CHAPTER 11

Average

Average

A single expression representing the whole group is selected which may convey a fairly adequate idea of the whole group. This single expression in statistics is known as the average.

There are five types of averages which are commonly used. These are

1. Average or Arithmetic Mean (AM)
2. Median
3. Mode
4. Geometric Mean (GM)
5. Harmonic Mean (HM)

We shall be studying arithmetic mean only.

$$\text{Mean or average} = \frac{\text{Sum of observations}}{\text{Number of observations}}$$

or $$\bar{x} = \frac{x_1 + x_2 + x_3 + \ldots + x_n}{n}$$

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

Important Rules and Formulae

Rule 1 If $\bar{x}$ is the mean of n observations $x_1, x_2, x_3, \ldots, x_n$, then $\sum_{i=1}^{n} (x_i - \bar{x}) = 0$.

i.e., The algebraic sum of deviations from mean is zero.

Rule 2 If every observation is increased by a constant, the mean of the observations so, obtained also increases by the same constant.

Example 1. Sachin Tendulkar scores 28, 54, 26, 32 and 20 runs, respectively in 5 innings. Then his average score is

(a) 30 (b) 32
(c) 36 (d) 42

Sol. (*b*) Sum of scores $= 28 + 54 + 26 + 32 + 20 = 160$

$\therefore$ Average $= \frac{160}{5} = 32$

Example 2. If the average of 6, 8, 5, 7, x and 4 is 7. Then the value of x is

(a) 10 (b) 11 (c) 12 (d) 15

Sol. (*c*) Average $= \frac{6+8+5+7+x+4}{6}$

$$7 = \frac{30+x}{6}$$

$$42 = 30 + x \Rightarrow x = 42 - 30 = 12$$

Example 3. The average of 27 observations is 35. If 5 is added to each observation, what will be the new mean?

(a) 10 (b) 20 (c) 30 (d) 40

Sol. (*d*) Here, $\bar{x} = 35$

$n = 27$

Sum of observation $= n\bar{x} = 27 \times 35 = 945$

New total of observation $= 945 + 27 \times 5 = 1080$

$\therefore$ New mean $= \frac{1080}{27} = 40$

Shortcut method

New mean = Previous mean + Number added to each term

$= 35 + 5 = 40$

Rule 3 If every observation is decreased by a constant the mean of the observation, so obtained also decreases by the same constant.

Example 4. The mean of 15 observations is 20. If 8 is subtracted from each observation. Then, the new mean is

(a) 10 (b) 12 (c) 16 (d) 20

Sol. (*b*) Here, mean $= 20$

$n = 15$

Sum of observation $= 15 \times 20 = 300$

New total of observation $= 300 - 8 \times 15 = 300 - 120 = 180$

$\therefore$ New mean $= \frac{180}{15} = 12$

Shortcut method

New mean = Previous mean − Number subtracted from each term

$= 20 - 8 = 12$

Rule 4 If each observation is multiplied by a constant, the mean of the resulting observations can be obtained by multiplying the mean by the same constant.

Example 5. The mean of 53 observations is 18. If each observation is multiplied by 3. What will be the new mean?

(a) 18 (b) 36 (c) 53 (d) 54

Sol. (d) Here, $\bar{x} = 18$

$n = 53$

So, sum of observation $= n\bar{x} = 53 \times 18 = 954$

New total $= 954 \times 3 = 2862$

$$\text{New mean} = \frac{2862}{53} = 54$$

Shortcut method

New mean = Previous mean × Constant multiplied to each term $= 18 \times 3 = 54$

Rule 5 If each observation is divided by a constant, the mean of the resulting observation can be obtained by dividing the mean by the same constant.

Example 6. The mean of 78 numbers is 27. If each observation is divided by 3, then new mean is

(a) 9 (b) 18

(c) 27 (d) None of these

Sol. (a) $\bar{x} = 27$

$n = 78$

So total of observation $= 78 \times 27 = 2106$

$\therefore$ New total of observation $= \frac{2106}{3} = 702$

$$\text{New mean} = \frac{702}{78} = 9$$

Shortcut method

$$\text{New mean} = \frac{\text{Previous mean}}{\text{Number by which each term is divided}}$$

$$= \frac{27}{3} = 9$$

Rule 6 If a man covers some journey from P to Q at u km/h and returns back to P at a uniform speed of v km/h, then the average speed during the whole journey is $\left(\frac{2uv}{u+v}\right)$ km/h.

Example 7. A constant distance from Delhi to Jammu is covered by Jyoti at 40 km/h. She rides back to same distance at 30 km/h. Then her average speed during the whole journey is

(a) 24.25 km/h (b) 32.29 km/h

(c) 34.29 km/h (d) 36.25 km/h

Sol. (c) Here,

$$\text{Average speed} = \left(\frac{2uv}{u+v}\right) \text{km/h}$$

$u = 40$ km/h, $v = 30$ km/h

$$\text{Average speed} = \frac{2 \times 30 \times 40}{30 + 40} = 34.29 \text{ km/h}$$

Rule 7 If the averages and the number of observations of two or more groups are known, then the combined average of these groups can be calculated as

$$\text{Combined average} = \frac{N_1\bar{x}_1 + N_2\bar{x}_2}{N_1 + N_2}$$

Where N_1 and N_2 are the number of observations in the two group and $\bar{x}_1$ and $\bar{x}_2$ are the corresponding averages of these groups.

Above formula for combined average can be extended to any number of groups as

$$\text{Combined average} = \frac{N_1\bar{x}_1 + N_2\bar{x}_2 + \ldots + N_n\bar{x}_n}{N_1 + N_2 + N_3 + \ldots + N_n}$$

Example 8. There are 45 student in a class of which 15 are girls. The average weight of 15 girls is 45 kg and that of 30 boys is 52 kg. Then the mean weight in kg of the entire class is

(a) 49.67 kg (b) 50.01 kg

(c) 53.23 kg (d) 57.23 kg

Sol. (a) Here, $n_1 = 15, n_2 = 30$

$\bar{x}_1 = 45$ kg and $\bar{x}_2 = 52$ kg

$$\therefore \quad \bar{X} = \frac{n_1\bar{x}_1 + n_2\bar{x}_2}{n_1 + n_2} = \frac{15 \times 45 + 30 \times 52}{15 + 30} = \frac{2235}{45} \text{kg} = 49.67 \text{ kg}$$

Hence, mean weight of entire class is 49.67 kg.

Example 9. A school has four sections in a class X having 40, 35, 45 and 42 students. The mean marks obtained in a Chemistry test are 50, 60, 55 and 45, respectively, for the four sections. Then the overall average of the marks per student is

(a) 51.75 (b) 51.95 (c) 52.25 (d) 52.75

Sol. (c) Here, $n_1 = 40, n_2 = 35, n_3 = 45, n_4 = 42$.

$\bar{x}_1 = 50, \bar{x}_2 = 60, \bar{x}_3 = 55, \bar{x}_4 = 45$

$$\therefore \quad \bar{X} = \frac{n_1\bar{x}_1 + n_2\bar{x}_2 + n_3\bar{x}_3 + n_4\bar{x}_4}{n_1 + n_2 + n_3 + n_4}$$

$$= \frac{40 \times 50 + 35 \times 60 + 45 \times 55 + 42 \times 45}{40 + 35 + 45 + 42}$$

$$= \frac{2000 + 2100 + 2475 + 1890}{162}$$

$$= \frac{8465}{162} = 52.25$$

$\therefore$ Overall average of marks per student = 52.25

Rule 8 The average of odd numbers from 1 to n is $\left[\frac{\text{Last odd number} + 1}{2}\right]$ and the average of even numbers from 1 to n is $\left[\frac{\text{Last even number} + 2}{2}\right]$.

Exercise

1. An aeroplane filies along the four sides of a square at a speed of 100, 200, 300 and 400 km/h, respectively. What is the average speed of the plane in its flight around the square? **(CDS 2007 II)**
   (a) 196 km/h (b) 200 km/h
   (c) 250 km/h (d) None of these

2. The average age of a class of 40 boys is reduced by 1 yr. Where 10 boys whose average age is 20 yr are discharged and 10 new boys admitted. Find the average age of new-comers.
   (a) $16\frac{1}{2}$ yr (b) 16 yr (c) $15\frac{1}{2}$ yr (d) 17 yr

3. The mean of first ten odd natural numbers is
   (a) 10 (b) 15 (c) 11 (d) 20

4. The mean of first ten prime numbers is
   (a) 12 (b) 12.9 (c) 13 (d) 14

5. The population of a state increased from 100 million to 169 million in two decades. What is the average increase in population per decade? **(CDS 2008 II)**
   (a) 20% (b) 34.5% (c) 69% (d) 30%

6. How much tea at ₹ 9 per kg must be mixed with 100 kg of superior tea at ₹ 13.50 per kg to give an average price of ₹ 11 per kg? **(CDS 2008 II)**
   (a) 85 kg (b) 120 kg (c) 125 kg (d) 130 kg

7. A car runs for t_1 hours at v_1 km/h, t_2 hours at v_2 km/h. What is the average speed of the car for the entire journey?
   (a) $\frac{v_1t_1 + v_2t_2}{t_1 + t_2}$ (b) $\frac{(v_1 + v_2)t_2}{t_1}$ (c) $\frac{t_1 + v_1t_2}{v_1 + v_2}$ (d) $\frac{v_1 + v_2}{t_2 + t_1}$

8. A car runs x km at an average speed of v_1 km/h and y km at an average speed of v_2 km/h. What is the average speed of the train for the entire journey?
   (a) $\frac{x + y}{v_1 + v_2}$ (b) $\frac{v_1v_2(x + y)}{xv_2 + yv_1}$
   (c) $\frac{x_1v_1 + x_2v_2}{v_1 + v_2}$ (d) None of these

9. Of three numbers, the first is twice the second and thrice the third, the average of all the three numbers is 88, then the smallest number is
   (a) 72 (b) 46 (c) 48 (d) 52

10. Out of 250 observations, the first 100 observations have mean 5 and the average of the remaining 150 observations is $\frac{25}{3}$. What is the average of the whole group of observations? **(CDS 2007 II)**
    (a) 6 (b) 7 (c) 8 (d) 9

11. A batsman scores 80 runs in his sixth innings and thus increases his average by 5. What is his average after six innings? **(CDS 2007 I)**
    (a) 50 (b) 55 (c) 60 (d) 65

12. The average age of m boys is 'b' years and 'n' girls is 'c' years. Find the average age of all together.
    (a) $\frac{mb - nc}{m - n}$ (b) $\frac{mb - nc}{m + n}$ (c) $\frac{mb + nc}{m + n}$ (d) $\frac{mb + nc}{m - n}$

13. A truck made a trip of 200 km, covering the first 100 km at the rate of 50 km/h and the second 100 km at 40 km/h. What was the average speed of the truck in km/h? **(CDS 2008 II)**
    (a) 22.2 (b) 28.2 (c) 33.3 (d) 44.4

14. Rohit goes from a place to another and returns by the same route. He pedals his way uniformly with speed u while going and with speed v while returning. The average speed of his journey is
    (a) $\frac{1}{\frac{1}{2}\left(\frac{1}{u} + \frac{1}{v}\right)}$ (b) $\frac{1}{2\left(\frac{1}{u} - \frac{1}{v}\right)}$ (c) $\frac{1}{\frac{1}{2}(u - v)}$ (d) $\frac{u + v}{2}$

15. The average of the price per kg of sugar at 10 different places was ₹ 4.85. After a week, the price per kg was increased by 20 paise at 3 places and decreased by 10 paise at one place. The new average of price per kg is
    (a) ₹ 4.00 (b) ₹ 4.90 (c) ₹ 4.12 (d) ₹ 5.15

16. If the mean of 4 observations is 20 and when a constant P is added to each observation the mean becomes 30, the value of P is
    (a) −10 (b) 10 (c) 4 (d) 8

17. In class of 100 students the mean marks obtained in a subject is 30 and in another class of 50 students the mean marks obtained in the same subject is 60. The mean marks obtained by the students of two classes taken together is
    (a) 60 (b) 55 (c) 40 (d) 35

18. A man lands ₹ 1200 in four sums. If he gets 5% for ₹ 300, 6% for ₹ 350 and 6.5% for ₹ 400. What percentage must be get for the remainder, if the average interest is 6.5%?
    (a) 31% (b) 6% (c) $\frac{31}{3}$% (d) $\frac{32}{3}$%

19. The average noon temperature for Monday, Tuesday and Wednesday was 53° and for Tuesday, Wednesday and Thursday it was 56°. If the noon temperature on Thursday was 60°. Find the noon temperature on Monday.
    (a) 51° (b) 53° (c) 56° (d) 57°

20. A person invested part of ₹ 45000 at 4% and the rest at 6%. If his annual income from both are equal, then what is the average rate of interest? **(CDS 2009 I)**
    (a) 4.6% (b) 4.8% (c) 5.0% (d) 5.2%

21. In an examination, 40% of the candidates wrote their answers in Hindi and the others in English. The average marks of the candidates written in Hindi is 74 and the average marks of the candidates written in English is 77. What is the average marks of all the candidates? **(CDS 2010 II)**
    (a) 75.5 (b) 75.8 (c) 76.0 (d) 76.8

22. 9 men visited a hotel, 8 of them spent ₹ 4 each over their meal and the 9th spent ₹ 2 more than the average of all the nine. The total money spent by them on the meal is
(a) ₹ 40 (b) ₹ 38.25 (c) ₹ 38 (d) ₹ 38.50

23. The average age of the three boys is 15 yr. Their ages are in the ratio 3 : 5 : 7. Then, the age of the oldest is
(a) 7 yr (b) 20 yr (c) 21 yr (d) 14 yr

24. The mean weight of 150 students in a certain class is 60 kg. the mean weight of the boys from the class is 70 kg, while that of girls in 55 kg. What is the number of girls in the class? **(CDS 2010 II)**
(a) 105 (b) 100 (c) 95 (d) 60

25. Of the three numbers, the first is twice the second and is half the third. If the average of three numbers is 56, the three numbers in order are
(a) 48, 24, 96 (b) 48, 36, 96 (c) 48, 12, 14 (d) 24, 12, 48

26. Nine numbers are written in ascending order. The middle number is the average of the nine numbers. The average of the first five larger numbers is 68 and that of five smaller numbers is 44. What is the sum of all nine numbers? **(CDS 2009 I)**
(a) 450 (b) 501 (c) 504 (d) 540

27. Raja buys 1000 articles at ₹ 3 each; he sells 700 of them at ₹ 4.50 each and the rest at ₹ 2.50 each. Find his average profit per article sold.
(a) ₹ 0.90 (b) ₹ 1.50 (c) ₹ 1.00 (d) ₹ 0.70

28. The average age of x boys and y girls is 'p' years. If the average age of the boys is 'r' years. Find the average age of girls.
(a) $P+\frac{x(r-P)}{y}$ year (b) $P-\frac{x(r-P)}{y}$ year
(c) $P-\frac{x(P-r)}{y}$ year (d) $P+\frac{x(P-r)}{y}$ year

29. The mean of $x, x+2, x+4, x+6$ and $x+8$ is
(a) $5x+4$ (b) $x+20$
(c) $x+4$ (d) None of these

30. A motorist covered the first 20 km of his journey in 30 min and the remaining 29 km in 40 min. His average speed in km/h is
(a) $42\frac{1}{3}$ (b) $\frac{7}{6}$ (c) 49 (d) 42

31. A boy travels a distance of 8 km at the rate of 4 km/h, 6 km at the rate of 3 km/h and 4 km at the rate of 2 km/h. What is the average speed for the entire journey? **(CDS 2009 II)**
(a) 2 km/h (b) 3 km/h (c) 4 km/h (d) 6 km/h

32. One-third of a certain journey was covered at a rate of 25 km/h one-fourth at the rate of 30 km/h and the rest at the rate of 50 km/h. Find the average speed per hour for the whole journey.
(a) 33 km/h (b) $33\frac{1}{3}$ km/h
(c) $66\frac{1}{2}$ km/h (d) None of these

33. If a, b, c, d and e are five consecutive odd integers, then their average is
(a) $a+4$ (b) $5(a+b+c+d+e)$
(c) $\frac{abcde}{5}$ (d) None of these

34. A person travelled by train for 1 h at a speed of 50 km/h. He, then travelled by a texi for 30 min at a speed of 32 km/h to complete his journey. What is the average speed at which he travelled during the journey? **(CDS 2010 I)**
(a) 44 km/h (b) 42 km/h
(c) 41 km/h (d) 33 km/h

Answers

1. (d)	2. (b)	3. (a)	4. (b)	5. (b)	6. (c)	7. (a)	8. (b)	9. (c)	10. (b)
11. (b)	12. (c)	13. (d)	14. (a)	15. (b)	16. (b)	17. (c)	18. (d)	19. (a)	20. (b)
21. (b)	22. (b)	23. (c)	24. (b)	25. (a)	26. (c)	27. (a)	28. (d)	29. (c)	30. (d)
31. (b)	32. (b)	33. (a)	34. (a)						

Hints and Solutions

1. Average speed $=\frac{\text{Total distance}}{\text{Total time}}$

$$=\frac{x+x+x+x}{\frac{x}{100}+\frac{x}{200}+\frac{x}{300}+\frac{x}{400}}=\frac{4x}{\frac{12x+6x+4x+3x}{1200}}$$

$$=\frac{4x\times 1200}{25x}=192 \text{ km/h}$$

2. Let total age of 40 boys in beginning $=x$

$\therefore$ Average age of 40 boys $=\frac{x}{40}$

Total age when 10 boys whose average age is 20 yr are discharged and 10 new boys whose average age is 'y' years are admitted is $x-200+10y$.

New average of 40 boys $=\frac{x-200+10y}{40}$

$\therefore$ $\frac{x}{40}-1=\frac{x-200+10y}{40}$ (by given condition)

$\Rightarrow$ $y=16$ yr

3. Mean $=\frac{1+3+5+7+9+11+13+15+17+19}{10}=10$

4. $\text{Mean} = \dfrac{2+3+5+7+11+13+17+19+23+29}{10} = \dfrac{129}{10} = 12.9$

5. The difference of population in two decades
$= 169 - 100 = 69$ million
$\therefore$ Population in first decade $= \dfrac{69}{2} = 34.5\%$

6. Let x kg of tea of ₹ 9 per kg.
By given condition, $\dfrac{9 \times x + 13.5 \times 100}{x + 100} = 11$
$\Rightarrow \quad 9x + 1350 = 11x + 1110 \Rightarrow 2x = 250 \Rightarrow x = 125$ kg

7. Distance covered by car in t_1 hours $= t_1 v_1$ km
Distance covered in t_2 hours $= t_2 v_2$ km $\quad \left(\because \text{Speed} = \dfrac{\text{Distance}}{\text{Time}}\right)$
Total distance $= t_1 v_1 + t_2 v_2$
Total time $= t_1 + t_2$
$\therefore \quad$ Average $= \dfrac{v_1 t_1 + v_2 t_2}{t_1 + t_2}$ km/h

8. Time taken in the I journey $= \dfrac{x}{v_1}$ hours
Time taken in the II journey $= \dfrac{y}{v_2}$ hours
Total distance $= (x + y)$ km
Total time $= \left(\dfrac{x}{v_1} + \dfrac{y}{v_2}\right)$ hours
$\therefore \quad$ Average speed $= \dfrac{\text{Distance}}{\text{Time}} = \dfrac{x+y}{\left(\dfrac{x}{v_1} + \dfrac{y}{v_2}\right)} = \dfrac{v_1 v_2 (x+y)}{x v_2 + v_1 y}$ km/h

9. Let the numbers be $2a, a$ and $\dfrac{2a}{3}$. (by given condition)
$\therefore \quad \dfrac{2a + a + \dfrac{2a}{3}}{3} = \dfrac{\dfrac{11a}{3}}{3} = 88 \Rightarrow a = 72$
$\therefore$ The smallest number is $\dfrac{2}{3} \times 72 = 48$

10. Average of whole group of observations
$$= \frac{100 \times 5 + 150 \times \frac{25}{3}}{100 + 150} = \frac{500 + 1250}{250} = \frac{1750}{250} = 7$$

11. Let the average of 5 innings $= x$
Score in sixth innings $= 80$
$\therefore \quad$ Total of 5 innings $= 5x$
By given condition, $\dfrac{5x + 80}{6} = x + 5$
$\Rightarrow \quad 5x + 80 = 6x + 30 \Rightarrow x = 80 - 30 = 50$
$\therefore$ His average after six innings $= 50 + 5 = 55$

12. Here, average age of m boys is b.
Total age of boys $= mb$
Average of n girls is c.
Total age of girls $= nc$
$\therefore \quad$ Total age $= bm + nc$
$\therefore \quad$ Average $= \dfrac{bm + nc}{m + n}$

13. Average speed $= \dfrac{2uv}{u+v} = \dfrac{2 \times 50 \times 40}{50 + 40} = \dfrac{4000}{90} = 44.4$ km/h

Aliternative Method Average speed $= \dfrac{\text{Total distance}}{\text{Total time}}$
$$= \frac{20}{\frac{100}{50} + \frac{100}{40}} = \frac{200 \times 2}{9} = 44.4 \text{ km/h}$$

14. Let the one side distance be y.
$\therefore$ Total distance covered $= 2y$
Total time taken $= \left(\dfrac{y}{u} + \dfrac{y}{v}\right)$
$\therefore \quad$ Average speed $= \dfrac{2y}{\left(\dfrac{y}{u} + \dfrac{y}{v}\right)} = \dfrac{1}{\frac{1}{2}\left(\frac{1}{u} + \frac{1}{v}\right)}$

15. Average price per kg $=$ ₹ 4.85
Price increased at 3 places by 20 paise.
So, price $= 4.85 + 0.20 =$ ₹ 5.05
Price decreased at one place by 10 paise.
So, price $= 4.85 - 0.10 =$ ₹ 4.75
Price remaining at 6 place $=$ ₹ 4.85
$\therefore$ Total new price of 10 kg sugar
$= 3 \times 5.05 + 4.75 + 6 \times 4.85 =$ ₹ 49
$\therefore$ Average price per kg $=$ ₹ $\dfrac{49}{10} =$ ₹ 4.90

16. Constant added $=$ New mean $-$ Previous mean
$\Rightarrow \quad P = 30 - 20$
$P = 10$

17. Total marks of 100 students $= 30 \times 100 = 3000$
Total marks of 50 students $= 60 \times 50 = 3000$
$\therefore$ Total marks of 150 students $= 6000$
$$\text{Mean marks} = \frac{6000}{150} = 40$$

18. The interest of ₹ 300 at the rate of 5% $= 300 \times \dfrac{5}{100} =$ ₹ 15
The interest on ₹ 350 at the rate of 6% $= 350 \times \dfrac{6}{100} =$ ₹ 21
The interest on ₹ 400 at the rate of 6.5% $= 400 \times \dfrac{650}{100} =$ ₹ 26
$\therefore$ Interest for ₹ 1050 (300 + 350 + 400) $=$ ₹ (15 + 21 + 26)
$=$ ₹ 62
$\therefore$ The remainder sum $= 1200 - 1050$
$=$ ₹ 150
$\therefore$ Total interest required for ₹ 1200 at the rate of 6.5% is
$$1200 \times \frac{6.5}{100} = ₹\ 78$$
$\therefore$ Interest he gets for ₹ 150 is ₹ $(78 - 62) =$ ₹ 16
$\therefore$ Interest on ₹ 150 in ₹ 16
$\therefore$ Per cent interest for the remainder $= \dfrac{32}{3}\%$

19. The average noon temperature for
Tuesday and Wednesday $= 108°$
Average noon temperature of Monday $= 53 \times 3 - 108 = 51°$
So, average noon temperature of Monday $= 51°$

20. Let a person invest 4% of x.

$\therefore \quad \frac{x\times 4}{100}=\frac{(45000-x)}{100}\times 6 \Rightarrow 2x=45000\times 3-3x$

$\Rightarrow \quad x=\frac{45000\times 3}{5}=₹\ 27000$

And another part is ₹ 18000.

Interest for Ist part in one year $=\frac{27000\times 4}{100}=₹\ 1080$

Similarly, interest for rest part in one year = ₹ 1080

$\because$ Total interest = ₹ 2160

$\therefore \quad \frac{45000\times r}{100}=2160 \Rightarrow r=\frac{216}{45}=4.8\%$

21. Let total number of candidates = 100

$\therefore$ Total marks of 40 candidates $= 40\times 74$

and total marks of 60 candidates $= 60\times 77$

Hence, required average marks $=\frac{40\times 74+60\times 77}{100}$

$=\frac{2960+4620}{100}=\frac{7580}{100}=75.80$

22. Average money spent by 8 persons = ₹ 4

Increase in average expenditure by including the 9th person = ₹ 2/8 = ₹ 0.25

$\therefore$ Average of all the 9 men = 4 + 0.25 = ₹ 4.25

$\therefore$ Total money spent by all the 9 men $= 9\times 4.25 =$ ₹ 38.25

23. Let their ages be $3x, 5x$ and $7x$.

$\therefore$ Total of their ages $= 3x+5x+7x=15x$

or $15x=3\times 15 \Rightarrow x=3$

$\therefore$ Age of the oldest boy $= 3\times 7 = 21$ yr

24. Total weight of 150 students $= 150\times 60 = 9000$ kg and total weight of x boys $= 70x$ kg.

Also, total weight of $(150-x)$ girls $= 55(150-x)$ kg

$\therefore \quad 70x+55(150-x)=9000$

$\Rightarrow \quad 70x+8250-55x=9000$

$\Rightarrow \quad 15x=9000-8250$

$\Rightarrow \quad 15x=750 \Rightarrow x=50$

Hence, number of girls $= 150-50=100$

25. Let first number be x and second number be $\frac{x}{2}$.

Third number be $2x$.

Hence, average of numbers = 56

So, $\frac{x+\frac{x}{2}+2x}{3}=56$ (by given condition)

$\frac{2x+x+4x}{\frac{2}{3}}=56 \Rightarrow \frac{7x}{6}=56$

$\Rightarrow \quad 7x=56\times 6 \Rightarrow x=48$

$\therefore$ Numbers are 48, 24 and 96.

26. Since, 5th term = Average of 9 numbers = x

Sum of first five larger numbers $= 68\times 5=340$

Sum of first five smaller numbers $= 44\times 5=220$

Average of 5 numbers $=\frac{340+220-x}{9}$

($\because x$ is subtracted because 5th term repeated twice)

$\therefore \quad x=\frac{560-x}{9}$

$\Rightarrow \quad 9x+x=560 \Rightarrow x=56$

$\therefore$ Sum of 9 numbers $= 56\times 9=504$

27. Cost price of 1000 article = ₹ 3000

Selling price of 700 article = ₹ 3150

Selling price of 300 article = ₹ 750

$\therefore$ Total selling price of 1000 article = ₹ 3900

$\therefore$ Total profit $= 3900-3000=$ ₹ 900

$\therefore$ Profit per article $=\frac{900}{1000}=$ ₹ 0.90

28. Average age of x boys and y girls is $\frac{rx+ym}{x+y}$,

here m = average age of girls.

$\frac{rx+ym}{x+y}=P \Rightarrow m=P+\frac{x(P-r)}{y}$ year

29. Mean $=\frac{x+(x+2)+(x+4)+(x+6)+(x+8)}{5}=\frac{5x+20}{5}=(x+4)$

30. Total distance covered = (20 + 29) km = 49 km

Total time taken = (30 + 40) min = 70 min

Average speed $=\left(\frac{49}{70}\times 60\right)$ km/h = 42 km/h

31. $\because \quad t=\frac{d}{s}$

Ist case, $t_1=\frac{8}{4}=2$ h

IInd case, $t_2=\frac{6}{3}=2$ h

IIIrd case, $t_3=\frac{4}{2}=2$ h

$\therefore$ Average speed $=\frac{\text{Total distance}}{\text{Total time}}=\frac{8+6+4}{2+2+2}=\frac{18}{6}=3$ km/h

32. Let total distance = x km

$\therefore \quad \frac{x}{\frac{\frac{1}{3}x}{25}+\frac{\frac{1}{4}x}{30}+\frac{x-\frac{1}{3}x-\frac{1}{4}x}{50}}=\frac{x}{\frac{3x}{100}}=\frac{100}{3}=33\frac{1}{3}$

Hence, $33\frac{1}{3}$ is the required average speed.

33. Here, the numbers are

$b=a+2, c=a+4, d=a+6, e=a+8$

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

$=\frac{(5a+20)}{5}=(a+4)$

34. Average speed $=\frac{\text{Total distance}}{\text{Total time}}$

$=\frac{50\times 1+32\times \frac{1}{2}}{1+\frac{1}{2}}=\frac{50+16}{3/2}=\frac{66\times 2}{3}=44$ km/h