

Averages

Assume 5 friends went to a movie. If the total money with the friends is equal to 1000 then we say that average money with each person is Rs.200/- But it is not necessary that each person has Rs.200.

Some may have more money than the others, but the total money is equal to Rs.1000.

Let us say Person E is rich and he bought Rs.500 to the movie. So the money with the remaining friends is equal to Rs.500. If E has not come to the movie, the average money with the other friends comes down to Rs.125. That means, Person E has more money than the combined average money of all the five friends together so he contributes to the other friends above the average required.

That means, had person E bought Rs.125 to the movie the average stands at Rs.125 but he has Rs.375 more than the average required to maintain and this extra amount is distributed among all the friends equally, so that

Average or mean: The Mean (Average) of a group of numbers is the sum of the numbers divided by the number of numbers:

Average or Mean = Sum of the observations / Number of observations

If the average of 'm' quantities is 'x' and the average of 'n' other quantities is 'y' then the average of all of them put together is = $\frac{mx + ny}{m + n}$

If the average of 'm' quantities is 'x' and the average of 'n' quantities out of them (m quantities) is 'y' then the average of the rest of the quantities is = $\frac{mx - ny}{m - n}$

If the average of 'n' numbers is 'x' and if 'k' is added to or subtracted from each given number the average of 'n' numbers becomes (x+k) or (x-k) respectively. In the other words average value will be increased or decreased by 'k'.

If the average of 'n' numbers is 'x' and if each given number is multiplied to or divided by 'k' then the average of n numbers becomes kx or $\frac{x}{k}$ respectively.

If a person travels a distance at a speed of x km/hr and the same distance at a speed of y km/hr then the average speed during the whole journey is given by $\frac{2xy}{x + y}$ km/hr.

If a person covers A km at x km/hr and B km at y km/hr and C km at z km/hr, then the average speed in covering the whole distance is $\frac{A + B + C}{\frac{A}{x} + \frac{B}{y} + \frac{C}{z}}$ km/hr.

The average of n (where n is an odd number) consecutive numbers is always the middle number E.g. 1, 3, 5, 7, 9.

The Average = Middle number = 5

The average 'n' (where n is even number) consecutive numbers is the average of the two middle numbers.

E.g. Average of (2, 4, 6, 8, 10, 12) = $\frac{6+8}{2} = 7$

Solved Examples

1. The average of ages of 10 persons in a club was 32. What should be the age of the new person joining in the club so as to increase the average by 4 ?

Total age of 10 persons = $10 \times 32 = 320$

Total age of 11 persons = $11 \times 36 = 396$ (as the new average is 4 more than present average)

So the age of the person joining is = $396 - 320 = 76$

Alternate method:

If the age of the new person joining the club is 32 then there is no change in the average. If the new average has to be 36, the person who is joining must contribute 4 years to all 11 persons. That is he must have an age 44 years above 32. So new average is 76

2. The average weight of the teacher and six students is 12 kg which is reduced by 5 kg if the weight of the teacher is excluded. How much does the teacher weigh ? Total age of the students and teacher together = $7 \times 12 = 84$

New average after excluding teacher = $6 \times 7 = 42$

Teachers weight = $84 - 42 = 42$

Alternate method:

Teacher has taken her contribution of 5 kgs from each of the students. As she is contributing 30 kgs to all students, once she is excluded those 30 kgs remains with her along with original weight 12kgs. So her weight is $30 + 12 = 42$ kgs

3. A batsman had a certain average of runs for 16 innings. In the 17th innings, he made a score of 87 runs thereby increasing his average by 3. What is his average after 17 innings?

Assume his initial average = X

His total runs after 16 innings = $16X$

After scoring 87 runs his average got increased by 3 to $X + 3$

So his total runs after 17 innings = $17 \times (X+3)$

But it was given that the difference in the total scores after 16 innings and 17 innings = 87

Therefore $17 \times (x + 3) - 16x = 87 \Rightarrow X = 36$

His new average = $36 + 3 = 39$

Alternate method:

His 87 runs in the 17th innings contributed to all the seventeen innings to increase the average by 3. So he must have scored $17 \times 3 = 51$ runs extra to maintain the average. So his previous average will be $87 - 51 = 36$. Present average = 39

4. Some consecutive natural numbers, starting with 1, are written on the board. Now, one of the numbers was erased and the average of the remaining numbers is $800/39$. Find the number which was erased.

We know that average of n consecutive numbers average =
$$\frac{\frac{n \times (n+1)}{2}}{n} = \frac{(n+1)}{2}$$

If the given n is sufficiently large, the average does not change much even though we exclude one or two numbers from it. So the approximate number of observations is almost double to the average (Remember: the average of consecutive numbers almost lies in the middle)

The approximate average is $800/39 = \text{Approx } 20$. So the initial numbers may be nearer to 40.

In this question it is actually 40 as from the denominator of the new average $800/39$. The initial numbers are 40.

Sum of 40 consecutive numbers =
$$\frac{40 \times (40+1)}{2} = 820$$

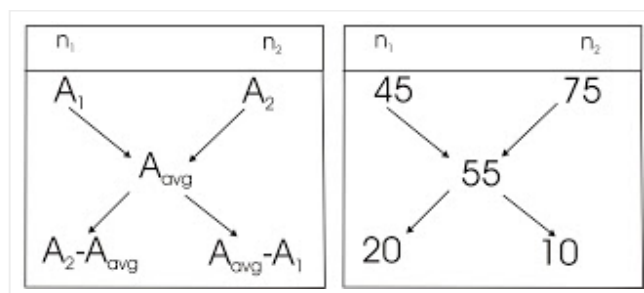
Sum of 39 numbers = average \times number of observations =
$$\frac{800}{39} \times 39 = 800$$

So the number excluded = $820 - 800 = 20$

5. The average weight of the students in four sections A, B, C and D is 55 kg. The average weights of the students A, B, C and D are 45 kg, 40 kg, 75 kg and 85 kg respectively. If the average weight of the students of section A and D together is 65 kg and that of B and D together 55 kg, then what is the ratio of the number of students in A and C?

If we observe carefully, the total average of A, B, C, D is equal to Average of B and D together. So the average of A and C must be 55.

We apply alligation rule to determine in what ratio A and C must be clubbed together to get an average of 55.



So ratio = 2 : 1

6. The average age of 40 students in a class is 15 years. If the age of teacher is also included, the average becomes 16 years, find the age of the teacher.

If teacher's age is 15 years, there is no change in the average. But teacher has contributed 1 year to all the students along with maintaining his age at 16.

Age of teacher = Average age of all + Total increase in age

$$= 16 + (1 \times 40) = 56 \text{ years}$$

7. Average age of 9 members of a club is 29 years. If 2 more persons with the average age of 40 years have become the members of the club, find average age of all the 11 members.

Average age of 9 members = 29 years; Excess age of 2 new members = $(40 - 29) \times 2 = 22$ years

Therefore, Increase in the average age on inclusion of 2 new members = $\frac{22}{11} = 2$ years

Therefore, Average age of 11 members = $29 + 2 = 31$ years

8. Average age of 18 men is decreased by 1 year when one man whose age is 49 years is replaced by a new man. Find age of the new man.

If the replaced persons age is same with the existing average, there is no change in the average. But by replacement overall decrease in the age is $18 \times 1 = 18$ years. This is the change bought by the new man.

Age of new man = Age of man replaced - Total decrease in age

$$= 49 - (1 \times 18) = 31 \text{ years}$$

9. The average weight of 12 persons is 50 kg. On replacing a man whose weight is 53 kg. with a new man, new average becomes 49 kg. The weight of the new man is:

If the replaced persons weight is the same as the existing average, there is no change in the average. But by replacement overall decrease in the age is $12 \times 1 = 12$ kg. This is the change bought by the new man.

Weight of new man = Weight of man replaced - Total decrease in weight

$$= 53 - 1 \times 12 = 41 \text{ kg.}$$

10. The average age of 12 men in a group is increased by 2 years when two men whose ages are 20 years and 22 years, are replaced by new members. What is the average age of the new men included?

Total age of two men replaced = $20 + 22 = 42$ years

Total increase in age on replacement = $2 \times 12 = 24$ years

Total age two new persons included = $42 + 24 = 66$ years

Therefore, Average age of new persons = $\frac{66}{2} = 33$ years

11. Average age of 7 members of a family is 29 years. If present age of the youngest member is 5 year, find average age of the remaining members at the time of birth of the youngest member.

Average age (present) of 7 members = 29 years

5 years ago, average age of 7 members was $29 - 5 = 24$ years.

Since, the youngest member was not born 5 years ago.

Therefore, Average age of remaining 6 members is increased by $\frac{24}{6} = 4$ years.

Therefore, 5 years ago, average age of 6 members was $24 + 4 = 28$ years.

12. Average weight of 8 persons is 48 kg. If one man weighing 34 kg, is died, what is a average age of the remaining 7 persons.

Average weight of 8 persons = 48 kg.

Therefore, Excess of average weight than the weight of man died

$$= 48 \text{ kg.} - 34 \text{ kg.} = 14 \text{ kg.}$$

$$\text{Therefore, Increase in weight of the remaining 7 persons} = \frac{14}{7} = 2 \text{ kg.}$$

$$\text{Therefore, Weight of remaining 7 persons} = 48 + 2 = 50 \text{ kg.}$$

13. The average expenditure of a man for 10 days is Rs. 45 per day. If his average expenditure for the first 3 days is Rs. 52 per day, find his average expenditure for the remaining 7 days.

Average expenditure for 10 days = Rs. 45

Average expenditure for first 3 days = Rs. 52

$$\text{Therefore, Excess expenditure for first 3 days} = 3 \times (\text{Rs. } 52 - \text{Rs. } 45) = \text{Rs. } 21$$

$$\text{Therefore, Decrease in average expenditure for remaining 7 days} = \frac{21}{7} = \text{Rs. } 3$$

$$\text{Therefore, Average expenditure for remaining 7 days} = 45 - 3 = \text{Rs. } 42$$

14. The average weight of the students of a class is 40 kg. 5 new students with the average weight of 46 kg. having joined the class, the average weight of the class is increased by 2 kg. Find the number of students in the class originally?

Total increase in weight on including 5 more students

$$= 5 \times (46 - 40) = 30 \text{ kg.}$$

But, increase in average weight = 2 kg.

$$\text{Therefore, Total students (at present)} = \frac{30}{2} = 15 \text{ students}$$

$$\text{Therefore, Students (originally)} = 15 - 5 = 10 \text{ students}$$

15. Average temperature from 9th to 16th of a month is 30°C and that from 10th to 17th is 31°C . What is the temperature on 17th, if temperature on 9th is 35°C ?

Total days in each case are 8 days

$$\text{Difference between temperature on 9th and 17th} = 8 \times (31^{\circ}\text{C} - 30^{\circ}\text{C}) = 8^{\circ}\text{C}$$

Since, temperature for 8 days including 17th is more than that of 8 days including 9th.

Therefore, Temperature on 17th is more than the temperature on 9th.

$$\begin{aligned} \text{Therefore, Temperature on 17th} &= \text{Temperature on 9th} + \text{Difference between temperatures} \\ &= 35^{\circ}\text{C} + 8^{\circ}\text{C} = 43^{\circ}\text{C.} \end{aligned}$$

16. The average of 11 observations is 72. If average of first 6 observations is 70 and that of last 6 observations is 71, then the 6th observation is:

$$\begin{aligned} 6\text{th observation} &= 72 + 6 \times (70 - 72) + 6 \times (71 - 72) \\ &= 72 - 6 \times 2 - 6 \times 1 = 54 \end{aligned}$$

17. Average expenditure of a person for the first 3 days of a week is Rs. 350 and for the next 4 days is Rs. 420. Average expenditure of the man for the whole week is:

Assumed mean = Rs. 350

Total excess than assumed mean = $4 \times (\text{Rs. } 420 - \text{Rs. } 350) = \text{Rs. } 280$

Therefore, Increase in average expenditure = $\text{Rs. } \frac{280}{7} = \text{Rs. } 40$

Therefore, Average expenditure for 7 days = $\text{Rs. } 350 + \text{Rs. } 40 = \text{Rs. } 390$

18. 11 friends went to a hotel and decided to pay the bill amount equally. But 10 of them could pay Rs. 60 each as a result 11th has to pay Rs. 50 extra than his share. Find the amount paid by him.

Average amount paid by 10 persons = Rs. 60

Increase in average due to Rs. 50 paid extra by the 11th men = $\text{Rs. } \frac{50}{10} = \text{Rs. } 5$

Therefore, Average expenditure of 11 friends = $\text{Rs. } 60 + \text{Rs. } 5 = \text{Rs. } 65$

Therefore, Amount paid by the 11th men = $\text{Rs. } 65 + \text{Rs. } 50 = \text{Rs. } 115$

19. The average marks obtained by some students in an examination is 54. If 20% of the students got a mean score of 90 marks and the 30% of the students got a mean score of 20. Find the average marks of the remaining students.

Remaining students = $100\% - 20\% - 30\% = 50\%$

Let remaining students got a mean score of x marks.

Then, $20\% \text{ of } 90 + 30\% \text{ of } 20 + 50\% \text{ of } x = 54$

Therefore, $18 + 6 + 50\% \text{ of } x = 54$

Therefore, $50\% \text{ of } x = 54 - 18 - 6 = 30$

Therefore, $x = 30 \times 2 = 60$ marks

MCQ's

1. The average temperature of Monday, Tuesday, Wednesday and Thursday was 38° and that of Tuesday, Wednesday, Thursday and Friday was 40° . If the temperature on Monday was 30° , the temperature of Friday was :

- a. 40°
- b. 39°
- c. 38°
- d. 30°

Correct Option: C

Explanation:

$$M+T+W+Th=(4 \times 38) = 152$$

Monday temperature is 30. So $T+W+Th=(152-30)=122$

$$T+W+Th+F=(4 \times 40) = 160$$

$$F = (160-122)=38^\circ$$

2. A shop keeper earned Rs.504 in 12 days. His average income for the first four days was Rs.40 a day. His average income for the remaining days is :

- a. Rs.40
- b. Rs.42
- c. Rs.43
- d. Rs.45

Correct Option: C

Explanation:

Let the average for remaining 8 days be Rs.x a day. Then, $4 \times 40 + 8 \times x = 504$ or $8x = 344$ or $x = 43$

Required average = Rs.43

3. A man whose bowling average is 12.4 takes 5 wickets for 26 runs and there by decreases his average by 0.4.

The number of wickets taken by him before his last match is:

- a. 85
- b. 78
- c. 72
- d. 64

Correct Option: A

Explanation:

Let the number of wickets taken before the last match=x.

$$\text{then } \frac{12.4x + 26}{x + 5} = 12 \Rightarrow x = 85$$

4. The average of weight of three men A,B and C is 84 kg. Another man D joins the group and the average now becomes 80 kg. If another man E, whose weight is 3 kg.more than that of D, replaces A, then the average weight of B,C,D and E becomes 79 kg. The weight of A is :

- a. 70 kg
- b. 72 kg
- c. 75 kg
- d. 80 kg

Correct Option: C

Explanation:

$$A+B+C = 3 \times 84 = 252$$

$$A+B+C+D = (4 \times 80) = 320$$

$$D = (320-252)=68 \text{ and } E = (68+3)=71$$

$$\text{Now, } B+C+D+E = (4 \times 79) = 316$$

$$B+C+D=(316-71)=245 \text{ kg}$$

$$\text{So, } A = (320-245)=75 \text{ kg}$$

5. The average age of A,B,C,D five years ago was 45 years. By including X, the present average age of all the five is 49 years. The present age of X is :

- a. 64 years

- b. 48 years
- c. 45 years
- d. 40 years

Correct Option: C

Explanation:

As 5 years ago average is 45, the present average is 50. So sum of the ages of A, B, C, D is $50 \times 4 = 200$

But given that average of A, B, C, D and X is 49. So sum of their ages = $49 \times 5 = 245$

Present age of X = $245 - 200 = 45$ years.

6. The average age of 24 students in a class is 10. If the teacher's age is including, the average increases by one.

The age of the teacher is :

- a. 25 years
- b. 30 years
- c. 35 years
- d. 40 years

Correct Option: C

Explanation:

Sum of the ten students age = 24×10

Sum of the ten students including the teacher = 25×11

Age of the teacher = $(25 \times 11 - 24 \times 10) = 35$ years

7. The average of marks obtained by 120 candidates was 35. If the average of marks of passed candidates was 39 and that of failed candidates was 15, the number of candidates who passed the examination is :

- a. 100
- b. 110
- c. 120
- d. 150

Correct Option: A

Explanation:

Let the number of candidates who passed = x, Then,

$$39 \times x + 15 \times (120 - x) = 120 \times 35$$

$$24x = 4200 - 1800 \text{ or}$$

$$x = \left(\frac{2400}{24} \right) = 100$$

8. The average expenditure of a man for the first five months is Rs.120 and for the next seven months it is Rs.130.

If he saves Rs.290 in that year, his monthly average income is :

- a. Rs.140
- b. Rs.150
- c. Rs.160

d. Rs.170

Correct Option: B

Explanation:

$$\text{Total income} = \text{Rs.}(120 \times 5 + 130 \times 7 + 290) = \text{Rs.}1800$$

Average monthly income

$$= \text{Rs.} \left(\frac{1800}{12} \right) = \text{Rs.}150$$

9. The average salary of 20 workers in an office is Rs.1900 per month. If the manager's salary is added, the average salary becomes Rs.2000 p.m. What is the manager's annual salary?

a. Rs.24,000

b. Rs.25,200

c. Rs.45,600

d. None of these

Correct Option:D

Explanation:

Manager's salary per month

$$= (\text{Rs.}21 \times 2000 - 20 \times 1900) = \text{Rs.}4000$$

$$\text{Manager's Annual salary} = \text{Rs.}(4000 \times 12) = \text{Rs.}48000$$

10. The average weight of a class of 40 students is 40 kg. If the weight of the teacher is included, the average weight increases by 500 gms. The weight of the teacher is :

a. 40.5 kg

b. 60 kg

c. 60.5 kg

d. 62 kg

Correct Option: C

Explanation:

$$\text{Weight of the teacher} = (41 \times 40.5 - 40 \times 40) \text{ kg} = 60.5 \text{ kg}$$

11. The average weight of 8 men is increased by 2 kg when one of the men, whose weight is 50 kg is replaced by a new man. The weight of the new man is :

a. 52 kg

b. 58 kg

c. 66 kg

d. 68 kg

Correct Option: C

Explanation:

$$\text{Weight increased} = (8 \times 2) \text{ kg} = 16 \text{ kg}$$

$$\text{Weight of new man} = (50 + 16) \text{ kg} = 66 \text{ kg}$$

12. The average weight of 8 persons is increased by 2.5 kg, When one of them whose weight is 56 kg is replaced by a new man. The weight of the new man is :

- a. 66 kg
- b. 75 kg
- c. 76 kg
- d. 86 kg

Correct Option: C

Explanation:

Total increase = (8×2.5) kg = 20 kg.

Weight of new man = $(56 + 20)$ kg = 76 kg

13. The average age of an adult class is 40 years. 12 new students with an average of 32 years join the class, thereby decreasing the average by 4 years. The original strength of the class was :

- a. 10
- b. 11
- c. 12
- d. 15

Correct Option: C

Explanation:

Let original strength = x, Then,

$$40x + 12 \times 32 = (x + 12) \times 36$$

$$\text{or } 40x + 384 = 36x + 432 \text{ or}$$

$$4x = 48 \text{ or } x = 12$$

14. The average of 6 observations is 12. A new seventh observation is included and the new average is decreased by 1. The seventh observation is :

- a. 1
- b. 3
- c. 5
- d. 6

Correct Option: C

Explanation:

$$\text{Seventh observation} = (7 \times 11 - 6 \times 12) = 5$$

15. Out of four numbers, the average of first three is 15 and that of the last three is 16. If the last number is 19, the first is :

- a. 15
- b. 16

c. 18

d. 19

Correct Option: B

Explanation:

Sum of four numbers = $(15 \times 3 + 19) = 64$

Sum of last three numbers = $(16 \times 3) = 48$

First number = $(64 - 48) = 16$

16. The average of 10 numbers is calculated as 15. It is discovered later on that while calculating the average one number, namely 36 was wrongly read as 26. The correct average is :

a. 12.4

b. 14

c. 16

d. 18.6

Correct Option: C

Explanation:

Sum of numbers = $(10 \times 15 - 26 + 36) = 160$

Correct average = $\frac{160}{10} = 16$

17. The average of 25 results is 18, that of first twelve is 14 and of last twelve is 17. Thirteenth result is :

a. 28

b. 72

c. 78

d. 85

Correct Option: C

Explanation:

Thirteenth result = $(25 \times 18 - 12 \times 14 + 12 \times 17) = 78$

18. A man goes to a place at the rate of 4 kmph. He comes back on a bicycle at 16 kmph. His average speed for the entire journey is :

a. 5 km/hr

b. 6.4 km/hr

c. 8.5 km/hr

d. 10 km/hr.

Correct Option: B

Explanation:

Average speed = $\left(\frac{2xy}{x+y} \right)$ km/hr

= $\left(\frac{2 \times 4 \times 16}{4 + 16} \right)$ km/hr = 6.4 km/hr.

19. The average temperature of the first three days is 27°C and that of the next three days is 29°C . If the average of the whole week is 28.5°C , the temperature of the last day of the week is :

- a. 10.5°C
- b. 21°C
- c. 31.5°C
- d. 42°C

Correct Option: C

Explanation:

Let the seventh day temperature be x . Then total temperature for the whole week is

$$3 \times 27 + 3 \times 29 + 1 \times x = 7 \times 28.5$$

$$x = 31.5$$

20. The average age of 30 students in a class is 12 years. The average age of a group of 5 of the students is 10 years and that of another group of 5 of them is 14 years. The average of the remaining students is :

- a. 8 years
- b. 10 years
- c. 12 years
- d. 14 years

Correct Option: C

Explanation:

Let it be x . Then :

$$5 \times 10 + 5 \times 14 + 20 \times x = 30 \times 12$$

$$20x = 360 - 120 \text{ or } 20x = 240 \text{ or } x = 12$$

21. The average of 8 numbers is 21. If each of the number is multiplied by 8, the average of the new set of numbers is :

- a. 8
- b. 21
- c. 29
- d. 168

Correct Option: D

Explanation:

$$\text{Average of new numbers} = (21 \times 8) = 168$$

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

- a. 36.5
- b. 37.0
- c. 37.5

d. 37.52

Correct Option: C

Explanation:

Total of 50 numbers = $(50 \times 38) = 1900$

Total of 48 numbers = $(1900 - (45 + 55)) = 1800$

Required average = $\frac{1800}{48} = \frac{225}{6} = 37.5$

23. The average height of 30 girls out of a class of 40 is 160 cm. and that of the remaining girls is 156 cm. The average height of the whole class is :

a. 158 cms

b. 158.5 cms

c. 159 cms

d. 159.5 cms

Correct Option: C

Explanation:

Average height of the whole class = $(\frac{36 \times 160 + 10 \times 156}{40}) = 159$ cms

24. If a,b,c,d,e are five consecutive odd numbers, their average is :

a. $5(a+4)$

b. $\frac{abcde}{5}$

c. $5(a+b+c+d+e)$

d. None of these

Correct Option: D

Explanation:

If the first number is a, then the remaining numbers a + 2, a + 4, a + 6, a + 8

Average : = $(\frac{a + (a + 2) + (a + 4) + (a + 6) + (a + 8)}{5}) = (a + 4)$

25. The average age of three boys is 15 years. If their ages are in the ratio 3:5:7, the age of the youngest boy is :

a. 9 years

b. 15 years

c. 18 years

d. 21 years

Correct Option: A

Explanation:

$\frac{3x + 5x + 7x}{3} = 15 \Rightarrow 15x = 15 \times 3$ or $x = 3$

Age of youngest = $3x = 9$ years

www.FirstRanker.com