

## Learn the Concept of Change in Averages for WBP Constable Exam

Welcome to a tailored guide designed to enhance your preparation for the **WBP Constable Exam** by delving into the nuanced concept of **Change in Averages**. In the dynamic landscape of competitive exams, a strong command of mathematical principles is paramount, and understanding how averages change is a foundational skill. This resource offers a comprehensive exploration, providing clarity through detailed explanations, practical examples, and strategic problem-solving techniques.

Whether you're a WBP Constable Exam aspirant aiming to strengthen your quantitative aptitude or someone seeking a thorough understanding of changing averages, this guide is crafted to meet your needs. Join us on this educational journey, where conceptual mastery meets strategic application, ensuring you're well-equipped to tackle quantitative challenges in the WBP Constable Exam.

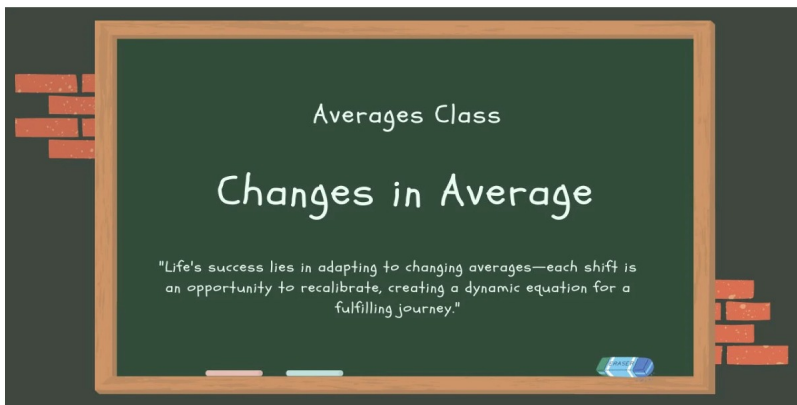
Before start discussing the Change in Averages, just learn the **Basic Concept of Averages** by clicking on the embedded link, so that, you can understand this topic better.

## Change in Averages

As, we know the average =  $[\text{Sum of given observation}(S)] / [\text{Number of observation}(N)]$ .

So when the number of items increases or decreases, the average would change.

Technically, Change in averages, also known as the mean absolute deviation, is a statistical measure that quantifies the variability or dispersion of a set of data points. It represents the average distance of each data point from the mean of the dataset. A higher change in averages indicates a more spread-out or dispersed dataset, while a lower change in averages suggests a more centralized or tightly clustered dataset.



But it's too complicated. So let's try to understand it in simplistic way with different examples.

## Addition of Item



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When items are added then the average also changes, let's try to find out the change in average.

**E.g.** The average age of 40 students in a class is 15 years. When 10 new students were admitted, the average increased by 0.2 years. Find the average age of new students.

**Sol:** According to the question, the average age of 40 students is 15.

So, total age =  $40 \times 15 = 600$  Years

When due to addition the average increases by 0.2

So, new average =  $15 + 0.2 = 15.2$

But the total students also changes due to addition Total students =  $40 + 10 = 50$

Now, the sum of ages is =  $50 \times 15.2 = 760$

So, the total increment in ages would be  $760 - 600 = 160$

This is due to those 10 students, so their average would be Average of new students added =  $160/10 = 16$  Years (**Ans.**)

## Removal of Item

When items are removed then the average also changes, let's try to find out the change in average.

**E.g.** The average salary of 15 teachers is 4500 rs per month. Three teachers left the school and the average salary of the remaining teachers dropped by 175 rs. Find the total salary of the teachers who left the school.

**Sol:** The average salary of 15 teachers were 4500.

So the total salary of all of them =  $15 \times 4500 = 67500$

Now, 3 teachers left the school, so, total teachers =  $15 - 3 = 12$

Now, the average salary also drops by 175.

So, the new average =  $4500 - 175 = 4325$

So, the total salary of 12 teachers =  $4325 \times 12 = 51900$

So, the difference =  $67500 - 51900 = 15600$  rs (**Ans.**)

These are a bit tedious tasks and time taking in exams so let's learn about short-tricks.

Let the average of N items = A

Now, 'n' new items are added and the average increases or decreases by 'x' then

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**Average of new items added =  $A \pm (1 + N/n)x$**

Use "+" when average increases and "-" when average decreases. When  $n = 1$ ,

**Average of new items added =  $A \pm (1 + N)x$**

**E.g.** The average age of 40 students in a class is 15 years. When 10 new students are admitted, the average increases by 0.2 years. Find the average age of new students.

**Sol:** Here,  $A = 15$ ,  $N = 40$ ,  $n = 10$ ,  $x = 0.2$

So by according to formula,

Average of new items added =  $15 \pm (1 + 40/10)0.2$

We will use '+' sign here because the average increases

$\Rightarrow$  Average =  $15 + (1 + 4)0.2 = 15 + 5 \times 0.2 = 16$  Years (**Ans.**)

In the case of removing items by replacing  $-N/n$  in place of  $N/n$  in addition's case.

So, we got the formula for removal Average of new items removed =  $A \pm (1 - N/n)x$

Use "+" in case of increase on average and use "-" in case of a decrease in average.

**E.g.** The average salary of 15 teachers is 4500 rs per month. Three teachers left the school and the average salary of the remaining teachers dropped by 175 rs. Find the total salary of the teachers who left the school.

**Sol:** Here,  $A = 4500$ ,  $N = 15$ ,  $n = 3$ ,  $x = 175$

Average of new items removed =  $4500 \pm (1 - 15/3)175$

Use "-" because there is a decrease in average Average of new items removed

=  $4500 - (1 - 5)175$

Average of new items removed =  $4500 + 4 \times 175 = 4500 + 700 = 5200$

Sum of all the salaries of teachers who left =  $5200 \times 3 = 15600$  rs. (**Ans.**)

## Replacement of Item

Sometimes, when a number of items are removed and these are replaced by the same amount of different items so the quantity remains unchanged.

The average increases/decreases by "x", let there be N items then,



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Sum of new items are added - Sum of removed items =  $\pm Nx$

Use "-" when average decreases and "+" when average increases.

**E.g.** When a man weighing 80 kg is replaced by another man in a group of five people, the average weight decreases by 3 kg. What is the weight of the new man?

**Sol:** Weight of a new man – the weight of the removed man =  $-Nx$

$$\Rightarrow \text{Weight of new man} - 80 = -5 \times 3$$

$$\Rightarrow \text{Weight of new man} = 80 - 15 = 65 \text{ kg (Ans.)}$$

**E.g.** The average weight of 29 students in a class is 48kg, if the weight of the teacher is included the average weight rises by 500g, find the weight of the teacher.

**Sol:** Here only one item is added and the increase in average is 0.5 kg.

$$A = 48, N = 29, n = 1, x = 0.5$$

According to our formula,

$$\text{Weight of teacher} = A + (N + 1)x$$

$$\text{Weight of teacher} = 48 + (29 + 1)0.5 = 63 \text{ kg (Ans.)}$$

We discussed all types of replacement questions which are essential for your **WBP Constable Exam** point of view. Let's discuss **some formulae about averages of numbers**.

## Some Formulae about Averages of Numbers

These are some formulas to solve the average related questions on numbers.

- Average of first  $n$  natural numbers =  $(n + 1)/2$
- Average of first  $n$  even numbers =  $(n + 1)$
- Average of first  $n$  odd numbers =  $n$
- Average of squares of first  $n$  natural numbers =  $(n + 1)(2n + 1)/6$
- Average of cubes of first  $n$  natural numbers =  $[n(n + 1)^2]/4$

**E.g.** What is the average of numbers from 1 to 100?

**Sol:** According to formula,  $A = (n + 1)/2$

$$\Rightarrow A = (100 + 1)/2 = 101/2 = 50.5$$

**E.g.** What is the average of the first 5 even numbers?



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**Sol:** As we know first 5 even numbers are 2, 4, 6, 8 and 10.

Their sum is  $2 + 4 + 6 + 8 + 10 = 30$

Average =  $30/5 = 6$

According to the formula:  $n + 1 = 5 + 1 = 6$  (**Ans.**)

Let us look at few examples and if you are now confident about this section, just try these questions by yourself before looking at my solution. Some of these questions were asked in the **WBP Constable** Exam. So, please take this section very seriously.

## Examples on Averages for Better Understanding

**E.g.** If the average of 7 consecutive numbers is 20, what is the largest number? [**WBP Constable Exam 2019**]

**Sol:** Let,  $a, a + 1, a + 2, \dots, a + 6$  are the 7 consecutive numbers. So,

Average =  $20 = [a + (a + 1) + (a + 2) + (a + 3) + (a + 4) + (a + 5) + (a + 6)]/7$

$\Rightarrow 20 = (7a + 21)/7$

$\Rightarrow 7a + 21 = 140$

$\Rightarrow a = (140 - 21)/7 = 17$

So, the largest number is  $(a + 6) = 17 + 6 = 23$  (**Ans.**)

If you remember a question in our previous blog regarding the average of first 15 odd numbers, then you now after the formulas given above, you can clearly answer this question within no time i.e. the average of first 15 odd numbers is 15.

**E.g.** The average of first 10 even numbers is [**WBP Constable Exam 2021**]

**Sol:** We know that, average of first  $n$  even numbers =  $(n + 1)$

$\Rightarrow$  Average of first 10 even numbers =  $(10 + 1) = 11$  (**Ans.**)

**E.g.** The average weight of 8 persons increases by 2.5 kg when a new person comes in place of one of them weighing 65 kg. What might be the weight of the new person? [**WBP Constable Exam 2020**]

**Sol:** Let, the average of 8 persons be  $x$  and the weight of new person is  $y$ .

$\Rightarrow$  Total weight of 8 persons =  $x \times 8 = 8x$

According to the question,



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$$\Rightarrow 8(x + 2.5) = (8x - 65 + y)$$

$$\Rightarrow 8x + 20 = 8x - 65 + y$$

$$\Rightarrow y = 85 \text{ (Ans.)}$$

Concluding this comprehensive guide on the Concept of Change in Averages for the WBP Constable Exam, you've gained valuable insights and skills crucial for quantitative success. Armed with a deep understanding of how averages evolve, you're well-prepared to navigate the mathematical challenges of the exam. Apply this knowledge strategically, approach problems with confidence, and elevate your quantitative performance.

As you embark on your WBP Constable Exam journey, carry the proficiency acquired here, knowing that a solid grasp of changing averages is a key asset in achieving success in the competitive landscape. So, this is all for today. In our next blog, we will discuss the [The Basics of Ratios and Proportions](#) for **WBP Constable Exam**. Till then, stay tuned!

