CHAPTER 06

Average

An average or arithmetic mean of given data is the sum of the given observations divided by number of observation.

Average

The average of a number of quantities belongs to some kind is their sum divided by the number of those quantities.

In other words, an average of a given observation or data is a number which is found on dividing the sum of observations or data by the number of observations or data given.

$$\textbf{Average} = \frac{\text{Sum of observations}}{\text{Number of observations}}$$

Points to be Remember

- The quantities whose average is to be determined, should be in the same unit.
- Average of the given observations is x.

(i) If each observation is increased by a, then new average $= x + a$

(ii) If each observation is decreased by a, then new average $= x - a$

(iii) If each observation is multiplied by a, then new average $= ax$

(iv) If each observation is divided by a, then new average $= \frac{x}{a}$

Important Tips/Formulae

- Average of two groups are a and b, respectively. If number of items in first and second group are x and y respectively, then Average of both the groups $= \frac{ax+by}{x+y}$
- The average weight/age of group of n person is x. If a person of y kg/yr is replaced by another person of z kg/yr, then New average weight/age $= x + \left(\frac{z-y}{n}\right)$
- The average of marks of n students was calculated as x. But it was later found that the marks of one student had been wrongly entered as a instead of b and of another as c instead of d.
- The correct average

$= x + \left[\dfrac{\text{Sum of correct marks -Sum of wrongly entered marks}}{n}\right]$

- The average of consecutive natural numbers upto $n = \frac{n+1}{2}$
- The average of square of consecutive natural numbers upto n

$$= \frac{(n+1)(2n+1)}{6}$$

- The average of cubes of consecutive natural numbers upto n

$$= \left[n\left(\frac{n+1}{2}\right)\right]^2$$

- The average of consecutive even numbers upto $n = \frac{n}{2} + 1$
- The average of consecutive odd numbers upto $n = \frac{n+1}{2}$
- The average of first n consecutive even numbers $= (n+1)$
- The average of first n consecutive odd numbers $= n$
- A man covers a distance d at x km/h and returns back to the starting point at y km/h. Then,

Average speed during whole journey $= \frac{2xy}{(x+y)}$ km/h

Solved Examples:

1. If average of given numbers $3,5,6,7,9,x$ is 7, then find the value of x.

(a) 12
(b) 10
(c) 14
(d) 11

Sol. (a) Average $= \frac{3+5+6+7+9+x}{6}$

i.e., $7 = \dfrac{30+x}{6}$

$\Rightarrow 30 + x = 42 \Rightarrow x = 12$

2. A tabulator while calculating the average marks of 100 students of an examination, by mistake enters 68, instead of 86 and obtained the average as 58, the actual average marks of those students is

(a) 58.18
(b) 57.82
(c) 58.81
(d) 57.28

Sol. (a) Actual total marks of 100 students

$$= 5800 + (86 - 68) = 5818$$

$\therefore$ Required actual average $= \dfrac{5818}{100} = 58.18$

3. The average weight of 8 persons increased by 1.5 kg when a person weighing 65 kg is replaced by a new person. What could be the weight of new person?

(a) 75 kg
(b) 82 kg
(c) 77 kg
(d) 70 kg

Sol. (c) Let the average weight of 8 persons be $\bar{x}$ and the weight of the new person be w kg.

Sum of the weight of 8 persons $= 8\bar{x}$

By given condition, new sum $= 8\bar{x} - 65 + w$

$\therefore$ New average $= \frac{8\bar{x}-65+w}{8} = \bar{x} + 1.5 \Rightarrow 8\bar{x} - 65 + w = 8\bar{x} + 12 \Rightarrow w = 77$ kg

Alternate Method

Weight of new person = number of persons × increment of average + weight of the person replaced

$$= 8 \times 1.5 + 65 = 77 \text{ kg}$$

4. The average of 9 numbers is 30. The average of first 5 numbers is 25 and that of the last 3 numbers is 35. What is the 6th number?

(a) 42
(b) 40
(c) 39
(d) 41

Sol. (b) Average $= \frac{\text{Sum of observations}}{\text{Number of observations}}$

$\Rightarrow$ Total sum $= 9 \times 30 = 270$

Sum of first five $= 5 \times 25 = 125$

Sum of last three $= 3 \times 35 = 105$

$\therefore$ 6th number $= 270 - (125 + 105) = 40$

5. A library has an average number of 510 visitors on Sunday and 240 on other days. The average number of visitors per day in a month of 30 days beginning with Sunday is

(a) 290
(b) 285
(c) 295
(d) 300

Sol. (b) A month beginning with Sunday will have $= 5$

Sundays total number of other days $= 30 - 5 = 25$ days

$\therefore$ Average number of visitor $= \frac{510 \times 5 + 25 \times 240}{30}$

$= \frac{2250 + 6000}{30} = 285$ visitors

Practice Questions

1. The average of $10,12,16,20, p$ and 26 is 17. Find the value of p.

(a) 17
(b) 18
(c) 15
(d) 16

2. The average of 11 results is 60 marks. If the average of first six results is 59 marks and that of the last six is 62 marks, then the sixth result contains

(a) 65 marks
(b) 66 marks
(c) 60 marks
(d) 61 marks

3. The average wage of workers in a factory is ₹ 6000. There are 12 officers having an average wage of ₹ 14000, while the average wage of the remaining persons is ₹ 5600, the number of the workers is that factory is

(a) 242
(b) 252
(c) 240
(d) 230

4. The average of 5 numbers is 20 and 4 of the numbers are 10,15,20 and 25 . If the number are arranged in ascending order, then the average of the last three is

(a) 25
(b) 18.75
(c) 24
(d) 22.33

5. In a class, the average score of girls in an examination is 73 and that of boys is 71. The average score for the whole class is 71.8. Find the percentage of girls.

(a) 40%
(b) 50%
(c) 55%
(d) 60%

6. The average of three numbers is 135. The largest number is 195 and the difference between the other two is 20. The smallest number is

(a) 65
(b) 95
(c) 105
(d) 115

7. The average of 6 numbers is 30. If first four numbers average is 25 and last three numbers average is 35, then fourth number will be

(a) 25
(b) 30
(c) 35
(d) 40

8. In the first 10 overs of a cricket game, the run rate was only 3.2. What should be the run rate in the remaining 40 overs to reach the target of 282 runs?

(a) 6.25
(b) 6.5
(c) 6.75
(d) 7

9. A grocer has a sale of ₹ 6435, ₹ 6927, ₹ 6855, ₹ 7230 and ₹ 6562 for 5 consecutive months. How much sale must he have in the sixth month, so that he gets an average sale of ₹ 6500?

(a) ₹ 4991
(b) ₹ 5991
(c) ₹ 6001
(d) ₹ 6991

10. The population of a town increased from 175000 to 262500 in a decade. The average per cent increase of population per year is

(a) 4.37%
(b) 5%
(c) 6%
(d) 8.75%

11. The average of the even numbers from 1 to 30 is

(a) 15
(b) 17
(c) 19
(d) 16

12. The average of 5 consecutive numbers is 18. The highest of these numbers will be

(a) 24
(b) 18
(c) 20
(d) 22

13. The average of two numbers is M. If one number is N, then the other number is

(a) $2N$
(b) $2M$
(c) $M - N$
(d) $2M - N$

14. The average of marks of a student in 7 subjects is 75. His average in 6 subjects excluding Science is 72. How many marks did he get in science?

(a) 72
(b) 90
(c) 93
(d) None of these

15. The average age of a class is 15.8yr. The average age of the boys in the class is 16.4yr while that of the girls is 15.4yr. What is the ratio of boys to girls in the class?

(a) 1: 2
(c) 3: 5
(b) 3: 4
(d) None of these

16. The average of 50 numbers is 38. If two numbers namely 45 and 55 are discarded, the average of remaining numbers is

(a) 36.5
(b) 37
(c) 37.5
(d) 37.52

17. A motorist travels to a place 150 km away at an average speed of 50 km/h and returns at 30 km/h. His average speed for the whole journey (in km/h) is

(a) 35
(b) 37
(c) 37.5
(d) 40

18. Three years ago, the average age of a family of 5 members was 17yr. A baby having been born, the average age of the family is the same today. The present age of the baby is

(a) 2yr
(b) 2.4yr
(c) 3yr
(d) 1.5yr

19. Five years ago, the average age of P and Q was 15 yr. Average age of P, Q and R today is 20yr. How old will R be after 10yr?

(a) 35yr
(b) 40yr
(c) 30yr
(d) 50yr

20. The average of 11 observations is 60. If the average of first five observations is 58 and that of last five is 56, the sixth observation is

(a) 90
(b) 110
(c) 85
(d) 100

21. A cricketer has completed 14 innings and his average is 30 runs. How many runs must he make in his next innings so as to raise his average to 32?

(a) 60
(b) 55
(c) 65
(d) 50

22. The average of five numbers is 42 while the average of another eight numbers is 81. What is the combined average of all numbers together?

(a) 66
(b) 60.5
(c) 68.5
(d) 64

23. The average of first five multiple of 3 is

(a) 3
(b) 9
(c) 12
(d) 15

24. Find the average of four numbers $2\frac{3}{4}, 5\frac{1}{3}, 4\frac{1}{6}, 8\frac{1}{2}$.

(a) $5\frac{3}{16}$
(b) $3\frac{3}{16}$
(c) $16\frac{5}{3}$
(d) $3\frac{16}{3}$

ANSWERS

1. (b)	**2.** (b)	**3.** (b)	**4.** (a)	**5.** (a)	**6.** (b)	**7.** (a)	**8.** (a)	**9.** (a)	**10.** (b)
11.(d)	**12.**(c)	**13.**(d)	**14.(c)**	**15.**(d)	**16.**(c)	**17.**(c)	**18.** (a)	**19.(c)**	**20.** (a)
21.(a)	**22.**(a)	**23.**(b)	**24.**(a)						

Hints & Solutions

1. Average of $10,12,16,20, p$ and $26 = 17$

$\Rightarrow \frac{10+12+16+20+p+26}{6} = 17$

$\Rightarrow 84 + p = 102 \Rightarrow p = 18$

2. Required perimeter

$= 6 \times 59 + 6 \times 62 - 11 \times 60$
$= 6[59 + 62 - 110]$
$= 6[121 - 110] = 6 \times 11 = 66$

3. Let the total number of Employee in factory be n, then According to question,

$6000 = \frac{12 \times 14000 + (n-12) \times 5600}{n} \Rightarrow 6000n$

$= 168000 + 5600n - 67200$

$\Rightarrow 400n = 100800$

$\therefore n = 252$

4. Sum of 5 numbers $= 20 \times 5 = 100$

Since, 4 of the number are 10, 15, 20 and 25, therefore fifth number $= 100 - (10 + 15 + 20 + 25)$

$= 100 - 70 = 30$

Now, arranging in ascending order, last three numbers are 20,25 and 30.
∴ Required average

$$= \frac{20 + 25 + 30}{3} = \frac{75}{3} = 25$$

5. Let the number of girls and boys are x, y respectively.

By given condition,

$$73x + 71y = 71.8(x + y)$$
$$\Rightarrow 1.2x = 0.8y$$
$$x = \frac{2}{3}y$$

∴ Percentage of girls

$$= \frac{x}{(x + y)} \times 100\%$$
$$= \frac{\frac{2}{3}y}{\left(\frac{2}{3}y + y\right)} \times 100\% = 40\%$$

6. Let smallest number $= x$

∴ Second number $= x + 20$

According to question,

Average of three numbers $= 135$

$$\frac{x + x + 20 + 195}{3} = 135$$
$$\Rightarrow 2x = 135 \times 3 - (20 + 195)$$
$$\Rightarrow 2x = 405 - 215$$
$$x = \frac{190}{2} = 95$$

7. Sum of 6 numbers $= 6 \times 30 = 180$

Sum of first 4 numbers $= 4 \times 25 = 100$

Sum of last 3 numbers $= 3 \times 35 = 105$

Hence, fourth number:

$$= (100 + 105) - 180$$
$$= 205 - 180 = 25$$

8. Total run in 10 overs $= 3.2 \times 10 = 32$ runs

Remaining run in 40 overs $= 282 - 32 = 250$ runs

∴ Required run rate in 40 overs

$$= \frac{250}{40} = 6.25$$

9. Let total sell will be in 6 months = ₹x

$$\text{Average} = \frac{\text{Total amount}}{\text{Number of months}}$$

$$6435 + 6927 + 6855$$

$$6500 = \frac{+7230 + 6562 + x}{6}$$
$$\Rightarrow\ 6500 \times 6 = 34009 + x$$
$$\therefore\ x = 39000 - 34009$$
$$= ₹\ 4991$$

10. Population increased in a decade $= 262500 - 175000 = 87500$

The average per cent increase of population

$$= \frac{87500}{175000 \times 10} \times 100$$
$$= \frac{8750}{1750} = 5\%$$

11. The average of even numbers from 1 to n is

$$= \frac{n+2}{2} = \frac{30+2}{2}$$

$$= \frac{32}{2} = 16$$

12. The four consecutive numbers

are $x, x+1, x+2, x+3, x+4$

$x + (x+1) + (x+2)$

$$\Rightarrow \frac{+(x+3)+(x+4)}{5} = 18$$

$$\Rightarrow \frac{5x+10}{5} = 18$$

$$\Rightarrow 5x = 90 - 10$$

$$\Rightarrow x = \frac{80}{5}$$

$$\therefore x = 16$$

The highest number $= x + 4$

13. Given, $M = \frac{N+x}{2}$,

$= 16 + 4 = 20$

where x is the other number.

Then, $x = 2M - N$

14. Average:

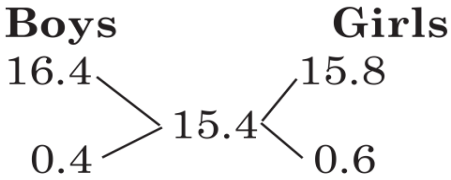
$$\frac{\text{Sum of numbers in all subjects}}{\text{Number of subjects}}$$

$\therefore$ Sum of numbers in 7 subjects $= 75 \times 7 = 525$

Sum of numbers in 6 subjects (excluding Science) $= 72 \times 6 = 432$

$\therefore$ Marks in Science $= 525 - 432 = 93$

15. Boys



Required ratio $= 2:3$

16. Average of remaining numbers

$$= \frac{(38 \times 50) - (45 + 55)}{48}$$

$$= \frac{1800}{48} = 37.5$$

17. Average speed

$$= \frac{\text{Total distance}}{\text{Total time}}$$

$$= \frac{300}{\frac{150}{30} + \frac{150}{50}}$$

$$= \frac{300}{8} = 37.5 \text{ km/h}$$

18. Total age of family three years ago

$= 17 \times 5 = 85$yr

Total age of family today

$= 85 + 5 \times 3 = 100$yr

Let the age of the baby be x yr.

$$\therefore \ \frac{100 + x}{6} = 17$$

$$\Rightarrow \ x = 2\text{yr}$$

19. Total age of P and Q today $= (15 \times 2 + 5 \times 2) = 40\text{yr}$

Total age of P, Q and R today

$= 20 \times 3 = 60\text{yr}$

Therefore, present age of $R = 60 - 40 = 20\text{yr}$

Age of R after $10\text{yr} = 20 + 10 = 30\text{yr}$

20. Sum of 11 observation $= 60 \times 11 = 660$

Sum of first 5 observation $= 5 \times 58 = 290$

Sum of last 5 observation $= 5 \times 56 = 280$

$\therefore$ 6th observation

$= 660 - (290 + 280) = 90$

21. Total runs scored in 14 innings $= 30 \times 14 = 420$

Suppose he makes x runs in his next inning.

Then, $\frac{420+x}{15} = 32$

$\therefore\ x = 32 \times 15 - 420 = 60$ runs

22. Sum of five numbers

$= 42 \times 5 = 210$

Sum of eight numbers

$= 81 \times 8 = 648$

$\therefore$ Average of all numbers

$= \frac{210 + 648}{13} = \frac{858}{13} = 66$

23. First five Multiple of $3 = 3,6,9,12,15$

Average $= \frac{3+6+9+12+15}{5} = \frac{45}{5} = 9$

24. Sum $= (2 + 5 + 4 + 8) +$

$$\left(\frac{3}{4} + \frac{1}{3} + \frac{1}{6} + \frac{1}{2}\right)$$

$$= 19 + \frac{7}{4} = 20 + \frac{3}{4}$$

$$\text{Average} = \frac{20 + \frac{3}{4}}{4}$$

$$= \frac{20}{4} + \frac{3}{16} = 5 + \frac{3}{16} = 5\frac{3}{16}$$