kg)	40 - 50	50 - 60	60 - 70	70 - 80	80 - 90
No. of students	5	14	9	4	3

What is the median weight of the students?

- a. 58.93 kg
 - b. 58.98 kg
 - c. 58.95 kg
 - d. 58.97 kg
5. The weights of 50 oranges were recorded as given below. What is the mean weight using the standard deviation method?

Weight (in gm)	55 - 60	60 - 65	65 - 70	70 - 75	75 - 80	80 - 85	85 - 90
No. of oranges	11	5	8	10	9	5	2

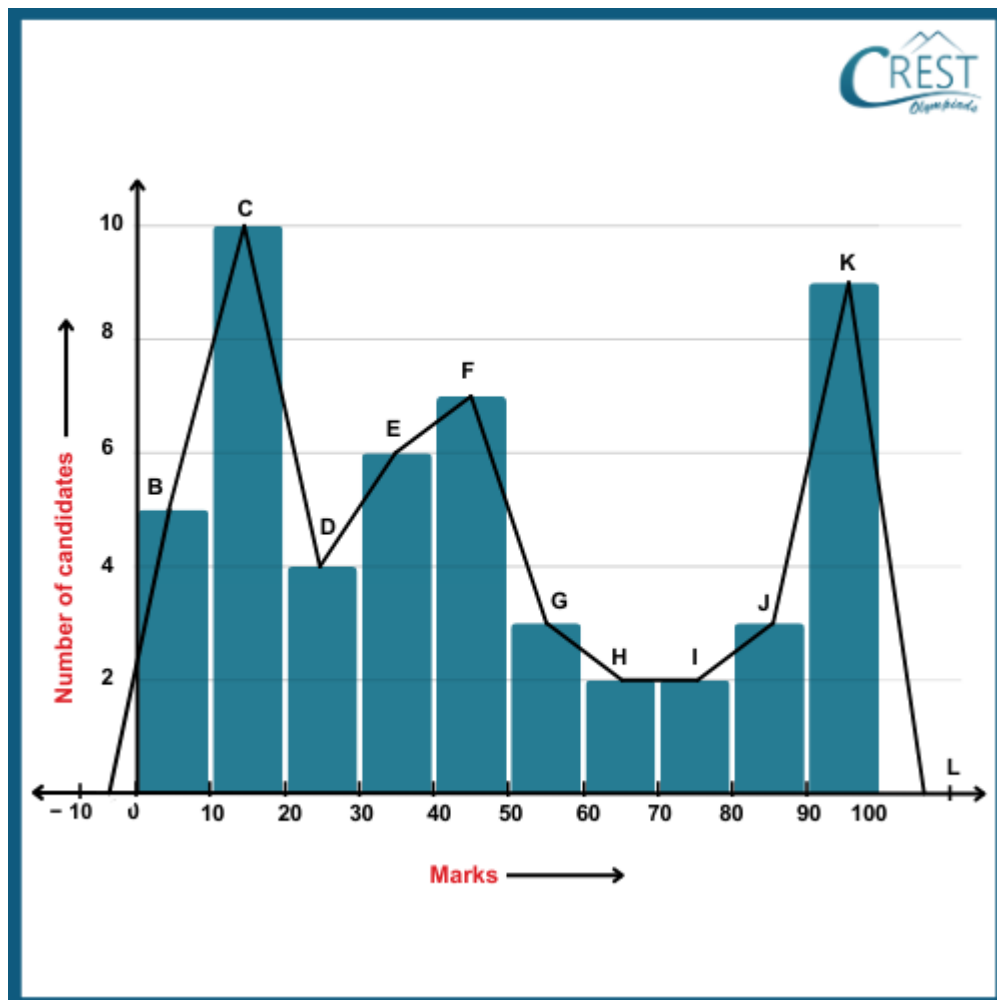
- a. 69.7 gm
- b. 69.8 gm
- c. 69.5 gm
- d. 69.9 gm



Answer Key

1. d - 33.33%

Explanation: We are given the following frequency polygon



A frequency polygon is a graph that represents the frequency distribution of a dataset.

From the frequency polygon, we get the following frequency distribution table:

Marks	Number of Students
0 - 10	5
10 - 20	10
20 - 30	4
30 - 40	6
40 - 50	7
50 - 60	3
60 - 70	2
70 - 80	2
80 - 90	3
90 - 100	9

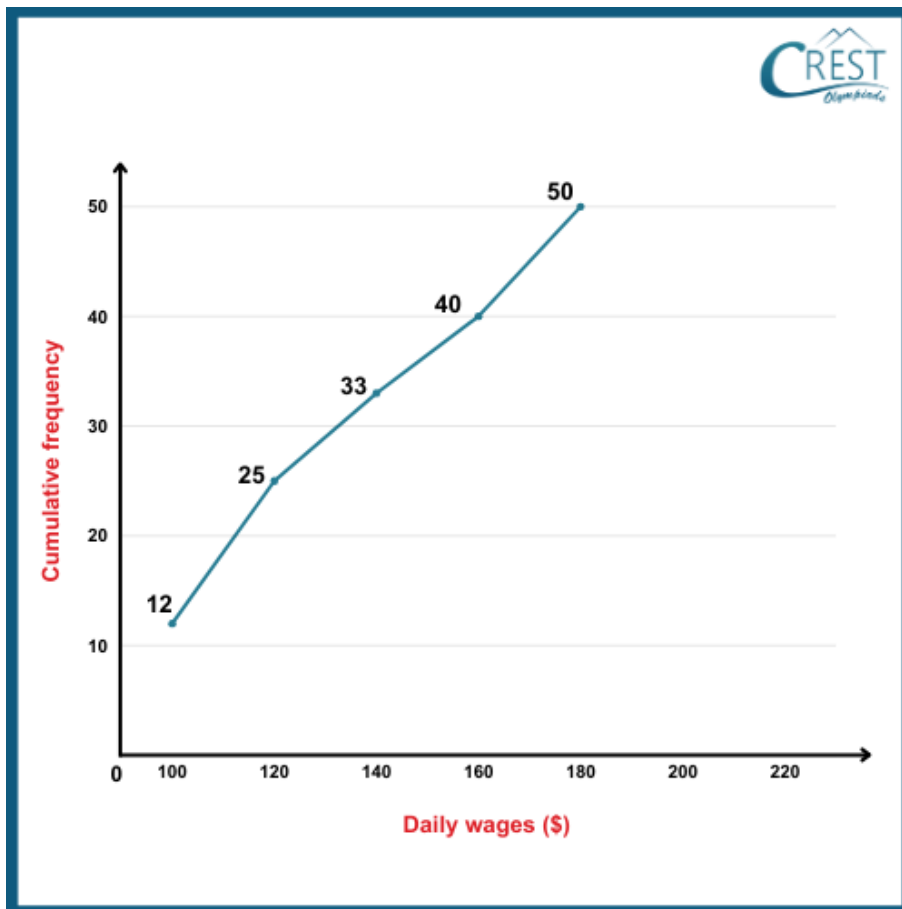
Total number of students = $5 + 10 + 4 + 6 + 7 + 3 + 2 + 2 + 3 + 9$
= 51

No. of students scoring marks more than 40 but less than 90 = $7 + 3 + 2 + 2 + 3$
= 17

Percentage of students scoring marks more than 40 but less than 90 = $[(\text{No. of students scoring marks more than 40 but less than 90}) / (\text{Total no. of students})] \times 100$
= $(17 / 51) \times 100$
= $100 / 3$
= 33.33%

2. c – 50%

Explanation: We are given the following of give



An ogive is a graphical representation that displays the cumulative frequencies of a dataset.

From the ogive, we get the following frequency distribution table:

Daily Income (in \$)	Cumulative Frequency
Less than 120	12
Less than 140	25
Less than 160	33
Less than 180	40
Less than 200	50
Daily Income (in \$)	Number of Workers
100 - 120	12
120 - 140	13
140 - 160	8
160 - 180	7
180 - 200	10

Total number of workers = 50

No. of workers earning less than \$140 = 25

Percentage of workers earning less than \$140 = $\frac{[(\text{No. of workers earning less than \$140}) / (\text{Total no. of workers})] \times 100}{}$

$$= (25 / 50) \times 100$$

$$= 100/2$$

$$= 50\%$$

3. b - 18.353

Explanation: Steps for finding the mean using the direct method are:

a. Make a frequency table using the following three columns:

(i) Enter the variate (x_i) values in the first column from the left.

(ii) Write the matching frequency (f_i) for each variate in column (a) in the second column from the left.

(iii) Enter each value of $f_i x_i$, or the product of each x and its frequency (f), in the third column.

b. To obtain $\sum f_i$ (the total of all the frequencies), add each entry in the second column.

c. To obtain $\sum f_i x_i$, add each entry in the third column.

d. Required mean = $\frac{\sum f_i x_i}{\sum f_i}$

Thus,

x_i	f_i (frequency)	$f_i x_i$
5	11	55
10	20	200
15	14	210
20	10	200
25	8	200
30	15	450
35	7	245
$\sum f_i = 85$	$\sum f_i x_i = 1560$	

Now,

$$\begin{aligned}\text{Mean} &= \frac{\sum fixi}{\sum fi} \\ &= 1560 / 85 \\ &= 312 / 17 \\ &= 18.353\end{aligned}$$

4. a - 58.93 kg

Explanation: The frequency distribution table with the given cumulative frequencies becomes:

Class Interval	Frequency	Cumulative frequency
40 - 50	5	5
50 - 60	14	19
60 - 70	9	28
70 - 80	4	32
80 - 90	3	35

We know that


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

Here, $n = 35$

$$\begin{aligned}\rightarrow n / 2 &= 35 / 2 \\ &= 17.5\end{aligned}$$

This observation lies in the class interval 50 - 60.

$$\rightarrow l \text{ (lower limit)} = 50$$

$$\rightarrow h \text{ (class size)} = 10$$

$$\rightarrow f \text{ (frequency of the median class)} = 14$$

$$\rightarrow cf \text{ (cumulative frequency of the preceding class, i.e. 40 - 50)} = 5$$

$$\begin{aligned}\rightarrow \text{Median} &= 50 + \frac{17.5 - 5}{14} \times 10 \\ &= 50 + \frac{12.5}{14} \times 10 \\ &= 50 + \frac{125}{14} \\ &= 50 + 8.93 \\ &= 58.93 \text{ kg}\end{aligned}$$

5. d – 69.9 gm

Explanation: Steps for finding mean using the step deviation method:

a. Create a five-column frequency table.

(i) Enter the variate (x_i) values in the first column from the left.

(ii) Record the frequency (f_i) of each variate in column (a) in the second column from the left.

b. Select a number, 'A' (ideally from the variate ' x_i ' values that are provided in the first column). In this case, 'A' is referred to as the assumed mean.

To obtain the deviation ' d_i ,' subtract the assumed mean ' A ' from each value of variate ' x ' in the first column.

Thus, deviation (d_i) = $x_i - A$

In the third column, record the values of each deviation ($d = x - A$) together with the matching frequencies.

c. Divide each value of d_i by h to get $d_i / h = (x_i - A) / h$. Denote the values that were obtained by t_i and write in the fourth column.

d. To obtain the values of $f_i t_i$, multiply the frequencies in the second column by the matching values of t_i in the fourth column. Then, record each value of $f_i t_i$ in the fifth column.

e. To find the value of $\sum f_i t_i$, add up all the numbers in the fifth column. To obtain the value of $\sum f_i$, add all the numbers in the second column.

f. The following formula gives the required mean using the step-deviation method:

$$\text{Mean} = A + \left(\frac{\sum f_i t_i}{\sum f_i} \times h \right)$$

Where

A is the assumed mean.

$$t_i = (x_i - A) / h$$

h = class size

Thus,

Let the assumed mean (A) be 72.5

$$h = 5$$

Weight	No. of oranges (f_i)	Mid-value (x_i)	$d_i = x_i - A$ $= x_i - 72.5$	$t_i = (x_i - A) / h$	$f_i t_i$
55 - 60	11	57.5	-15	-3	-33
60 - 65	5	62.5	-10	-2	-10
65 - 70	8	67.5	-5	-1	-8
70 - 75	10	72.5	0	0	0
75 - 80	9	77.5	5	1	9
80 - 85	5	82.5	10	2	10
85 - 90	2	87.5	15	3	6
$\sum f_i = 50$		$\sum f_i t_i = -26$			

$$\begin{aligned}
 \text{Mean} &= A + \left(\frac{\sum f_i t_i}{\sum f_i} \times h \right) \\
 &= 72.5 + \left(\frac{-26}{50} \times 5 \right) \\
 &= 72.5 + \left(\frac{-26}{10} \right) \\
 &= 72.5 - 2.6 \\
 &= 69.9 \text{ gm}
 \end{aligned}$$

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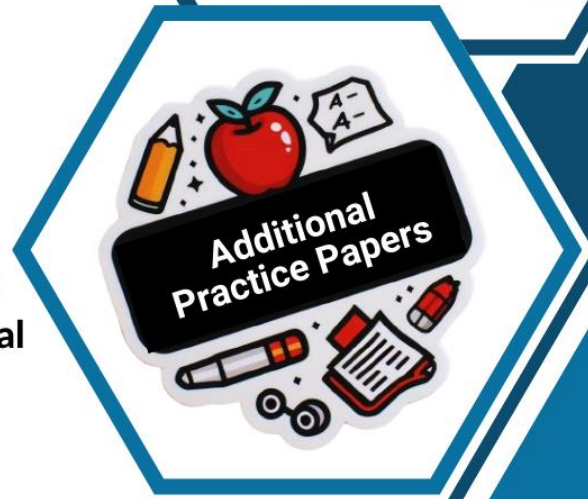
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