

EXERCISE 19B

1. Find the median of:

- (i) 25, 16, 26, 16, 32, 31, 19, 28 and 35
(ii) 241, 243, 347, 350, 327, 299, 261, 292, 271, 258 and 257
(iii) 63, 17, 50, 9, 25, 43, 21, 50, 14 and 34
(iv) 233, 173, 189, 208, 194, 194, 185, 200 and 220.

Solution:

(i) Arrange the numbers in ascending order

16, 16, 19, 25, 26, 28, 31, 32, 35

As $n = 9$ (odd)

$$\text{Median} = \text{Value of } \left(\frac{n+1}{2}\right)^{\text{th}} \text{ term}$$

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

$$= 5^{\text{th}} \text{ term}$$

$$= 26$$

Hence, the median is 26.

(ii) Arrange the numbers in ascending order

241, 243, 257, 258, 261, 271, 292, 299, 327, 347, 350

As $n = 11$ (odd)

$$\text{Median} = \text{Value of } \left(\frac{n+1}{2}\right)^{\text{th}} \text{ term}$$

$$= \left(\frac{11+1}{2}\right)^{\text{th}} \text{ term}$$

$$= 6^{\text{th}} \text{ term}$$

$$= 271$$

Hence, the median is 271.

(iii) Arrange the numbers in ascending order

9, 14, 17, 21, 25, 34, 43, 50, 50, 63

As $n = 10$ (even)

$$\text{Median} = \frac{1}{2} [\text{value of } (n/2)^{\text{th}} \text{ term} + \text{value of } (n/2 + 1)^{\text{th}} \text{ term}]$$

$$= \frac{1}{2} [\text{value of } (10/2)^{\text{th}} \text{ term} + \text{value of } (10/2 + 1)^{\text{th}} \text{ term}]$$

$$= \frac{1}{2} [25 + 34]$$

$$= \frac{1}{2} [59]$$

$$= 29.5$$

Hence, the median is 29.5.

(iv) Arrange the numbers in ascending order

173, 185, 189, 194, 194, 200, 204, 208, 220, 223

As $n = 10$ (even)

$$\text{Median} = \frac{1}{2} [\text{value of } (n/2)^{\text{th}} \text{ term} + \text{value of } (n/2 + 1)^{\text{th}} \text{ term}]$$

$$= \frac{1}{2} [\text{value of } (10/2)^{\text{th}} \text{ term} + \text{value of } (10/2 + 1)^{\text{th}} \text{ term}]$$

$$= \frac{1}{2} [200 + 194]$$

$$= \frac{1}{2} [394]$$

$$= 197$$

Hence, the median is 197.

2. The following data have been arranged in ascending order. If their median is 63, find the value of x .

34, 37, 53, 55, x , $x + 2$, 77, 83, 89 and 100.

Solution:

Numbers given are 34, 37, 53, 55, x , $x + 2$, 77, 83, 89 and 100

As $n = 10$ (even)

$$\text{Median} = \frac{1}{2} [\text{value of } (n/2)^{\text{th}} \text{ term} + \text{value of } (n/2 + 1)^{\text{th}} \text{ term}]$$

$$= \frac{1}{2} [\text{value of } (10/2)^{\text{th}} \text{ term} + \text{value of } (10/2 + 1)^{\text{th}} \text{ term}]$$

$$= \frac{1}{2} [\text{value of } 5^{\text{th}} \text{ term} + \text{value of } (5 + 1)^{\text{th}} \text{ term}]$$

$$= \frac{1}{2} [\text{value of } 5^{\text{th}} \text{ term} + \text{value of } 6^{\text{th}} \text{ term}]$$

Substituting the values

$$63 = \frac{1}{2} [x + x + 2]$$

$$[2 + 2x]/2 = 63$$

Taking 2 as common

$$x + 1 = 63$$

$$x = 62$$

3. In 10 numbers, arranged in increasing order, the 7th number is increased by 8, how much will the median be changed?

Solution:

We know that for any given set of data, the median is the value of its middle term

Total observations $n = 10$ (even)

$$\text{Median} = \frac{1}{2} [\text{value of } (n/2)^{\text{th}} \text{ term} + \text{value of } (n/2 + 1)^{\text{th}} \text{ term}]$$

$$= \frac{1}{2} [\text{value of } (10/2)^{\text{th}} \text{ term} + \text{value of } (10/2 + 1)^{\text{th}} \text{ term}]$$

$$= \frac{1}{2} [\text{value of } 5^{\text{th}} \text{ term} + \text{value of } 6^{\text{th}} \text{ term}]$$

Therefore, if the 7th number is diminished by 8, there will be no change in the median value.

4. Out of 10 students, who appeared in a test, three secured less than 30 marks and 3 secured more than 75 marks. The marks secured by the remaining 4 students are 35, 48, 66 and 40. Find the median score of the whole group.

Solution:

Total observations $n = 10$ (even)

$$\begin{aligned}\text{Median} &= \frac{1}{2} [\text{value of } (10/2)^{\text{th}} \text{ term} + \text{value of } (10/2 + 1)^{\text{th}} \text{ term}] \\ &= \frac{1}{2} [\text{value of } 5^{\text{th}} \text{ term} + \text{value of } 6^{\text{th}} \text{ term}]\end{aligned}$$

Substituting the values

$$\begin{aligned}\text{Median} &= \frac{1}{2} [40 + 48] \\ &= 88/2 \\ &= 44\end{aligned}$$

Hence, the median score of the whole group is 44.

5. The median of observations 10, 11, 13, 17, $x + 5$, 20, 22, 24 and 53 (arranged in ascending order) is 18; find the value of x .

Solution:

Total observations $n = 9$ (odd)

As n is odd

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

$$\text{Median} = \left(\frac{9 + 1}{2}\right)^{\text{th}} \text{ term}$$

$= 5^{\text{th}}$ term

$= x + 5$

It is given that, Median = 18

$$x + 5 = 18$$

$$x = 13$$



EXERCISE 19C

1. Find the mean of 8, 12, 16, 22, 10 and 4. Find the resulting mean, if each of the observations, given above be:

(i) Multiplied by 3.

(ii) Divided by 2.

(iii) Multiplied by 3 and then divided by 2.

(iv) Increased by 25%.

(v) Decreased by 40%.

Solution:

Mean of the given data

$$= \frac{8 + 12 + 16 + 22 + 10 + 4}{6}$$

$$= \frac{72}{6}$$

$$= 12$$

(i) Multiplied by 3

If \bar{x} is the mean of n number of observations $x_1, x_2, x_3, \dots, x_n$,

Mean of $ax_1, ax_2, ax_3, \dots, ax_n$ is $a\bar{x}$

When each of the given data is multiplied by 3, then mean is also multiplied by 3

Mean of the original data = 12

Therefore, the new mean = $12 \times 3 = 36$

(ii) Divided by 2

If \bar{x} is the mean of n number of observations $x_1, x_2, x_3, \dots, x_n$,

Mean of $x_1/a, x_2/a, x_3/a, \dots, x_n/a$ is \bar{x}/a

When each of the given data is divided by 2, the mean is also divided by 2.

Mean of the original data = 12

Therefore, the new mean = $12/2 = 6$

(iii) Multiplied by 3 and then divided by 2

If \bar{x} is the mean of n number of observations $x_1, x_2, x_3, \dots, x_n$,

Mean of $a/b x_1, a/b x_2, a/b x_3, \dots, a/b x_n$ is $a/b \bar{x}$

When each of the given data is multiplied by $3/2$, the mean is also multiplied by $3/2$.

Mean of original data = 12

Therefore, the new mean = $3/2 \times 12 = 36/2 = 18$

(iv) Increased by 25%

We know that

New mean = Original mean + 25% of original mean

New mean = $12 + 25\% \text{ of } 12$

New mean = $12 + 25/100 \times 12$

So we get

$$\text{New mean} = 12 + \frac{1}{4} \times 12$$

$$\text{New mean} = 12 + 3$$

$$\text{New mean} = 15$$

(v) Decreased by 40%

We know that

$$\text{New mean} = 12 - 40\% \text{ of } 12$$

$$\text{New mean} = 12 - \frac{40}{100} \times 12$$

So we get

$$\text{New mean} = 12 - \frac{2}{5} \times 12$$

$$\text{New mean} = 12 - 0.4 \times 12$$

$$\text{New mean} = 12 - 4.8$$

$$\text{New mean} = 7.2$$

2. The mean of 18, 24, 15, $2x + 1$ and 12 is 21. Find the value of x .

Solution:

We know that

Mean of given data

$$= \frac{18 + 24 + 15 + 2x + 1 + 12}{5}$$

$$21 = \frac{70 + 2x}{5}$$

By cross multiplication

$$5 \times 21 = 70 + 2x$$

$$105 = 70 + 2x$$

On further calculation

$$2x = 105 - 70$$

$$2x = 35$$

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

3. The mean of 6 numbers is 42. If one number is excluded, the mean of remaining number is 45. Find the excluded number.

Solution:

If \bar{x} is the mean of n number of observations $x_1, x_2, x_3, \dots, x_n$

$$\text{Mean of given data} = \frac{x_1 + x_2 + x_3 + \dots + x_n}{n}$$

It is given that mean of 6 numbers is 42

$$\frac{x_1 + x_2 + x_3 + \dots + x_6}{6} = 42$$

$$x_1 + x_2 + x_3 + \dots + x_6 = 42 \times 6$$

$$x_1 + x_2 + x_3 + x_4 + x_5 = 252 - x_6 \dots \dots (1)$$

It is also given that the mean of 5 numbers is 45

$$\frac{x_1 + x_2 + x_3 + x_4 + x_5}{5} = 45$$

$$x_1 + x_2 + x_3 + x_4 + x_5 = 45 \times 5$$

$$x_1 + x_2 + x_3 + x_4 + x_5 = 225 \dots\dots (2)$$

From equating both the equations

$$252 - x_6 = 225$$

$$x_6 = 252 - 225 = 27$$

4. The mean of 10 numbers is 24. If one more number is included, the new mean is 25. Find the included number.

Solution:

If \bar{x} is the mean of n number of observations $x_1, x_2, x_3, \dots\dots x_n$

$$\text{Mean of given data} = \frac{x_1 + x_2 + x_3 + \dots\dots + x_n}{n}$$

It is given that the mean of 10 numbers is 24

$$\frac{x_1 + x_2 + x_3 + \dots\dots + x_{10}}{10} = 24$$

$$x_1 + x_2 + x_3 + \dots\dots + x_{10} = 24 \times 10$$

$$x_1 + x_2 + x_3 + x_4 + \dots\dots + x_{10} = 240$$

$$x_1 + x_2 + x_3 + x_4 + \dots\dots + x_{10} = 240 + x_{11} \dots\dots (1)$$

It is also given that the mean of 11 numbers is 25.

$$\frac{x_1 + x_2 + x_3 + \dots\dots + x_{10} + x_{11}}{11} = 25$$

$$x_1 + x_2 + x_3 + x_4 + \dots\dots + x_{10} + x_{11} = 11 \times 25$$

$$x_1 + x_2 + x_3 + x_4 + \dots\dots + x_{10} + x_{11} = 275 \dots\dots (2)$$

From equating both the equations

$$240 + x_{11} = 275$$

$$x_{11} = 275 - 240 = 35$$

5. The following observations have been arranged in ascending order. If the median of the data is 78, find the value of x.

44, 47, 63, 65, x + 13, 87, 93, 99, 110.

Solution:

The data given is

44, 47, 63, 65, x + 13, 87, 93, 99, 110

Total number of observations (n) = 9 which is odd

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

$$\text{Median} = \left(\frac{9+1}{2}\right)^{\text{th}} \text{term}$$

$$= 5^{\text{th}} \text{ term}$$

$$= x + 13$$

It is given that the median is 78

$$x + 13 = 78$$

$$x = 78 - 13 = 65$$



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