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Solutions
Class 9 Maths
Chapter 24
Ex 24.1

Q.1: If the heights of 5 persons are 140 cm, 150 cm, 152 cm, 158 cm and 161 cm respectively. Find the mean height.

SOLUTION :

Given : the heights of 5 persons are 140 cm , 150 cm , 152 cm , 158 cm and 161 cm

∴ Mean Weight = $\frac{\text{sum of heights}}{\text{total no. of persons}}$

= $\frac{140+150+152+158+161}{5}$

= $\frac{761}{5}$ =152.2

Q 2 . Find the mean of 994 , 996 , 998 , 1000 , 1002.

SOLUTION :

Given :

Numbers are 994 , 996 , 998 , 1000 , 1002.

∴ Mean = $\frac{\text{sum of numbers}}{\text{total numbers}}$

= $\frac{994+996+998+1000+1002}{5}$

= $\frac{4990}{5}$ = 998

Mean = 998

Q 3 . Find the mean of first five natural numbers.

SOLUTION :

The first five odd numbers are 1 , 2 , 3 , 4 , 5.

∴ Mean = $\frac{\text{sum of numbers}}{\text{total numbers}}$

= $\frac{1+2+3+4+5}{5}$

= $\frac{15}{5}$ = 3

Mean = 3

Q 4 . Find the mean of all factors of 10.

SOLUTION :

All factors of 6 are 1 , 2 , 5 , 10.

∴ Mean = $\frac{\text{sum of factors}}{\text{total factors}}$

= $\frac{1+2+5+10}{4}$ = 4.5

Mean = 4.5

Q 5 . Find the mean of first ten even natural numbers.

SOLUTION :

The first five even natural numbers are 2 , 4 , 6 , 8 , 10 , 12 , 14 , 16 , 18 , 20

$\therefore$ Mean = $\frac{\text{sum of numbers}}{\text{total numbers}}$

$= \frac{2+4+6+8+10+12+14+16+18+20}{10}$ =11

Mean = 11

Q 6 . Find the mean of x , x + 2 , x + 4 , x + 6 , x + 8.

SOLUTION :

Numbers are x , x + 2 , x + 4 , x + 6 , x + 8.

$\therefore$ Mean = $\frac{\text{sum of numbers}}{\text{total numbers}}$

$= \frac{x+x+2+x+4+x+6+x+8}{5}$

$= \frac{5x+20}{5}$

$= 5\left(\frac{x+4}{5}\right)$

= x + 4

Q 7 . Find the mean of first five multiples of 3.

SOLUTION :

First five multiples of 3 are 3 , 6 , 9 , 12 , 15.

$\therefore$ Mean = $\frac{\text{sum of numbers}}{\text{total numbers}}$

$= \frac{3+6+9+12+15}{5}$

=9

Mean = 9

Q 8 . Following are the weights of 10 new born babies in a hospital on a particular day : 3.4 , 3 .6 , 4.2 , 4.5 , 3.9 , 4.1 , 3.8 , 4.5 , 4.4 , 3.6 (in kg). Find the mean.

SOLUTION :

The weights (in kg) of 10 new born babies are : 3.4 , 3 .6 , 4.2 , 4.5 , 3.9 , 4.1 , 3.8 , 4.5 , 4.4 , 3.6

$\therefore$ Mean Weight = $\frac{\text{sum of weights}}{\text{total no. of babies}}$

$= \frac{3.4+3.6+4.2+4.5+3.9+4.1+3.8+4.5+4.4+3.6}{10}$

=4 kg

Q 9 . The percentage marks obtained by students of a class in mathematics are as follows: 64 , 36 , 47 , 23 , 0 , 19 , 81 , 93 , 72 , 35 , 3 , 1 .Find their mean.

SOLUTION :

The percentage marks obtained by students are 64 , 36 , 47 , 23 , 0 , 19 , 81 , 93 , 72 , 35 , 3 , 1

$\therefore$ Mean marks $= \dfrac{\text{sum of marks}}{\text{total numbers of marks}}$

$= \dfrac{64+36+47+23+0+19+81+93+72+35+3+1}{5}$ =39.5

Mean Marks = 39.5

Q 10. The numbers of children in 10 families of a locality are 2 , 4 , 3 , 4 , 2 , 3 , 5 , 1 , 1 , 5 . Find the number of children per family.

SOLUTION :

The numbers of children in 10 families are : 2 , 4 , 3 , 4 , 2 , 3 , 5 , 1 , 1 , 5

$\therefore$ Mean = $\dfrac{\text{total no. children}}{\text{total families}}$

$= \dfrac{2+4+3+4+2+3+5+1+1+5}{10}$ = 3

Q 11 . If M is the mean of x_1, x_2, x_3, x_4, x_5 and x_6 **, Prove that**
$(x_1 - M) + (x_2 - M) + (x_3 - M) + (x_4 - M) + (x_5 - M) + (x_6 - M) = 0.$

SOLUTION :

Let M be the mean of x_1, x_2, x_3, x_4, x_5 and x_6

Then M= $\dfrac{x_1+x_2+x_3+x_4+x_5+x_6}{6}$

= $x_1 + x_2 + x_3 + x_4 + x_5 + x_6$ = 6M

To Prove :- $(x_1 - M) + (x_2 - M) + (x_3 - M) + (x_4 - M) + (x_5 - M) + (x_6 - M) = 0.$

Proof :- L . H . S

= $(x_1 - M) + (x_2 - M) + (x_3 - M) + (x_4 - M) + (x_5 - M) + (x_6 - M)$

= $(x_1 + x_2 + x_3 + x_4 + x_5 + x_6) - (M + M + M + M + M + M)$

= 6M − 6M

= 0

= R . H . S

Q 12 . Duration of sunshine(in hours) in Amritsar for first 10 days of August 1997 as reported by the Meterological Department are given as follows : 9.6 , 5.2 , 3.5 , 1.5 , 1.6 , 2.4 , 2.6 , 8.4 , 10.3 , 10.9

1. Find the mean $\overline{X}$

2.Verify that $\sum_{i=1}^{10} ({}_x i - \overline{X}) = 0$

SOLUTION :

Duration of sunshine (in hours) for 10 days are =9.6 , 5.2 , 3.5 , 1.5 , 1.6 , 2.4 , 2.6 , 8.4 , 10.3 , 10.9

(i) Mean $\overline{X} = \dfrac{\text{sum of numbers}}{\text{total numbers}}$

$= \dfrac{9.6+5.2+3.5+1.5+1.6+2.4+2.6+8.4+10.3+10.9}{10}$

= $\dfrac{56}{10}$ = 5.6

(ii) L.H.S = $\sum_{i=1}^{10} (x_i - \overline{X})$

= $(x_1 - \overline{x}) + (x_2 - \overline{x}) + (x_3 - \overline{x})+........ +(x_{10} - \overline{x})$

=

$(9.6 - 5.6) + (5.2 - 5.6) + (3.5 - 5.6) + (1.5 - 5.6) + (1.6 - 5.6) + (2.4 - 5.6) + (2.6 - 5.6)$
$+ (8.4 - 5.6) + (10.3 - 5.6) + (10.9 - 5.6)$

= 4 − 0.4 − 2.1 − 4.1 − 4 − 3.2 − 3 + 2.8 + 4.7 + 5.3

= 16.8 − 16.8 = 0

= R.H.S

Q 13. Explain, by taking a suitable example, how the arithmetic mean alters by (i) adding a constant k to each term, (ii) Subtracting a constant k from each term, (iii) multiplying each term by a constant k and (iv) dividing each term by non-zero constant k.

SOLUTION :

Let say numbers are 3 , 4 , 5

∴ Mean = $\frac{\text{sum of numbers}}{\text{total numbers}}$

= $\frac{3+4+5}{3}$ = 4

(i). Adding constant term k = 2 in each term.

New numbers are = 5 , 6 , 7

∴ Mean = $\frac{\text{sum of numbers}}{\text{total numbers}}$

= $\frac{5+6+7}{3}$

= 6 = 4 + 2

∴ new mean will be 2 more than the original mean.

(ii). Subtracting constant term k = 2 in each term.

New numbers are = 1 , 2 , 3

∴ Mean = $\frac{\text{sum of numbers}}{\text{total numbers}}$

= $\frac{1+2+3}{3}$

= 2 = 4 − 2

∴ new mean will be 2 less than the original mean.

(iii) . Multiplying by constant term k = 2 in each term.

New numbers are = 6 , 8 , 10

∴ Mean = $\frac{\text{sum of numbers}}{\text{total numbers}}$

= $\frac{6+8+10}{3}$

= 8 = 4×2

∴ new mean will be 2 times of the original mean.

(iv) . Divide the constant term k =2 in each term.

New numbers are = 1.5 , 2 , 2.5.

∴ Mean $= \frac{\text{sum of numbers}}{\text{total numbers}}$

$= \frac{1.5+2+2.5}{3}$

$= 2 = \frac{4}{2}$

∴ new mean will be half of the original mean.

Q 14. The mean of marks scored by 100 students was found to be 40. Later on, it was discovered that a score of 53 was misread as 83. Find the correct mean.

SOLUTION :

Mean marks of 100 students = 40

Sum of marks of 100 students = 100×40

= 4000

Correct value = 53

Incorrect value = 83

Correct sum = 4000 – 83 + 53 = 3970

∴ correct mean = $\frac{3970}{100}$ = 39.7

Q 15 . The traffic police recorded the speed (in km/hr) of 10 motorists as 47 , 53 , 49 , 60 , 39 , 42 , 55 , 57 , 52 , 48 . Later on, an error in recording instrument was found. Find the correct average speed of the motorists if the instrument is recorded 5 km/hr less in each case.

SOLUTION :

The speed of 10 motorists are 47 , 53 , 49 , 60 , 39 , 42 , 55 , 57 , 52 , 48 .

Later on it was discovered that the instrument recorded 5 km/hr less than in each case

∴ correct values are = 52 , 58 , 54 , 65 , 44 , 47 , 60 , 62 , 57 , 53.

∴ correct mean = $\frac{52+58+54+65+44+47+60+62+57+53}{10}$

$= \frac{552}{10}$ =55.2 km/hr

Q 16. The mean of five numbers is 27. If one number is excluded, their mean is 25. Find the excluded number.

SOLUTION :

The mean of five numbers is 27

The sum of five numbers = 5×27 = 135

If one number is excluded , the new mean is 25

∴Sum of 4 numbers = 4×25 = 100

∴ Excluded number = 135 – 100 = 35

Q 17. The mean weight per student in a group of 7 students is 55 kg. The individual weights of 6 of them (in kg) are 52, 54, 55, 53, 56 and 54. Find the weight of the seventh student.

SOLUTION :

The mean weight per student in a group of 7 students = 55 kg

Weight of 6 students (in kg) = 52 , 54 , 55 , 53 , 56 and 54

Let the weight of seventh student = x kg

∴ Mean Weight = $\frac{\text{sum of weights}}{\text{total no. of students}}$

$\Rightarrow 55 = \frac{52+54+55+53+56+54+x}{7}$

$\Rightarrow 385 = 324 + x$

$\Rightarrow x = 385 - 324$

$\Rightarrow x = 61$ kg

∴ weight of seventh student = 61 kg.

Q 18. The mean weight of 8 numbers is 15. If each number is multiplied by 2 , what will be the new mean?

SOLUTION :

We have ,

The mean weight of 8 numbers is 15

Then , the sum of 8 numbers = 8×15 = 120

If each number is multiplied by 2

Then , new mean = 120×2 = 240

∴ new mean = $\frac{240}{8}$ = 30.

Q 19. The mean of 5 numbers is 18. If one number is excluded, their mean is 16. Find the excluded number.

SOLUTION :

The mean of 5 numbers is 18

Then , the sum of 5 numbers = 5×18 = 90

If one number is excluded

Then , the mean of 4 numbers = 16

∴ sum of 4 numbers = 4×16 = 64

Excluded number = 90 − 64 = 26.

Q 20. The mean of 200 items was 50. Later on, it was on discovered that the two items were misread as 92 and 8 instead of 192 and 88. Find the correct mean.

SOLUTION :

The mean of 200 items = 50

Then the sum of 200 items = 200×50 = 10,000

Correct values = 192 and 88.

Incorrect values = 92 and 8.

∴ correct sum = 10000 − 92 − 8 + 192 + 88 = 10180

∴ correct mean = $\frac{10180}{200}$ = $\frac{101.8}{2}$ = 50.9 .

Q 21 . Find the values of n and $\overline{X}$ in each of the following cases :

(i). $\sum_{i=1}^{n}(x_i - 12) = -10$ and $\sum_{i=1}^{n}(x_i - 3) = 62$

(ii). $\sum_{i=1}^{n}(x_i - 10) = 30$ and $\sum_{i=1}^{n}(x_i - 6) = 150$

SOLUTION :

(i). Given $\sum_{i=1}^{n}(x_i - 12)$=-10

$\Rightarrow (x_1 - 12) + (x_2 - 12)+$ ……… $+(x_n - 12) = -10$

$\Rightarrow (x_1 + x_2 + x_3 + x_4 + x_5 + \cdots + x_n) - (12 + 12 + 12 + 12 + \cdots + 12) = -10$

$\Rightarrow \sum x - 12n = -10 \cdots\cdots\cdots\cdots\cdots\cdots (1)$

And $\sum_{n}^{i=1}(x_i - 3) = 62$

$\Rightarrow (x_1 - 3) + (x_2 - 3) + \cdots\cdots + (x_n - 3) = 62$

$\Rightarrow (x_1 + x_2 + \cdots + x_n) - (3 + 3 + 3 + \cdots + 3) = 62$

$\Rightarrow \sum x - 3n = 62 \cdots\cdots\cdots\cdots (2)$

By subtracting equation (1) from equation(2) , we get

$\sum x - 3n - \sum x + 12n = 62 + 10$

$\Rightarrow 9n = 72$

$\Rightarrow n = \frac{72}{9} = 8$

Put value of n in equation (1)

$\sum x - 12 \times 8 = -10$

$\Rightarrow \sum x - 96 = -10$

$\Rightarrow \sum x = 96 - 10 = 86$

$\therefore \overline{x} = \frac{\sum x}{n} = \frac{86}{8} = 10.75$

(ii). Given $\sum_{i=1}^{n}(x_i - 10)$=30

$(x_1 - 10) + (x_2 - 10)+$ ………… $+ (x_n - 10)$=30

$\Rightarrow (x_1 + x_2 + x_3 + x_4 + x_5 + \cdots + x_n) - (10 + 10 + 10 + 10 + \cdots + 10) = 30$

$\Rightarrow \sum x - 10n = 30 \cdots\cdots\cdots\cdots\cdots\cdots (1)$

And $\sum_{n}^{i=1}(x_i - 6) = 150$

$\Rightarrow (x_1 - 6) + (x_2 - 6) + \cdots\cdots + (x_n - 6) = 150$

$\Rightarrow (x_1 + x_2 + \cdots + x_n) - (6 + 6 + 6 + \cdots + 6) = 150$

$\Rightarrow \sum x - 6n = 150 \cdots\cdots\cdots (2)$

By subtracting equation (1) from equation(2) , we get

$\sum x - 6n - \sum x + 10n = 150 - 30$

$\Rightarrow 4n = 120$

$\Rightarrow n = \frac{120}{4} = 30$

Put value of n in equation (1)

$\sum x - 10 \times 30 = 30$

$\Rightarrow \sum x - 300 = 30$

$\Rightarrow \sum x = 30 + 300 = 330$

$\therefore \overline{x} = \frac{\sum x}{n} = \frac{330}{30} = 11.$

Q 22 . The sum of the deviations of a set of n values $x_1, x_2, x_3, \cdots, x_n$ measured from 15 and -3 are -90 and 54 respectively . Find the value of n and mean .

SOLUTION :

Given :

$\sum_n^{i=1} (x_i - 15) = -90$

$\Rightarrow (x_1 - 15) + (x_2 - 15) + \cdots\cdots + (x_n - 15) = -90$

$\Rightarrow (x_1 + x_2 + \cdots\cdot +_n) - (15 + 15 + 15 + \cdots\cdots +15) = -90$

$\Rightarrow \sum x - 15n = -90 \cdots\cdots (1)$

And $\sum_n^{i=1} (x_i + 3) = 54$

$\Rightarrow (x_1 + 3) + (x_2 + 3) + \cdots\cdots + (x_n + 3) = 54$

$\Rightarrow (x_1 + x_2 + \cdots\cdot +_n) + (3 + 3 + 3 + \cdots\cdots +3) = 54$

$\Rightarrow \sum x + 3n = 54 \cdots\cdots (2)$

By subtracting equation (1) from equation(2) , we get

$\sum x + 3n - \sum x + 15n = 54 + 90$

$\Rightarrow 18n = 144$

$\Rightarrow n = \frac{144}{18} = 8$

Put value of n in equation(1)

$\sum x - 15 \times 8 = -90$

$\sum x - 120 = -90$

$\sum x = 120 - 90 = 30$

$\therefore \overline{x} = \frac{\sum x}{n} = \frac{30}{8} = 3.75.$

Q 23 . Find the sum of the deviations of the variate values 3 , 4 , 6 , 7 , 8 , 14 from their mean.

SOLUTION :

Values 3 , 4 , 6 , 7 , 8 , 14

$\therefore \text{Mean} = \frac{\text{sum of numbers}}{\text{total numbers}}$

$\therefore \text{Mean} = \frac{3+4+6+7+8+14}{6}$

$\therefore \text{Mean} = \frac{42}{6}$

=7

∴ Sum of deviation of values from their mean

= $(3-7)+(4-7)+(6-7)+(7-7)+(8-7)+(14-7)$

= − 4 − 3 − 1 + 0 + 1 + 7

= − 8 + 8 = 0

Q 24 . If $\overline{X}$ is the mean of the ten natural numbers $x_1, x_2, x_3, \cdots, x_{10}$ **show that**
$(x_1-\overline{X})+(x_2-\overline{X})+\cdots\cdot+(x_{10}-\overline{X})=0$

SOLUTION :

We have , $\overline{x} = \frac{x_1+x_2+\cdots+x_{10}}{10}$

$\Rightarrow x_1+x_2+\cdots+x_{10} = 10\overline{x} \cdots\cdots\cdots (1)$

Now , $(x_1-\overline{X})+(x_2-\overline{X})+\cdots\cdot+(x_{10}-\overline{X})$

=$(x_1+x_2+\cdots\cdots+x_{10})-(\overline{x}+\overline{x}+\overline{x}+\text{upto 10 terms})$

=$10\overline{x}-10\overline{x}$ [By equation (i)]

$\therefore (x_1-\overline{X})+(x_2-\overline{X})+\cdots\cdot+(x_{10}-\overline{X})=0$