**AVERAGE**

Average is the arithmetic mean of the given data. If X1, X2, X3, X4… Xn are the ‘n’ number of quantities(i.e., data), then the average of (arithmetic mean of) these ‘n’ quantities = (X1+X2+X3+X4+…+Xn) / n

So, **Average = Sum of the quantities/ Number of the quantities**

**Properties of Averages:**

**Property 1:** The average of any two or more quantities is definitely in between the lowest and the highest of the given quantities.

**Example Problem 1: What is the average of 8, 10, 12, 24, 16 and 20?**

(a) 8 (b) 24 (c) 15 (d) 25

**Solution:**

**Method 1:**

We know Average = Sum of the terms/ Number of the terms

So, Average= (8+10+12+24+16+20)/6 = **15**. Option (c) is the answer.

**Method 2:**

We know thatthe average of the given quantities is definitely in between the lowest and the highest of the given quantities. Here, we can simply eliminate options (a), (b) and (d). So, Answer is option (c).

**Method 3:**

Assume an average. Let’s assume 14. Find the differences between our assumed average and the given quantities and adjust the error between our assumed average and the real average. 8 is 6 lesser than 14. So, consider the correction is -6. Similarly we get -4, -2, +10, +2, +6 . So the adjustment should be (-6-4-2+10+2+6)/ 6 which is equal to +1. i.e., our assumed average should be added with 1 to get the real average. So, the average is (14+1), i.e., **15**. (c) is the answer**. (NOTE: This method is well suitable for Numbers of greater denomination and the difference between the numbers is less)**

**Property 2:** If each quantity is increased by a certain value ‘K’, then the new average is also increased by the same value ‘K’.

**Example Problem 2: If the ages of the members of a family are 5, 10, 15, 20 and 25. What is the average age of that family after 7 years?**

**Solution:**

**Method 1:**

Average of the five quantities is (5+10+15+20+25)/5 = 15. So, the present average age is 15. After 7 years, everybody’s age will be increased by 7. So, the average is also increased by 7. So, the average age after 7 years will be 15+7= **22**.

**Method 2:**

After 7 years, Each of those persons’ age will be increased by 7. So, their ages will be 12, 17, 22, 27 and 32.

And, the average will be (12+17+22+27+32)/5= **22**

(This method is not suitable since the method 1 is better than this)

**Method 3:** Average of an arithmetic progression is the middle term, here it is 15. Then add 7 with it.

**Method 4:** Use average assumption method.(not the best one here)

**Property 3:** If each quantity is decreased by a certain value ‘K’, then the new average is also decreased by the same value ‘K’.

**Example Problem 3: Average weight of the members of a committee was 75 Kg. After providing fitness training to the members, each of them lost 8 Kg. What is the average weight of that committee after the training?**

**Solution:**

By applying the above property, the new average is 75-8 = **67**.

**Property 4:** If each quantity is multiplied by a certain value ‘K’, then the new average is also multiplied by the same value ‘K’.

**Example Problem 4 : The marks scored by seven students in an exam are 94, 86, 75, 93, 92, 82 & 80. If all their marks are multiplied by 3, find the average of the new marks.**

**Solution:**

**Method 1:**

Since each of the marks is multiplied by 3, average will also be multiplied by 3.

The initial average is (94+86+75+93+92+82+80)/7= 86.

It should be multiplied by 3. So, the final average is 86\*3= **258**.

**Method 2:**

Apply average assumption method and then multiply by 3.

**Method 3:**

Multiply each number by 3 and then find the average. (This method is time consuming and so not the best)

**Property 5:** If each quantity is divided by a certain value ‘K’, then the new average is also divided by the same value ‘K’.

**Example Problem 5: Six students scored 462, 487, 464, 450, 485 & 472 in their high school examination in which the maximum marks is 500. Find the average of their percentage of marks.**

**Solution:**

**Method 1:**

Percentage is the score calculated out of 100.

Here, the scores are calculated out of 500. To find out the percentage of marks, each value should be divided by 5.

Instead of that, we can directly find the average of all the given values and then divide it by 5. Average of the given values is (462+487+464+450+485+472)/6 = 470. Now, divide it by 5 i. e. , 470/5= **94**

**Method 2:** Use average assumption method.

**Property 6:** Weighted Average: If average of ‘m’ number of quantities is ‘x’ and the average of ‘n’ number of quantities is ‘y’, then the average of all these quantities is (m\*x + n\*y)/(m+n)

**Example Problem 6: The average salary of 12 employees of SRM is Rs. 18000 per month and 15 employees of IIT is Rs. 16000 per month. Find the average of all the 27 employees.**

**Solution:**

**Method 1:**

Average Salary = Sum of the salaries of all the employees/ Total number of employees

= (12\*18000 + 15\*16000) / (12+15)

= 456000/27

= **Rs. 16888.88**

**Method 2:**

Let’s assume all the employees get Rs. 16000 per month. So, the assumed average is 16000.

But, 12 people(SRM employees) get Rs.2000 more than the assumed average (ie, 18000). So, the extra amount is 12\*2000= 24000.

We need to distribute that 24000 among all the employees so that each will get 888.88(which is 24000/27). So, the average is 16000+888.88 = **16888.88**

**Method 3:**

Let’s assume all the employees get Rs. 18000 per month. So, the assumed average is 18000.

But, 15 people(IIT employees) get Rs.2000 less than the assumed average (ie, 16000).

The missed amount (15\*2000) is 30000. We need to subtract it(ie, 30000/27 which is 1111.1111) from the average of all the employees .

So the real average is 18000-1111.1111= **16888.88**

**Method 4:** Use allegation rule. (But, It’s not the best method for this problem)

**Example Problem 7: The number of students in CSE department , IT department and Software department is 30, 40 and 60 respectively and the respective average ages are 22, 21 and 25, then the average age of all the students is?**

**Solution:**

**Method 1:**

( 22\*30 + 21\*40 + 25\*60)/ 30+40+60 = 3000/130 = **23 1/13 years**

**Method 2 :** Use average assumption method. But, much practice is needed to use that method.

**Example Problem 8: The average age of Nilambari’s family consisting of 5 members 3 years ago was 35 years. One year ago, a new baby was born in this family. What will be the average age three years hence?**

**Solution:**

**Method 1:**

3 years ago, total age of 5 members = 5\*35 = 175 years

At the time of the birth of new baby, (ie, one year ago) , the total age of the family = 175+(2\*5) = 185 years.

The present age of the family = 185+ (1\*6) = 191 years.

3 years hence, the age of the employees= 191+(3\*6)= 209 years.

3 years hence, the average will be= 209/6= **34 5/6 years.**

**Method 2 :**

3 years ago, the average age was 35. So, 3 years hence, average age should be 35+6= 41.

But there will be a new baby in that family with the age of 4. That baby’s age is 37 lesser than the assumed average(ie, 41).

So, the correct average is 41-(37/6) =  **34 5/6 years.**

**Example Problem 9:**

**10 years ago, the average age of all the 25 teachers of a college was 45 years. 4 years ago, the principal has retired from his post at the age of 60 year. After one year, a new principal whose age was 54 years recruited from outside. Find out the present average age of all the teachers if the Principal is also considered as a teacher.**

**Solution:**

**Method 1:**

10 years ago, average age of the 25 teachers =45 years

4 years ago(just before the retirement of the Principal, average age of the 25 teachers= 45+6= 51 years

And the same time, the total age of the 25 teachers = 51\*25 = 1275 years

And the total age of the 24 teachers when just the principal has retired= 1275-60 = 1239 years

1 year later (ie, 3 years ago from present), total age of 24 teachers (just before the recruitment of the new Principal)= 1215+(1\*24)= 1239 years

And , the total age of the 25 teachers including the new Principal just after the recruitment = 1239+54 = 1293 years

Thus the present age of all the 25 teachers = 1293+(3\*25) = 1368 years.

Hence, the present average age of the 25 teachers= 1368/25= **54 18/25 years**

**Method 2:** Use the similar logic used in the method 2 of the previous question.

**Example Problem 10 : The average salary of Rahul, Basha and Aravind is Rs. 8000 per month. The average expenditure of of Rahul, Basha and Aravind per month is Rs. 5000. The average savings of all the 3 persons per month is?**

**Solution:**

Average saving= Average Income - Average Expenditure

= 8000 - 5000

**= 3000**

**Example Problem 11: The average salary of A, B and C is Rs.10,000 and average expenditure of A is Rs. 6000 then the average savings of B and C is**

**Solution:**

Total income = Total expenditure + Total savings  
We can not find the average savings of B and C. **Hence, data is insufficient**

**Example Problem 12: The average salary of A, B is Rs. 6000 and that of C, D and E is Rs. 8000. The average salary of all the 5 people is**

**Solution :**

**Method 1:**

Required average salary  
= ( 6000 x 2 + 8000 x 3) / (2 + 3 )  
= 36000 / 5  
= **Rs. 7200**

**Method 2:** Assume average salary of 5 people is Rs. 6000 or Rs. 8000 and then adjust the error in that assumption

**Example Problem 13: The captain of a cricket team of 11 members is 26 years old and the wicket keeper is 3 years older. If the ages of these two are excluded, the average age of the remaining players is one year less than the average age of the whole team. What is the average age of the team?**

**Solution:**

**Method 1:**

Let the average age of the whole team by *x* years.

https://www.indiabix.com/_files/images/aptitude/1-sym-tfr.gif 11*x* - (26 + 29) = 9(*x* -1)

https://www.indiabix.com/_files/images/aptitude/1-sym-imp.gif 11*x* - 9*x* = 46

https://www.indiabix.com/_files/images/aptitude/1-sym-imp.gif 2*x* = 46

https://www.indiabix.com/_files/images/aptitude/1-sym-imp.gif *x* = 23.

So, average age of the team is 23 years.

**Method 2:**

Average age of the captain and the wicket keeper is 27.5 which should be 4.5 greater than the average age of the whole team. So, Average age of the team is 27.5-4.5 = 23.

**Example Problem 14:** The average age of husband, wife and their child 3 years ago was 27 years and that of wife and the child 5 years ago was 20 years. The present age of the husband is:

**Solution:**

**Method 1:**

Sum of the present ages of husband, wife and child = (27 x 3 + 3 x 3) years = 90 years.

Sum of the present ages of wife and child = (20 x 2 + 5 x 2) years = 50 years.

* Husband's present age = (90 - 50) years = **40 years**.

**Method 2:**

3 years ago, the average age of husband, wife and their child = 27 years

So, **Present average of husband, wife and their child = 30**

5 years ago, the average age of wife and the child = 20 years

So, **Present average of wife and the child= 25**

So, it’s very easy to find the present age of the husband. It’s 10 more than the overall present average. Ie, 30+10= **40.**

**Example Problem 15: A library has an average of 510 visitors on Sundays and 240 on other days. The average number of visitors per day in a month of 30 days beginning with a Sunday is:**

**Solution:**

**Method 1:**

Since the month begins with a Sunday, to there will be five Sundays in the month.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Required average | |  |  |  |  | | --- | --- | --- | --- | | = | https://www.indiabix.com/_files/images/aptitude/1-sym-oparen-h1.gif | 510 x 5 + 240 x 25 | https://www.indiabix.com/_files/images/aptitude/1-sym-cparen-h1.gif | | 30 | |
|  | |  |  | | --- | --- | | = | 8550 | | 30 | |
|  | = **285** |

**Method 2:**

Each of the 5 Sundays has 270 visitors more than the other days. Ie, 270\*5 = 1350 visitors more than the remaining days.

That additional number of visitors 1350 should be distributed to the remaining days. For each day 1350/30 = 45 visitors should be added with the assumed average. So, It will be 240+45 = **285**.

**Example Problem 16: A pupil's marks were wrongly entered as 83 instead of 63. Due to that the average marks for the class got increased by half (1/2). The number of pupils in the class is:**

**Solution:**

**Method 1:**

Let there be *x* pupils in the class.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Total increase in marks = | https://www.indiabix.com/_files/images/aptitude/1-sym-oparen-h1.gif | *x* x | 1 | https://www.indiabix.com/_files/images/aptitude/1-sym-cparen-h1.gif | = | *x* |
| 2 | 2 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| https://www.indiabix.com/_files/images/aptitude/1-sym-tfr.gif | *x* | = (83 - 63)   https://www.indiabix.com/_files/images/aptitude/1-sym-imp.gif | *x* | = 20    https://www.indiabix.com/_files/images/aptitude/1-sym-imp.gif  *x*= **40**. |
| 2 | 2 |

**Method 2:**

If 20(ie, 83 instead of 63) is added wrongly in the sum, average will be increased by half(1/2). So, the number of people should be **40**.

**Example Problem 17: The average weight of 16 boys in a class is 50.25 kg and that of the remaining 8 boys is 45.15 kg. Find the average weights of all the boys in the class.**

**Solution:**

**Method 1:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Required average | |  |  |  |  | | --- | --- | --- | --- | | = | https://www.indiabix.com/_files/images/aptitude/1-sym-oparen-h1.gif | 50.25 x 16 + 45.15 x 8 | https://www.indiabix.com/_files/images/aptitude/1-sym-cparen-h1.gif | | 16 + 8 | |
|  | |  |  |  |  | | --- | --- | --- | --- | | = | https://www.indiabix.com/_files/images/aptitude/1-sym-oparen-h1.gif | 804 + 361.20 | https://www.indiabix.com/_files/images/aptitude/1-sym-cparen-h1.gif | | 24 | |
|  | |  |  | | --- | --- | | = | 1165.20 | | 24 | |
|  | = **48.55** |

**Method 2:**

Use average assumption method.

**Example Problem 18: The average weight of A, B and C is 45 kg. If the average weight of A and B be 40 kg and that of B and C be 43 kg, then the weight of B is:**

**Solution**:

Let A, B, C represent their respective weights. Then, we have:

A + B + C = (45 x 3) = 135 .... (i)

A + B = (40 x 2) = 80 .... (ii)

B + C = (43 x 2) = 86 ....(iii)

Adding (ii) and (iii), we get: A + 2B + C = 166 .... (iv)

Subtracting (i) from (iv), we get : B = 31.

https://www.indiabix.com/_files/images/aptitude/1-sym-tfr.gif B's weight = **31 kg**.

**Example Problem 19: A man on tour travels first 160 km at 64 km/hr and the next 160 km at 80 km/hr. The average speed of the entire journey is?**

**Solution:**

**Method 1:**

**Average speed= Total distance covered/ Total Time Taken**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total time taken = | https://www.indiabix.com/_files/images/aptitude/1-sym-oparen-h1.gif | 160 | + | 160 | https://www.indiabix.com/_files/images/aptitude/1-sym-cparen-h1.gifhrs. | = | 9 | hrs. |
| 64 | 80 | 2 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| https://www.indiabix.com/_files/images/aptitude/1-sym-tfr.gif Average speed = | https://www.indiabix.com/_files/images/aptitude/1-sym-oparen-h1.gif | 320 x | 2 | https://www.indiabix.com/_files/images/aptitude/1-sym-cparen-h1.gifkm/hr | = **71.11 km/hr**. |
| 9 |

**Method 2:**

**Average speed = (2\*X\*Y) / (X+Y**) If the same distance is covered twice at the rate of X kmph and Y kmph speeds

So, the average speed is (2\*64\*80)/ (64+80)= **71.11 km/hr**

(This will be discussed in Time, Speed and distance class)

**Example Problem 20: The total age of all the guests in a party was 540 years. If a couple left the party, the average remains unchanged. The wife and husband are of the same age. Then, the average age of this couple and the total number of guests respectively will be:**

**(a) 18, 27**

**(b) 20, 27**

**(c) 15, 38**

**(d) Can’t be determined**

**Solution**:

Let‘s assume ‘n’ is the number of people and ’x’ is the average. Then, n\*x = 540.

After the couple leaves, the average remains unchanged. So,

(540-2\*x)/ (n-2) = n.

Now, Solve through options

[540-(2\*20)]/25=20(unchanged)

Hence option **(b) 20, 27** is correct.