AVERAGE
SYNOPSIS - 1

The term 'average' plays a vital role when it comes to comparing the performances of two or more groups of individuals with respect to a certain parameter such as number of marks secured by the students of two or more classes, number of runs scored by the players of two or more teams and so on.

We define 'Average' as:

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

Using the above formula, we may thus find, a single average value for a set of given individual values.

Average thus provides us a single mid-value of the individual scores, that serves to represent the score of the group taken as a whole.

From the above formula, it is clear that

$$\text{Sum of given observations} = (\text{Average}) \times (\text{Number of observations})$$

Example 1: Rahul earned Rs. 55, Rs. 70, Rs. 82, Rs. 64, Rs. 36, Rs. 28 and Rs. 43 on consecutive days of a week. Find his average daily earning.

Sol. Sum of Rahul's earnings in 7 days

= Rs. (55 + 70 + 82 + 64 + 36 + 28 + 43) = Rs. 378.

$\therefore$ Rahul's average daily earning $= \dfrac{\text{Total earning in 7 days}}{\text{Number of days}} = Rs.\left(\dfrac{378}{7}\right) = Rs.54$

Example 2: Find the average of the number 13, 17, 221, 23, 29, 32.

Sol. Sum of given numbers = (13 + 17 + 21 + 23 + 29 + 32) = 135

$\therefore$ Average of given numbers $= \dfrac{\text{Sum of the numbersw}}{\text{Number of numbers}} = \dfrac{135}{6} = 22.5$

Example 3: The average height of 12 students of a class is 154 cm. Three students of heights 143 cm, 149 cm and 152 cm respectively, leave the class. Find the average height of the remaining students.

Sol. Sum of heights of 12 students $= (154 \times 12)\,cm = 1848cm$

Sum of heights of remaining 9 students $= (1848 - (143 + 149 + 152))\,cm$

$$= (1848 - 444)\,cm = 1404cm$$

$\therefore$ Average height of remaining 9 students $= \left(\dfrac{1404}{9}\right)cm = 156cm$

WORK SHEET

SINGLE ANSWER TYPE

1.   David obtained 76,65,82,67 and 85 marks (out of 100) in English, Mathematics, Physics, Chemistry and Biology. What are his average marks?
    1) 65   2) 69   3) 76   4) None of these

2.   Find the average of 20 numbers is zero. Of them, at the most, how many may be greater than zero?
    1) 18   2) 20   3) 24   4) 30

3.   The average of first five multiples of 3 is
    1) 3   2) 9   3) 12   4) 15

4.   The average of the first nine prime numbers is

    1) 9   2) 11   3) $11\dfrac{1}{9}$ 4) $11\dfrac{2}{9}$

5.   The average of 2, 7, 6 and x is 5 and the average of 18, 1, 6, x and y is 10. What is the value of y ?
    1) 5   2) 10   3) 20   4) 30

6.   If the mean of 5 observations $x, x+2, x+4, x+6$ and $x+8$ is 11, then the mean of the last three observations is
    1) 11   2) 13   3) 15   4) 17

7.   The average of first 50 natural numbers is
    1) 12.25   2) 21.25   3) 25   4) 25.5

8.   The average of all odd numbers upto 100 is
    1) 49   2) 49.5   3) 50   4) 51

9.   The average of 7 consecutive numbers is 20. THe largest of these numbers is
    1) 20   2) 22   3) 23   4) 24

10. The average of five consecutve odd numbes is 61. What is the difference between highest and lowest numbers?
    1) 2   2) 5   3) Cannot be determined   4) None of these

11. A family consists of grandparents, parents and three grandchildren. The average are of the grandparents is 67 years, that of the parents is 35 years and that of the grandchildren is 6 years. What is the average age of the family?

    1) $28\dfrac{4}{7}$ years   2) $31\dfrac{5}{7}$ years   3) $32\dfrac{1}{7}$ years   4) None of these

12. If the average marks of three batches of 55, 60 and 45 students respectively is 50, 55 and 60, then the average marks of all the students is
    1) 53.33   2) 54.68   3) 55   4) None of these

13. The average weight of 16 boys in a class is 50.25 kgs and that of the remaining 8 boys is 45.15 kgs. Find the average weight of all the boys in the class.
    1) 47.55 kgs   2) 48 kgs   3) 48.55 kgs   4) 49.25 kgs

14. The average of 50 numbers is 30. If two numbers, 35 and 40 are discarded, then the average of the remaining numbers is nearly
    1) 28.32   2) 28.78   3) 29.27   4) 29.68

15. The average of five numbers is 27. If one number is excluded, the average becomes 25. The excluded number is
    1) 25   2) 27   3) 30   4) 35

16. The average age of 35 studnets in a class is 16 years. The average age of 21 students is 14. What is the average age of remaining 14 students?
    1) 15 years   2) 17 years   3) 18 years   4) 19 years

17. The average score of a cricketer for ten matches is 38.9 runs. If the average for the first six matches is 42, then find the average for the last four matches.
    1) 33.25   2) 33.5   3) 34.25   4) 35

18. The batting average for 40 innings of a cricket player is 50 runs. His highest score exceeds his lowest score by 172 runs. If these two innings are excluded, the average of the remaining 38 innings is 48 runs. The highest score of the player is
    1) 165 runs   2) 170 runs   3) 172 runs   4) 174 runs

19. The average of runs of a cricket player of 10 innings was 32. How many runs must he make in his next innings so as to increase his average of runs by 4?
    1) 2   2) 4   3) 70   4) 76

20. The average of ten numbers is 7. If each number is multiplied by 12, then the average of the new set of numbers is
    1) 7   2) 19   3) 82   4) 84

21. The average monthly income of P and Q is Rs. 5050. The average monthly income of Q and R is Rs. 6250 and the average monthly income of P and R is Rs. 5200. THe monthly income of P is
    1) Rs. 3500   2) Rs. 4000   3) Rs. 4050   4) Rs. 5000

WORK SHEET (KEY)				
1) 4	2) 2	3) 2	4) 3	5) 3
6) 2	7) 4	8) 3	9) 3	10) 3
11) 2	12) 2	13) 3	14) 4	15) 4
16) 4	17) 3	18) 4	19) 4	20) 4
21) 2				

1. Average $= \left(\dfrac{76+65+82+67+85}{5} \right) = \left(\dfrac{375}{5} \right) = 75$

2. Average $= \left(\dfrac{10+15+20+25+30}{5} \right) = \dfrac{100}{5} = 20$

3. Average $= \dfrac{3(1+2+3+4+5)}{5} = \dfrac{45}{5} = 9$

4. Average $= \left(\dfrac{2+3+5+7+11+13+17+19+23}{9} \right) = \dfrac{100}{9} = 11\dfrac{1}{9}$

5. We have $\left(\dfrac{2+7+6+x}{4} \right) = 5$ or $15+x = 20$ or $x = 5$.

Also, $\left(\dfrac{15+1+6+x+y}{5}\right)=10$ or $25+5+y=50$ or $y=20$.

6. We have $\left[\dfrac{x+(x+2)+(x+4)+(x+6)+(x+8)}{5}\right]=11$ or $5x+20=55$ or $x=7$.

So, the numbers are 7, 9, 11, 13, 15.

$\therefore$ Required mean $=\left(\dfrac{11+13+15}{3}\right)=\dfrac{39}{3}=13$

7. Sum of first n natural numbers $=\dfrac{n(n+1)}{2}$

So, average of first n natural numbers $=\dfrac{n(n+1)}{2n}=\dfrac{n+1}{2}$.

$\therefore$ Required average $=\left(\dfrac{50+1}{2}\right)=\dfrac{51}{2}=25.5$

8. Sum of odd numbers upto

$$=(1+99)+(3+97)+(5+95)+.....+ \text{ upto 25 pairs}$$

$$=100+100+100+.....(25 \text{ times})=2500.$$

$\therefore$ Average $=\left(\dfrac{2500}{50}\right)=50$.

9. Let the numbers be $x, x+1, x+2, x+3, x+4, x+5$ and $x+6$.

Then $\dfrac{x+(x+1)+(x+2)+(x+3)+(x+4)+(x+5)+(x+6)}{7}=20$

or $7x+21=140$ or $7x=119$ or $x=17$.

10. Let the numbers be $x+x+2, x+4, x+6$ and $x+8$

Then, $\dfrac{x+(x+2)+(x+4)+(x+6)+(x+8)}{5}=61$ or $5x+20=305$ or $x=57$.

So, required difference $=(57+8)-57=8$

11. Required average $=\left(\dfrac{67\times2+35\times2+6\times3}{2+2+3}\right)$

$$=\left(\dfrac{134+70+18}{7}\right)=\dfrac{222}{7}=31\dfrac{5}{7} \text{ years.}$$

12. Required average $=\left(\dfrac{55\times50+60\times55+45\times60}{55+60+45}\right)$

$$=\left(\dfrac{2750+3300+2700}{160}\right)=\dfrac{8750}{160}=54.68$$

13. Required average $= \left(\dfrac{50.25 \times 16 + 45.15 \times 8}{16 + 8} \right)$

$= \left(\dfrac{804 + 361.20}{24} \right) = \dfrac{1165.20}{24} = 48.55$

14. Sum of 50 numbers $= 30 \times 50 = 1500$

Sum of remaining 48 numbers $= 1500 - (35 + 40) = 1425$

$\therefore$ Required average $= \left(\dfrac{1425}{48} \right) = \dfrac{475}{16} = 29.68$

15. Excluded number $= (27 \times 5) - (25 \times 4) = 135 - 100 = 35$

16. Sum of the ages of 14 students $= (16 \times 35) - (14 \times 21) = 560 - 294 = 266$

$\therefore$ Required average $= \left(\dfrac{266}{14} \right) = 19$ years.

17. Requried average $= \dfrac{(38.9 \times 10) - (42 \times 6)}{4} = \dfrac{137}{4} = 34.25$

18. Let the highest score be x. Then, lowest score $= (x - 172)$.

Then, $(50 \times 40) - [x + (x - 172)] = 38 \times 48$

$\Leftrightarrow 2x = 2000 + 172 - 1824 \Leftrightarrow 2x = 348 \Leftrightarrow x = 174$

19. Average after 11 innings $= 36$

$\therefore$ Requried number of runs $= (36 \times 11) - (32 \times 10) = 396 - 320 = 76$

20. Average of 10 numbers $= 7$.

Sum of these 10 numbers $= (10 \times 7) = 70$

$\therefore x_1 + x_2 + \ldots\ldots + x_{10} = 70$.

$\Rightarrow 12x_1 + 12x_2 + \ldots. + 12x_{10} = 840$

$\Rightarrow \dfrac{12x_1 + 12x_2 + \ldots\ldots + 12x_{10}}{10} = 84$

$\Rightarrow$ Average of new numbers is 84.

21. Let P, Q and R represents their respective monthly incomes. Then, we have

$P + Q = (5050 \times 2) = 10100$ ....(i)

$Q + R = (6250 \times 2) = 12500$ .....(ii)

$P + R = (5200 \times 2) = 10400$ ....(iii)

Adding (i), (ii) and (iii) we get: 2 (P + Q + R) = 330000 or P + Q + R = 16500   ....(iv)

Substracting (ii) from (iv), we get P = 4000.

$\therefore$ P's monthly income = Rs. 4000.