Average


OH, MOM, THEY CALLED ME AVERAGE! BOYS CAN BE SO MEAN!
NO SWEETIE, YOU'RE THE MEAN ONE.
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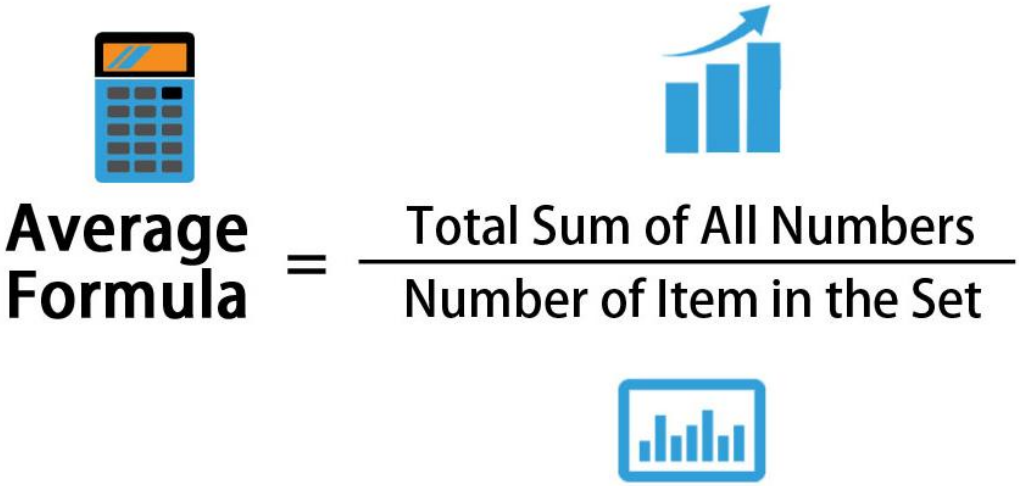

Average: All are having equal.

Ex:- Find the average of 1. {10,20,35,40,80}

2. {30,30,30,30,30}

3. {20,30,30,32,38}

Average lies between minimum and maximum.

Note: Suppose, If the average of a group is X, then we can say that every member of that group can be equal to X..

Q. $x > 4$

Quantity A	Quantity B
Average(x,4)	4

Q. Quantity A

Average (11,19, x, 40)

Quantity B

Average (10, 20, 40, x)

Ex:- List A = { 10,20,30,40,50 } . If 10 is added to each observation, then find the change in average .

Solution: Now the observations are { 20,30,40,50,60 }

Average = (20+30+40+50+60)/5

= 40

Here we can see that the average is increased by 10.

Note:

1. “Each observation + X” , then average will be increased by X
2. “Each observation - X” , then average will be decreased by X
3. “Each observation ×X” , then average will be multiplied by X
4. “Each observation ÷ X”, then average will be divided by X

Q. Present average age of a group of boys is 25 years. Find the average age of the group after 7 years?

Soln: Average age increases by 7 years.

25+7 = 32

Q. If Average amount with some boys is 20. If there is decrease of 100 in their whole amount, then new average becomes 17.5 then find number of boy?

Q. If Average amount with some boys is 20. If there is decrease of 100 in their whole amount, then new average becomes 17.5 then find number of boy?

Soln: Average decreases by 2.5 means each boy contributed 2.5

Therefore, Number of boys$= \frac{100}{2.5} = 40$

When a number is inserted in the group

List A ={10, 20, 45,75, 90,48}

Average = 48

If average is inserted then there is no change in the average.

If more than average is inserted then average increases.

If less than average is inserted then average decreases.

When a number is removed from the group

List A ={10, 20, 45,75, 90,48}

Average = 48

If average is removed then there is no change in the average.

If more than average is removed then average decreases.

If less than average is removed then average increases.

Q. Average height of 80 boys is 104 cm. 2 boys with height 98cm and 110cm leaves the group then, find the new average?

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Soln: Average height of leaving boys = $\frac{98+110}{2}$ =104

Therefore, there is no change in the average.

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Soln: Overall decrease in sum = (72+94)-(106+48) = 12

For a decrease of 12 each one has to contribute 1.

Final average = 82-1 = 81

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Soln: 36,36,……36 x times

Average increase by 2 means everyone is getting 2 extra.

72-36 = 36

$x = \frac{36}{2} = 18$

Q. Average of first 4 numbers out of 5 numbers is 62 and average of last 4 numbers is 67. If ratio of first and last numbers is 7:9; then find last number?

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Soln: Let numbers are a,b,c,d& e

$b+c+d+e = 67\times4$ ------ (1)

$a+b+c+d = 62\times4$ -------(2)

(1) – (2)

⇨ e-a = 20

$9x - 7x = 20$

⇨ x = 10

⇨ e = 90 & a = 70

Q. Ten years ago average age of a couple was 27 years. Today the present average age of the couple and their child is 27 years. Find the present age of the child?

Soln: Sum of ages of man and his wife $27 \times 2 = 54$

After 10 years $54+10 \times 2 = 74$

Sum of all the 3

$27 \times 3 = 81$

Age of child = $81 - 74 = 7$

Arithmetic sequences

An **arithmetic sequence** or **arithmetic progression (AP)**, is a sequence whose terms go up or down by constant steps i.e. there is a **common difference**.

Examples:

(i) 5, 7, 9, 11, 13, ...

(ii) 88, 78, 68, 58, 48, ...

- The first term of an **AP** is denoted by **a**: $u_1 = a$
- The **common difference** is denoted by **d**: $u_{n+1} = u_n + d$
- Formula for the n^{th} term of AP is $a + (n - 1)d$
- n^{th} term: $u_n = a + (n - 1)d$ **or** $a + d(n - 1)$

Note : If the observations are in AP , then middle term will be the Average.

Ex:- List A = {100,150,200,250,300}

Here Average = 1000/5 = 200 (which is the middle term)

Note : Middle term = (1^{st} + last)/2 = (2^{nd} + 2^{nd} last)/2 and similarly goes on..

Q. Average of 25 consecutive natural numbers is 25. Find the smallest number?

Soln: Consecutive natural numbers are in AP.

Therefore, middle term is 25 and 12 numbers are less than 25 and 12 numbers are more than 25.

13,14…..24, 25, 26, ……36,37

Q. Find average of all the multiples of 7 between 100 & 350?

Q. Find average of all the multiples of 7 between 100 & 350?

Soln: Consecutive multiples of any number are always in AP.

If numbers are in AP then

$$\text{Avearge} = \text{Middle term} = \frac{\text{First term+last term}}{2}$$

$$\text{Average} = \frac{105+343}{2} = 224$$

Weighted Average

Class A

20 Boys- Average weight 40kg

30 Girls average weight 50kg

Class B

20 Boys- Average weight 50kg

30 Girls average weight 40kg

Class C

20 Boys- Average weight 40kg

20 Girls average weight 50kg

Class D

20 Boys- Average weight 40kg

30 Girls average weight 40kg

$$C_{avg} = \frac{C_1 w_1 + C_2 w_2 + ...}{w_1 + w_2 + ...}$$

C_{avg} is average of combined group/mixture

$C_1, C_2, ..$ are average of individual groups.

$w_1, w_2, \ldots.$ are ratio of group members or quantities.

- If $C_1 = C_2$; then $C_1 = C_2 = C_{avg}$ and it is independent of the group members or quantities.
- If $w_1 = w_2$; then $C_{avg} = \frac{C_1 + C_2}{2}$
- When 2 groups are combined then C_{avg} is closer to the average of the group with more members or quantities.

Q. In a class average height of x boys is 80cm & average height of y girls is 64cm and average height of entire class is not more than 72cm then which of the following can be the values for (x,y)?(Mark all the correct answers)

(A)(500,500) (B)(25,51) (C)(51,25) (D)(1,100) (E)(72,70)

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(A)(500,500) (B)(25,51) (C)(51,25) (D)(1,100) (E)(72,70)

Soln:

If x = y then combined average height = $\frac{80+64}{2} = 72$

It is given that average height of entire class is less than or equal to 72 means closer to the average of girls implies more number of members in girls group.
Therefore, $x \leq y$.
Answer A,B & D

Q. In a class average weight of 35 boys is x kg and that of 54 girls is y kg and average weight of entire class is z kg then

Quantity A	Quantity B
$\|x-z\|$	$\|y-z\|$

Soln: Case I

If x= y = z ; then both the quantities are equal.

Case II

Number of girls are more than the boys and therefore combined average (here z) is close to the average of girls i.e. y.

$|x-z| > |y-z|$ i.e. quantity A is greater.

Hence, answer is D.

Q. 15lit of 10% spirit solution is mixed with x lit of 6% spirit solution. If the resulting solution has 9% concentration, then find x?

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Soln:

$C_1 = 10$ $C_2 = 6$

$C_{avg} = 9$

(9-6 = 3) (10-9=1)

Therefore, $w_1 : w_2 = 3:1$

Quantity of 10% solution is 3k and that of 6% solution is k=x.

3k = 15

⇨ k =x = 5

Q. A milk vendor has 2 cans of milk. The first contains 25% water and the rest milk. The second contains 50% water. How much milk solution should he mix from each of the containers so as to get 12 lit solution such that the ratio of water to milk is 3:5? (Mark all the correct options)

(A) 4 lit (B) 5 lit (C) 6lit (D) 8lit (E) 7lit

Q. A milk vendor has 2 cans of milk. The first contains 25% water and the rest milk. The second contains 50% water. How much milk solution should he mix from each of the containers so as to get 12 lit solution such that the ratio of water to milk is 3:5? (Mark all the correct options)

(A) 4 lit (B) 5 lit (C) 6lit (D) 8lit (E) 7lit

Soln: Water in final solution is $\frac{3}{3+5} = 37.5\%$

$C_1 = 25$ $C_2 = 50$

$C_{avg} = 37.5$

(50-37.5 = 12.5) (37.5-25=12.5)

Therefore, $w_1 : w_2 = 1:1$

Total solution is 12 lit.

Divide 12 lit in 1:1 then quantity of both the solutions is 6 lit.

Q. A container contains 40lit of milk. From this container 4 lit of milk was taken out and replaced by water. This process was repeated further 2 times. How many litre of milk is now contained by the container?

Soln : $\frac{\text{Milk}}{\text{Total}} = \left(\frac{\text{P-Q}}{\text{P}}\right)^{\text{n}}$

P: Total Quantity of pure liquid (Initial Quantity)

Q: Quantity Replaced

n: Number of operations

1. Find the average of following numbers

(i) 7 , 10 , 23, 35 ,40

(ii) 14, 21, 28, 35, ……..343

(iii) 2, 6, 8, 12, 30

(iv) 1, 2, 3, 4, 96, 97, 98, 99

(v) 1,2,3,4,……..27

(vi) 90, 92, 89, 96, 95, 92

2. Average height of 80 boys is 104 cm. 2 boys with height 98cm and 110cm leaves the group then, find the new average?

3. Present average age of a group of boys is 12 years. Find the average age of the group after 7 years?

4. In a class average age of 10 boys is 13 years and average age of 30 girls is 13 years then, find the average age of the class?

5. Average height of a group of 12 is 82 cm. When two men with height 72 cm and 94 cm are replaced by men with height 106 cm and 48 cm then, find increase in the average height?

6. Average of first 4 numbers out of 5 numbers is 62 and average of last 4 numbers is 67.If ratio of first and last numbers is 7:9 then find last number?

7. Average amount with 10 children is Rs25. A child joins the group with Rs65. Find the new average?

8. Average amount with x boys is Rs36. When a boy with Rs72 joins the group then, average amount increases by Rs2. Find x?

9. Average age of a group of 25 members is 24 years. When a person left the group average age becomes 22 years. Find the age of that member?

10. Average marks of 20 students is 74 but later they came to know that 88 & 76 are wrongly taken as 75 & 59. Find the actual average marks?

11. Average of 1st 3 numbers out of 7 numbers is 12 and average of last 3 numbers is 10.Then find 4th number if average of 7 numbers is 13?

12. (i) $x > 4$

Quantity A	Quantity B
Average(x,4)	4

(ii)

Quantity A	Quantity B
Average (10, 20, 40, x)	Average (11,19, x, 40)

(iii)

Quantity A	Quantity A
Average (20,30,30,30)	Average (20,30,30,30,20)

(iv)

Quantity A	Quantity A
10 × Average (12,15,25,80)	Average (120,150,250,800)

13. 40Kg rice costing 24/kg is mixed with 120Kg rice costing 16/kg then find the selling price of the mixture if profit is 15%?

14. In a class average height of x boys is 80cm & average height of y girls is 64cm and average height of entire class is not more than 72cm then which of the following can be the values for (x,y)?(Mark all the correct answers)
(A)(500,500) (B)(25,51)
(C)(51,25) (D)(1,100) (E)(72,70)

15. Average of 25 consecutive natural numbers is 25. Find the smallest number?

16. Find average of all the multiples of 7 between 100 & 350?

17. In a class average weight of 35 boys is x kg and that 54 girls is y kg and average weight of entire class is z kg then

Quantity A	Quantity B
$\|x-z\|$	$\|y-z\|$

18. 15lit of 10% spirit solution is mixed with x lit of 6% spirit solution. If the resulting solution has 9% concentration, then find x?

19. 87% milk solution is mixed with x% milk solution in order to get 79% milk solution then find x if quantities of solutions are 5lit and 8lit respectively?

20. A container contains 40lit of milk. From this container 4 lit of milk was taken out and replaced by water. This process

was repeated further 2 times. How many litre of milk is now contained by the container?

21. A milk vendor has 2 cans of milk. The first contains 25% water and the rest milk. The second contains 50% water. How much milk solution should he mix from each of the containers so as to get 12 lit solution such that the ratio of water to milk is 3:5? (Mark all the correct options)
A. 4 lit (B) 5 lit (C) 6lit
(D) 8lit (E) 7lit

22. Average of 5 distinct natural numbers is 28 then find the value of maximum natural number out of five given numbers?

23. Ten years ago average age of a couple was 27 years. Today the present average age of the couple and their child is 27 years. Find the present age of the child?

24. A salesman sold 2 pens: first at 5% profit and second at 2% loss and his overall profit is 4% profit then find the ratio of CP of both the articles.

25. In the next match if Kohli scores 100 runs in the match his average score will be 62.85 but if he scores 50 runs in the match his average score will be 62.35. How many matches has he played?

Ratio

1. 30	2. 105	3. 165	4. C	5. A
6. 25,20	7. $\frac{2}{5}$	8. $\frac{89}{189}$	9. 17	10. 41
11. D	12. 27.27	13. No change, 17:3	14. 60	15. $\frac{2}{7}, \frac{40}{9}$
16. $\frac{51}{5}$	17. B	18. 72	19. 26	20. 8500
21. 50	22. 1200	23. 500,1000,2000	24. 200	25. CNBD

Average

1. 23,178.5,11.6,50,14,92.33	2. 104	3. 19	4. 13	5. 81
6. 90	7. 28.63	8. 17	9. 72	10. 75.5
11. 25	12. A,C,B,C	13. 18	14. A,B,D	15. 13
16. 224	17. D	18. 5	19. 74%	20. 29.16
21. C	22. 130	23. 7	24. 6:1	25. 99