Average

INTRODUCTION

Whenever we are asked the marks scored by us in any examination, we usually tell the marks in percentage, taking the percentage of total marks of all subjects. This percentage is called *average percentage*. Also, in a class, if there are 100 students, instead of knowing the age of individual student, we usually talk about average age.

The *average* or *mean* or *arithmetic mean* of a number of quantities of the same kind is equal to their sum divided by the number of those quantities. For example, the average of 3, 9, 11, 15, 18, 19 and 23 is

$$\frac{3+9+11+15+18+19+23}{7} = \frac{98}{7} = 14.$$

SOME BASIC FORMULAE

1. $\text{Average} = \dfrac{\text{Sum of quantities}}{\text{Number of quantities}}$
2. $\text{Sum of quantities} = \text{Average} \times \text{Number of quantities}$
3. $\text{Number of quantities} = \dfrac{\text{Sum of quantities}}{\text{Average}}$

Illustration 1 A man purchased 5 toys at the rate of ₹200 each, 6 toys at the rate of ₹250 each and 9 toys at the rate of ₹300 each. Calculate the average cost of one toy.

Solution: Price of 5 toys $= 200 \times 5 =$ ₹1000

Price of 6 toys $= 250 \times 6 =$ ₹1500

Price of 9 toys $= 300 \times 9 =$ ₹2700

Total number of toys $= 5 + 6 + 9 = 20$

$$\text{Average price of 1 toy} = \frac{1000 + 1500 + 2700}{20} = \frac{5200}{20} = ₹260$$

Illustration 2 The average marks obtained by 200 students in a certain examination is 45. Find the total marks.

Solution: Total marks

$= \text{Average marks} \times \text{Number of students}$

$= 200 \times 45 = 900$

Illustration 3 Total temperature for the month of September is 840°C. If the average temperature of that month is 28°C, find of how many days is the month of September.

Solution: Number of days in the month of September

$$= \frac{\text{Total temperature}}{\text{Average temperature}} = \frac{840}{28} = 30 \text{ days}$$

SOME USEFUL SHORT-CUT METHODS

1. Average of two or more groups taken together

   (*a*) If the number of quantities in two groups be n_1 and n_2 and their average is x and y, respectively, the combined average (average of all of them put together) is

$$\frac{n_1 x + n_2 y}{n_1 + n_2}$$

Explanation

No. of quantities in first group $= n_1$

Their average $= x$

$\therefore$ Sum $= n_1 \times x$

No. of quantities in second group $= n_2$

Their average $= y$

$\therefore$ Sum $= n_2 \times y$

No. of quantities in the combined group $= n_1 + n_2$

Total sum (sum of quantities of first group and second group)

$= n_1x + n_2y.$

$\therefore$ Average of the two groups

$$= \frac{n_1x + n_2y}{n_1 + n_2}$$

(*b*) If the average of n_1 quantities is x and the average of n_2 quantities out of them is y, the average of remaining group (rest of the quantities) is

$$\frac{n_1x - n_2y}{n_1 - n_2}.$$

Explanation

No. of quantities $= n_1$

Their average $= x$

$\therefore$ Sum $= n_1 x$

No. of quantities taken out $= n_2$

Their average $= y$

$\therefore$ Sum $= n_2y$

Sum of remaining quantities $= n_1x - n_2y$

No. of remaining quantities $= n_1 - n_2$

$\therefore$ Average of remaining group $= \dfrac{n_1x - n_2y}{n_1 - n_2}$

Illustration 4 The average weight of 24 students of section *A* of a class is 58 kg whereas the average weight of 26 students of section *B* of the same class is 60.5 kg. Find the average weight of all the 50 students of the class.

Solution: Here $n_1 = 24$, $n_2 = 26$, $x = 58$ and $y = 60.5$.

$\therefore$ Average weight of all the 50 students

$$= \frac{n_1x + n_2y}{n_1 + n_2}$$

$$= \frac{24 \times 58 + 26 \times 60.5}{24 + 26}$$

$$= \frac{1392 + 1573}{50} = \frac{2965}{50} = 59.3 \text{ kg}$$

Illustration 5 Average salary of all the 50 employees including 5 officers of a company is ₹850. If the average salary of the officers is ₹2500, find the average salary of the remaining staff of the company.

Solution: Here $n_1 = 50$, $n_2 = 5$, $x = 850$ and $y = 2500$

$\therefore$ Average salary of the remaining staff

$$= \frac{n_1x - n_2y}{n_1 - n_2} = \frac{50 \times 850 - 5 \times 2500}{50 - 5}$$

$$= \frac{42500 - 12500}{45} = \frac{30000}{45}$$

$= ₹667$ (approx.)

2. If $\bar{x}$ is the average of $x_1, x_2, ..., x_n$, then

(*a*) The average of $x_1 + a, x_2 + a, ..., x_n + a$ is $\bar{x} + a$.

(*b*) The average of $x_1 - a, x_2 - a, ... x_n - a$ is $\bar{x} - a$.

(*c*) The average of $ax_1, ax_2, ..., ax_n$ is $a\bar{x}$, provided $a \neq 0$.

(*d*) The average of $\frac{x_1}{a}, \frac{x_2}{a}, ..., \frac{x_n}{a}$ is $\frac{\bar{x}}{a}$, provided $a \neq 0$.

Illustration 6 The average value of six numbers 7, 12, 17, 24, 26 and 28 is 19. If 8 is added to each number, what will be the new average?

Solution: The new average $= \bar{x} + a$

$= 19 + 8 = 27$

Illustration 7 The average of x numbers is $5x$. If $x - 2$ is subtracted from each given number, what will be the new average?

Solution: The new average $\bar{x} = -a$

$= 5x - (x - 2) = 4x + 2$

Illustration 8 The average of 8 numbers is 21. If each of the numbers is multiplied by 8, find the average of a new set of numbers.

Solution: The average of a new set of numbers

$= a\bar{x} = 8 \times 21 = 168$

3. The average of n quantities is equal to x. If one of the given quantities whose value is p, is replaced by a new quantity having value q, the average becomes y, then $q = p + n(y - x)$

Illustration 9 The average weight of 25 persons is increased by 2 kg when one of them whose weight is 60 kg is replaced by a new person. What is the weight of the new person?

Solution: The weight of the new person

$$= p + n(y - x)$$
$$= 60 + 25(2) = 110 \text{ kg}$$

4. (*a*) The average of n quantities is equal to x. When a quantity is removed, the average becomes y. The value of the removed quantity is $n(x - y) + y$.

(*b*) The average of n quantities is equal to y. When a quantity is added, the average becomes y. The value of the new quantity is $n(y - x) + y$.

Illustration 10 The average age of 24 students and the lass teacher is 16 years. If the class teacher's age is excluded, the average age reduces by 1 year. What is the age of the class teacher?

Solution: The age of class teacher

$$= n(x - y) + y$$
$$= 25(16 - 15) + 15$$
$$= 40 \text{ years}$$

Illustration 11 The average age of 30 children in a class is 9 years. If the teacher's age be included, the average age becomes 10 years. Find the teacher's age.

Solution: The teacher's age

$$= n(y - x) + y$$
$$= 30(10 - 9) + 10$$
$$= 40 \text{ years}$$

5. (*a*) The average of first n natural numbers is $\frac{n+1}{2}$.

(*b*) The average of square of natural numbers till n is $\frac{(n+1)(2n+1)}{6}$.

(*c*) The average of cubes of natural numbers till n is $\frac{n(n+1)^2}{4}$.

(*d*) The average of odd numbers from 1 to n is $\frac{\text{last odd number} + 1}{2}$.

(*e*) The average of even numbers from 1 to n is $\frac{\text{last even number} + 2}{2}$.

Illustration 12 Find the average of first 81 natural numbers.

Solution: The required average

$$= \frac{n+1}{2} = \frac{81+1}{2} = 41.$$

Illustration 13 What is the average of squares of the natural numbers from 1 to 41?

Solution: The required average

$$= \frac{(n+1)(2n+1)}{6} = \frac{(41+1)(2\times 41+1)}{6} = \frac{42\times 83}{6}$$
$$= \frac{3486}{6} = 581.$$

Illustration 14 Find the average of cubes of natural numbers from 1 to 27.

Solution: The required average

$$= \frac{n(n+1)^2}{4} = \frac{27\times(27+1)^2}{4} = \frac{27\times 28\times 28}{4}$$
$$= \frac{21168}{4} = 5292$$

Illustration 15 What is the average of odd numbers from 1 to 40?

Solution: The required average

$$= \frac{\text{last odd number} + 1}{2} = \frac{39+1}{2} = 20$$

Illustration 16 What is the average of even numbers from 1 to 81?

Solution: The required average

$$= \frac{\text{last even number} + 2}{2} = \frac{80+2}{2} = 41$$

6. (*a*) If n is odd: The average of n consecutive numbers, consecutive even numbers or consecutive odd numbers is always the middle number.

(*b*) If n is even: The average of n consecutive numbers, consecutive even numbers or consecutive odd numbers is always the average of the middle two numbers.

(*c*) The average of first n consecutive even numbers is $(n + 1)$.

(*d*) The average of first n consecutive odd numbers is n.

(*e*) The average of squares of first n consecutive even numbers is $\frac{2(n+1)(2n+1)}{3}$.

(f) The average of squares of consecutive even numbers till n is $\frac{(n+1)(n+2)}{3}$.

(g) The average of squares of consecutive odd numbers till n is $\frac{n(n+2)}{3}$.

(h) If the average of n consecutive numbers is m, then the difference between the smallest and the largest number is $2(n-1)$.

Illustration 17 Find the average of 7 consecutive numbers 3, 4, 5, 6, 7, 8, 9.

Solution: The required average = middle number = 6

Illustration 18 Find the average of consecutive odd numbers 21, 23, 25, 27, 29, 31, 33, 35.

Solution: The required average

= average of middle two numbers

= average of 27 and 29

$$= \frac{27+29}{2} = 28$$

Illustration 19 Find the average of first 31 consecutive even numbers.

Solution: The required average = $(n+1) = 31 + 1 = 32$.

Illustration 20 Find the average of first 50 consecutive odd numbers.

Solution: The required average = $n = 50$.

Illustration 21 Find the average of squares of first 19 consecutive even numbers.

Solution: The required average

$$= \frac{2(n+1)(2n+1)}{3} = \frac{2(19+1)(2\times19+1)}{3}$$

$$= \frac{2\times20\times39}{3} = \frac{1560}{3} = 520.$$

Illustration 22 Find the average of squares of consecutive even numbers from 1 to 25.

Solution: The required average

$$= \frac{(n+1)(n+2)}{3} = \frac{(25+1)(25+2)}{3}$$

$$= \frac{26\times27}{3} = \frac{702}{3}$$

$$= 234$$

Illustration 23 Find the average of squares of consecutive odd numbers from 1 to 31.

Solution: The required average

$$= \frac{n(n+2)}{3} = \frac{31\times(31+2)}{3} = \frac{31\times33}{3} = 341$$

Illustration 24 If the average of 6 consecutive numbers is 48, what is the difference between the smallest and the largest number?

Solution: The required difference

$$= 2(n-1) = 2(6-1) = 10$$

7. Geometric mean or geometric average

Geometric mean of $x_1, x_2, ..., x_n$ is denoted by

$$\text{G.M.} = \sqrt[n]{x_1 \times x_2 \times ... \times x_n}$$

Geometric mean is useful in calculating averages of ratios such as average population growth rate, average percentage increase and so on.

Illustration 25 The production of a company for three successive years has increased by 10%, 20% and 40%, respectively. What is the average annual increase of production?

Solution: Geometric mean of x, y and $z = (x \times y \times z)^{1/3}$

$\therefore$ Average increase $= (10 \times 20 \times 40)^{1/3}\% = 20\%$

Illustration 26 The population of a city in two successive years increases at the rates of 16% and 4%, respectively. Find the average increase of two years.

Solution: In case of population increase, the geometric mean is required.

$\therefore$ Geometric mean of 16% and 4% is

$= (16 \times 4)^{1/2}$ %, i.e., 8%

8. Harmonic mean or harmonic average

Harmonic means of $x_1, x_2, ..., x_n$ is denoted by

$$\text{H.M.} = \frac{1}{\frac{1}{n}\left(\frac{1}{x_1} + \frac{1}{x_2} + ... + \frac{1}{x_n}\right)}$$

Harmonic mean is useful for finding out average speed of a vehicle, average production per day and so on.

Illustration 27 A man runs 1 Km at 15 Km per hour and another 1 Km he walks at 5 Km per hour. Find his average speed for the whole distance in covering 2 Km.

Solution: When the distance is constant and the speed varies, harmonic mean is used. Harmonic mean of x and y is $\frac{2}{\frac{1}{x}+\frac{1}{y}}$ or $\frac{2xy}{x+y}$.

$\therefore$ Average speed for the whole distance

$$= \frac{2\times15\times5}{15+5} = 7.5 \text{ Km/h}$$

9. If a certain distance is covered at a speed of x Km/h and the same distance is covered at a speed of y Km/h, the average speed during the entire journey is

$$\left(\frac{2xy}{x+y}\right)\text{Km/h}$$

Illustration 28 If half of the journey is travelled at a speed of 15 Km/h and the next half at a speed of 12 Km/h, find the average speed during the entire journey.

Solution: The average speed

$$= \left(\frac{2xy}{x+y}\right) = \left(\frac{2\times15\times12}{15+12}\right)$$

$$= \frac{360}{27} = \frac{1}{3}\,13 \text{ Km/h}$$

Illustration 29 A man goes to a certain place at a speed of 30 Km/h and returns to the original place at a speed of 20 Km/h, find the average speed during up and down journey.

Solution: The average speed

$$= \left(\frac{2xy}{x+y}\right) = \left(\frac{2\times30\times20}{30+20}\right) = \frac{1200}{50} = 24 \text{ Km/h}$$

10. If a person or a motor car covers three equal distances at the speed of x Km/h, y Km/h and z Km/h, respectively, then for the entire journey average speed of the person or motor car is $\left(\frac{3xzy}{xy+yz+zx}\right)$Km/h.

Illustration 30 A train covers the first 160 Kms at a speed of 120 Km/h, another 160 Kms at 140 Km/h and the last 160 Kms at 80 Km/h. Find the average speed of the train for the entire journey.

Solution: Average speed

$$= \frac{3xyz}{xy+yz+zx} = \frac{3\times120\times140\times80}{120\times140+140\times80+80\times120}$$

$$= \frac{360\times140\times80}{16800+11200+9600}$$

$$= \frac{4032000}{37600} = 107\frac{11}{47} \text{ Km/h}$$

11. If a person covers A Km at a speed of x Km/h, B Km at a speed of y Km/h and C Km at a speed of z Km/h, the average speed during the entire journey is

$$\left(\frac{A+B+C}{\frac{A}{x}+\frac{B}{y}+\frac{C}{z}}\right)\text{Km/h.}$$

Illustration 31 A person covers 9 Km at a speed of 3 Km/h, 25 Km at a speed of 5 Km/h and 30 Km at a speed of 10 Km/h. Find the average speed for the entire journey.

Solution: The average speed $= \left(\frac{A+B+C}{\frac{A}{x}+\frac{B}{y}+\frac{C}{z}}\right)$

$$= \left(\frac{9+25+30}{\frac{9}{3}+\frac{25}{5}+\frac{30}{10}}\right)$$

$$= \frac{64}{11} = 5\frac{9}{11} \text{ Km/h.}$$

12. If a person covers Ath part of the distance at x Km/h, Bth part of the distance at y Km/h and the remaining Cth part at z Km/h, then the average speed during the entire journey is

$$\left(\frac{1}{\frac{A}{x}+\frac{B}{y}+\frac{C}{z}}\right)\text{Km/h.}$$

Illustration 32 A person covers the first one-forth of the distance at 8 Km/h, the next three-fifths at 6 Km/h and the remaining distance at 15 Km/h. Find the average speed during the entire journey.

Solution: The average speed

$$= \frac{1}{\left(\frac{A}{x}+\frac{B}{y}+\frac{C}{z}\right)} = \left(\frac{1}{\frac{1/4}{8}+\frac{3/5}{6}+\frac{3/20}{15}}\right)$$

$$\left[\text{Here, } A=\frac{1}{4},\ B=\frac{3}{5} \text{ and } C=1-\left(\frac{1}{4}+\frac{3}{5}\right)=\frac{3}{20}\right]$$

$$= \frac{1}{\frac{1}{32}+\frac{1}{10}+\frac{1}{100}} = \frac{3200}{452} = 7\frac{9}{113} \text{ Km/h}$$

Illustration 33 A train covers 50% of the journey at 30 Km/h, 25% of the journey at 25 Km/h and the remaining at 20 Km/h. Find the average speed of the train during the entire journey.

Solution: The average speed

$$= \left(\frac{100}{\frac{A}{x}+\frac{B}{y}+\frac{C}{z}}\right) = \left(\frac{100}{\frac{50}{30}+\frac{25}{25}+\frac{25}{20}}\right)$$

[Here $A = 50$, $B = 25$ and $C = 25$]

$$= \frac{100}{47/12} = \frac{1200}{47} = 25\frac{25}{47} \text{ Km/h}$$

Practice Exercises

Difficulty Level-1 (Based on Memory)

1. The average of 11 numbers is 10.9. If the average of the first six numbers is 10.5 and that of the last six numbers is 11.4, then the middle number is:

(*a*) 11.5 (*b*) 11.4
(*c*) 11.3 (*d*) 11.0

[Based on MAT, 2003]

2. A car owner buys petrol at ₹7.50, ₹8.00 and ₹8.50 per litre for three successive years. What approximately is the average cost per litre of petrol if he spends ₹4000 each year?

(*a*) ₹8 (*b*) ₹9
(*c*) ₹7.98 (*d*) ₹8.50

[Based on MAT, 2001]

3. There are 197 boys and 591 girls in a college. If the average weight of boys is 63 kg and average weight of girls is 51 kg, then what is the average weight of the students in the college?

(*a*) 56 kg (*b*) 57 kg
(*c*) 54 kg (*d*) 60 kg

[Based on IIT Joint Man. Ent. Test, 2004]

4. A student on his birthday distributed on an average 5 chocolates per student. If on the arrival of the teacher and the headmaster to whom the student gives 10 and 15 chocolates respectively, the average chocolate distributed per head increases to 5.5, then what is the strength of the class?

(*a*) 28 (*b*) 30
(*c*) 32 (*d*) None of these

[Based on IIT Joint Man. Ent. Test, 2004]

5. If the mean of a, b, c is M and $ab + bc + ca = 0$, then the mean of a^2, b^2, c^2 is:

(*a*) M^2 (*b*) $3M^2$
(*c*) $6M^2$ (*d*) $9M^2$

[Based on IITTM, Gwalior, 2003]

6. A is the set of first ten consecutive natural numbers. Find the number of ways in which a subset B can be formed out of set A, such that the sum of all the elements in B is odd.

(*a*) 761 (*b*) 763
(*c*) 765 (*d*) 767

7. Three years ago, the average age of A and B was 18 years. With C joining them, the average age becomes 22 years. How old is C now?

(*a*) 24 years (*b*) 27 years
(*c*) 28 years (*d*) 30 years

[Based on FMS (Delhi), 2003]

8. The average of three numbers is 135. The largest number is 180 and the difference of the other numbers is 25. The smallest number is:

(*a*) 130 (*b*) 125
(*c*) 120 (*d*) 100

[Based on IIFT, 2003]

9. The ratio of the arithmetic mean of two numbers to one of the numbers is 3:5. What is the ratio of the smaller number to the larger one?

(*a*) 1:5 (*b*) 1:4
(*c*) 1:3 (*d*) 1:2

[Based on IIFT, 2003]

10. A person travels from X to Y at a speed of 40 Km/h and returns by increasing his speed by 50% What is his average speed for both the trips?

(*a*) 36 Km/h (*b*) 45 Km/h
(*c*) 48 Km/h (*d*) 50 Km/h

[Based on IIFT, 2003]

11. The average of 5 consecutive numbers is n. If the next two numbers are also included,. the average will:

(*a*) Increase by 1 (*b*) Remain the same
(*c*) Increase by 1.4 (*d*) Increase by 2

[Based on MAT, 2005]

12. For 10 hrs, a train travels at a constant speed of 20 miles per hour and during the next 15 hrs, it travels 240 miles. What is the average speed of the train for the whole journey?

(*a*) 17.6 miles/hr (*b*) 20.8 miles/hr
(*c*) 130 miles/hr (*d*) 176 miles/hr

[Based on IMT Ghaziabad, 2002]

13. Average of 10 positive numbers is $\bar{X}$. If each number increases by 10%, then $\bar{X}$:

(*a*) Remains unchanged
(*b*) Is increased by 10%
(*c*) May decrease
(*d*) May either increase or decrease

[Based on IMT Ghaziabad, 2002]

14. On an 800 miles trip, car W travelled half the distance at 80 miles per hour and the other half at 100 miles per hour. What was the average speed of the car?

(*a*) 18.00 (*b*) 180.00
(*c*) 90.00 (*d*) $88\frac{8}{9}$

[Based on Narsee Monjee Inst. of Man. Studies, 2002]

15. Having scored 98 runs in the 19th innings, a cricketer increases his average score by 4. What will be his average score after the 19th innings?

(*a*) 28 (*b*) 26

(*c*) 24 (*d*) 22

[Based on I.P. Univ., 2002]

16. Angad was conducting an experiment in which the average of 11 observations came to be 90, while the average of first five observations was 87, and that of the last five was 84. What was the measure of the 6th observation?

(*a*) 165 (*b*) 150

(*c*) 145 (*d*) 135

[Based on I.P. Univ., 2002]

17. A student who scored 30% marks in the first paper of Physics out of 180 marks, has to get an overall score of at least 50% in two papers, the second paper carrying 150 marks. What percentage of marks should he score in the second paper to get the overall average score?

(*a*) 80% (*b*) 76%

(*c*) 74% (*d*) 70%

[Based on I.P. Univ., 2002]

18. The captain of a cricket team of 11 players is 25 years old and the wicket keeper is 3 years elder to the captain. If the ages of these two are excluded, the average age of the remaining players is 1 year less than the average age of the whole team. What is the average age of the whole team?

(*a*) 21.5 years (*b*) 22 years

(*c*) 22.5 years (*d*) 32 years

19. A batsman has a certain average of runs for 12 innings. In the 13th innings he scores 96 runs, thereby increasing his average by 5 runs. What is his average after the 13th innings?

(*a*) 64 (*b*) 48

(*c*) 36 (*d*) 72

[Based on I.P. Univ., 2002]

20. Average of n numbers is 36 where n is a multiple of 4. If three-fourth of the numbers are increased by 4 and the remaining decreased by 4, what is the new average?

(*a*) 40 (*b*) 37.5

(*c*) 38 (*d*) None of these

21. The average age of a group of 14 persons is 27 years and 9 months. Two persons, each 42 years old, left the group. What will be the average age of the remaining persons in the group?

(*a*) 26.875 years (*b*) 26.25 years

(*c*) 25.375 years (*d*) 25 years

22. The average income of A, B and C is ₹12,000 per month and the average income of B, C and D is ₹15,000 per month. If the average salary of D be twice that of A, then the average salary of B and C is (in ₹)

(*a*) 8,000 (*b*) 18,000

(*c*) 13,500 (*d*) 9,000

23. While calculating the average of a batsman as 36 in 100 matches that he played, one of the score 90 was incorrectly noted as 40. The percentage error is:

(*a*) 0.6% (*b*) 1.36%

(*c*) 1.34% (*d*) 1.21%

[Based on MAT (Sept), 2010]

24. The average sale of a car dealership was 15 cars per week. After a promotional scheme, the average sale increased to 21 cars per week. The percentage increase in the sale of cars was:

(*a*) 40% (*b*) 140%

(*c*) $42\frac{6}{7}\%$ (*d*) 39.33%

[Based on MAT (Feb), 2010]

25. In a class with a certain number of students, if one new student weighing 50 kg is added, then the average weight of the class increased by 1 kg. If one more student weighing 50 kg is added, then the average weight of the class increases by 1.5 kg over the original average. What is the original weight (in kg) of the class?

(*a*) 46 (*b*) 42

(*c*) 27 (*d*) 47

[Based on MAT (Sept), 2009]

26. The average marks of a student in 8 subjects is 87. Of these, the highest marks is 2 more than the one next in value. If these two subjects are eliminated, the average marks of the remaining subjects is 85. What is the highest marks obtained by him?

(*a*) 94 (*b*) 91

(*c*) 89 (*d*) 96

[Based on MAT (Sept), 2009]

27. The average of 5 consecutive odd numbers A, B, C, D and E is 41. What is the product of A and E?

(*a*) 1677 (*b*) 1517

(*c*) 1665 (*d*) 1591

[Based on MAT (May), 2009]

28. The average age of a woman and her daughter is 42 year. The ratio of their ages is 2:1 respectively. What is the daughter's age?

(*a*) 28 years (*b*) 48 years

(*c*) 52 years (*d*) 32 years

[Based on MAT (May), 2009]

29. The average weight of 29 students in a class is 48 kg. If the weight of the teacher is included, the average weight rises by 500 g. Find the weight of the teacher.

(*a*) 57 kg (*b*) 60 kg

(*c*) 65 kg (*d*) 63 kg

[Based on MAT (Feb), 2009]

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

(*a*) 100 (*b*) 110

(*c*) 120 (*d*) 150

[Based on MAT (May), 2008]

31. The mean of five observations is 4 and their variance 5.2. If three of these observations are 1, 2 and 6, then the other two are:

(*a*) 2 and 9 (*b*) 3 and 8

(*c*) 4 and 7 (*d*) 5 and 6

[Based on MAT (Feb), 2008, (Sept), 2007]

32. The average of 11 results in 50. If the average of first six results is 49 and that of last six 52, the sixth result is:

(*a*) 60 (*b*) 56

(*c*) 64 (*d*) 70

[Based on MAT (Feb), 2008]

33. The average temperature from Monday to Thursday is 48° and from Tuesday to Friday is 52°. If the temperature on Monday is 42°, what was it on Friday?

(*a*) 55° (*b*) 52°

(*c*) 58° (*d*) 51°

[Based on MAT (Feb), 2008]

34. An investor earns 3% returns on one-fourth of his capital, 5% on two-thirds and 11% on the remainder. What is the average rate of return he earns on his total capital?

(*a*) 10% (*b*) 5%

(*c*) 5.5% (*d*) 10.5%

[Based on MAT (Feb), 2008]

35. A batsman has a certain average of runs for 12 innings. In the 13th inning, he scores 96 runs thereby increasing his average by 5 runs. What is his average after the 13th innings?

(*a*) 64 (*b*) 48

(*c*) 36 (*d*) 72

[Based on MAT (Feb), 2008]

36. There was one mess for 30 boarders in a certain hostel. If the number of boarders was increased by 10, the expenses of the mess increased by ₹40 per month, while the average expenditure per head diminished by ₹2. Find the original monthly expenses.

(*a*) ₹390 (*b*) ₹360

(*c*) ₹410 (*d*) ₹480

[Based on MAT (Dec), 2007]

37. The mean of 25 observations was found to be 78.4. But later on it was found that 96 was misread as 69. The correct mean is:

(*a*) 79.48 (*b*) 76.54

(*c*) 81.32 (*d*) 78.4

[Based on MAT (Sept), 2007]

38. The average age of a family of 6 members is 22 years. If the age of the youngest member be 7 years, what was the average age of the family at the birth of the youngest members?

(*a*) 15 (*b*) 18

(*c*) 21 (*d*) 22

39. The average score of boys in an examination in a school is 71 and that of the girls is 73. The average score of the school is 71.8. The ratio of the number of boys to that of the girls that appeared in the examination is:

(*a*) 1:2 (*b*) 3:2

(*c*) 2:3 (*d*) 4:2

[Based on MAT (May), 2006]

40. The mean monthly salary paid to 75 workers in a factory is ₹5680. The mean salary of 25 of them is ₹5400 and that of 30 others is ₹5700. The mean salary of the remaining workers is:

(*a*) ₹5000 (*b*) ₹7000

(*c*) ₹6000 (*d*) ₹8000

[Based on MAT (May), 2006]

41. The average monthly expenditure of a family was ₹2200 during the first 3 months; ₹2250 during the next 4 months and ₹3120 during the last 5 months of a year. If the total savings during the year were ₹1260, then the average monthly income was:

(*a*) ₹2605 (*b*) ₹2805

(*c*) ₹2705 (*d*) ₹2905

[Based on MAT (May), 2006]

42. Ram spends ₹3620 for buying pants at the rate of ₹480 each and shirts at the rate of ₹130 each. What will be the ratio of pants to shirts when maximum number of pants are to be bought?

(*a*) 7:2 (*b*) 7:3

(*c*) 2:7 (*d*) None of these

[Based on MAT, 1999]

43. The average weight of 45 students in a class is 52 kg. 5 of them whose average weight is 48 kg leave the class and other 5 students whose average weight is 54 kg join the class. What is the new average weight (in kg) of the class?

(*a*) 52.6 (*b*) $52\frac{2}{3}$

(*c*) $52\frac{1}{3}$ (*d*) None of these

[Based on MAT, 1999]

44. Of the three numbers, the first is twice the second and the second is twice the third. The average of these three numbers is 21. Find the largest number.

(*a*) 36 (*b*) 38

(*c*) 47 (*d*) 48

[Based on MAT, 1999]

45. The average of three numbers is 135. The largest number is 180 and the difference of the others is 25. The smallest number is x:

(a) 130 (b) 125

(c) 120 (d) 100

[Based on MAT, 1999]

46. 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. His highest score was:

(a) 172 (b) 173

(c) 174 (d) 176

[Based on MAT, 1999]

47. Nine persons went to a hotel for taking their meals. Eight of them spent ₹12 each over their meals and the ninth spent ₹8 more than the average expenditure of all the nine. Total money spent by them was:

(a) ₹104 (b) ₹105

(c) ₹116 (d) ₹117

[Based on MAT, 1999]

48. Out of three numbers, the first is twice the second and is half of the third. If the average of the three numbers is 56, the three numbers in order are:

(a) 48, 96, 24 (b) 48, 24, 96

(c) 96, 24, 48 (d) 96, 48, 24

[Based on MAT, 2000]

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

(a) $5(a+4)$ (b) $abcde/5$

(c) $5(a+b+c+d+e)$ (d) None of these

[Based on MAT, 2000]

50. The average 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.

[Based on MAT, 2000]

51. In a mathematics exam, a student scored 30% marks in the first paper out of a total of 180. How much should he score in the second paper out of a total of 150, if he is to get an overall average of at least 50%?

(a) 74% (b) 76%

(c) 70% (d) 80%

[Based on MAT, 2000]

52. The average of nine numbers is M and the average of three of these is P. If the average of remaining numbers is N, then:

(a) $M = N + P$ (b) $2M = N + P$

(c) $3M = 2N + P$ (d) $3M = 2P + N$

[Based on SNAP, 2007]

53. If the algebraic sum of deviations of 20 observations measured from 23 is 70, mean of these observations would be:

(a) 24 (b) 25

(c) 26 (d) None of these

[Based on SNAP, 2010]

54. A cricketer has completed 20 innings and his average is 44.5 runs. How many runs must be make in his next innings so as to raise his average to 45?

(a) 45 (b) 60

(c) 40 (d) 55

55. The average of 6 numbers is 30. If the average of first four is 25 and that of the last three is 35, the fourth number is:

(a) 35 (b) 30

(c) 25 (d) 20

[Based on FMS, 2006]

56. The average marks of the students in four sections A, B, C, and D of a school is 60% The average marks of the students of the A, B, C and D individually are 45%, 50%, 72%, and 80%, respectively. If the average marks of the students of sections A and B together is 48% and that of the students of B and C together is 60%, What is the ratio of the number of students in sections A and D?

(a) 2:3 (b) 4:3

(c) 5:3 (d) 3:5

[Based on MAT, 2012]

57. The average monthly salary of employees, consisting of officers and workers, of an organization is ₹3000. The average salary of an officer is ₹10000 while that of a worker is ₹2000 per month. If there are a total 400 employees in the organisation, find the number of officers.

(a) 50 (b) 60

(c) 80 (d) 40

[Based on MAT, 2012]

58. The average marks of a student in 8 subjects is 87. Of these, the highest marks are 2 more than the next in value. If these two subjects are eliminated, the average marks of the remaining subjects is 85. What is the highest score?

(a) 91 (b) 94

(c) 89 (d) 96

[Based on MAT, 2012]

59. The average monthly salary of employees, consisting of officers and workers, of an organization is ₹3000. The average salary of an officer is ₹10000 while that of a worker is ₹2000 per month. If there are a total 400 employees in the organisation, find the number of officers.

(a) 50 (b) 60

(c) 80 (d) 40

[Based on MAT, 2012]

60. The average marks of a student in 8 subjects is 87. Of these, the highest marks are 2 more than the next in value. If these two subjects are eliminated, the average marks of the remaining subjects is 85. What is the highest score?

(*a*) 91 (*b*) 94

(*c*) 89 (*d*) 96

[Based on MAT, 2012]

61. The average age of all the students of a class is 18 yr. The average age of boys of the class is 20 yr and that of the girls is 15 yr. If the number of girls in the class is 20, then what is the number of boys in the class?

(*a*) 30 (*b*) 15

(*c*) 45 (*d*) 50

[Based on MAT, 2013]

62. Average of five numbers is 61. If the average of first and third number is 69 and the average of second and fourth number is 69, what is the fifth number?

(*a*) 31 (*b*) 29

(*c*) 25 (*d*) 35

[Based on SNAP, 2013]

63. Average weight of 19 men is 74 kg, and the average weight of 38 women is 63 kgs. What is the average weight (rounded off to the nearest integer) of all the men and the women together?

(*a*) 59 kg (*b*) 65 kg

(*c*) 69 kg (*d*) 67 kg

[Based on SNAP, 2013]

64. The average marks in English subject of a class of 24 students is 56. If the marks of three students were misread as 44, 45 and 61 of the actual marks 48, 59 and 67 respectively, then what would be the correct average?

(*a*) 56.5 (*b*) 59

(*c*) 57.5 (*d*) None of these

[Based on SNAP, 2013]

Difficulty Level-2 (Based on Memory)

1. An officer's penson on retirement from service is equal to half the average salary during last 36 months of his service. His salary from 1 January, 1954 is ₹380 per month with increment of ₹40 on 1 October, 1954, 1 October, 1955 and 1 October, 1956. If he retires on 1 January, 1957, what pension does he draw?

(*a*) ₹210 (*b*) ₹215

(*c*) ₹220 (*d*) ₹225

2. A hiker walked for two days. On the second day, the hiker walked 2 hrs longer and at an average speed of 1 Km per hour faster than he walked on the first day. If during the two days he walked a total of 64 Km and spent a total of 18 hrs walking, what was his average speed on the first day?

(*a*) 2 Km/h (*b*) 3 Km/h

(*c*) 4 Km/h (*d*) 5 Km/h

3. In a class of 100 students the average marks obtained by a student in Maths is 44. If we remove the highest and the lowest the average of the class becomes 43.92. A total of three students get either highest or lowest. What is the average of these three students?

(*a*) 73.33 (*b*) 46.66

(*c*) 59.99 (*d*) Cannot be determined

4. Neeta's attendance for first two semesters out of four was 60% and 70%, respectively. What is the minimum attendance required in third semester so that her average attendance will be 80% throughout four semesters? (Assume equal number of days among the four semesters)

(*a*) 70% (*b*) 80%

(*c*) 90% (*d*) None of these

5. In a one-day cricket match, Agarkar, Sehwag, Sachin, Dravid and Ganguly scored an average of 39 runs. Dravid scored 7 more than Ganguly. Ganguly scored 9 fewer than Agarkar. Sehwag scored as many as Dravid and Ganguly combined; and Sehwag and Sachin scored 110 runs between them. How many runs did Sachin score?

(*a*) 47 (*b*) 51

(*c*) 53 (*d*) None of the above

[Based on FMS (Delhi), 2004]

6. There is a sequence of 11 consecutive odd numbers. If the average of first 7 numbers is X, then find the average of all the 11 integers.

(*a*) $X+3$ (*b*) $X+4$

(*c*) $X+5$ (*d*) $X+7$

[Based on FMS (Delhi), 2004]

7. The average temperature of the town in the first four days of a month was 58 degrees. The average for the second, third, fourth and fifth days was 60 degrees. If the temperatures of the first and fifth days were in the ratio 7:8, then what is the temperature on the fifth day?

(*a*) 240 degrees (*b*) 232 degrees

(*c*) 64 degrees (*d*) None of these

[Based on Narsee Manjee Inst. of Man. Studies, 2003]

8. An aeroplane flies along the four sides of a square field at the speeds of 200, 400, 600 and 800 Km/h. The average speed of the plane around the field in Km/h is:

(*a*) 384 (*b*) 400

(*c*) 500 (*d*) 284

[Based on FMS (Delhi), 2003]

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

(*a*) 100 (*b*) 110

(*c*) 120 (*d*) 150

[Based on FMS (Delhi), 2003]

10. A painter is paid x rupees for painting every 10 metres of a wall and y rupees for painting every extra metre. During one week, he painted 10 metres on Monday, 13 metres on Tuesday, 12 metres on Wednesday, 11 metres on Thursday and 12 metres on Friday. What is his average daily earning in rupees for the five day week?

(*a*) $x + (8/5)\,y$ (*b*) $(5x + 9y)/5$

(*c*) $10x + (8/5)y$ (*d*) $5x + 8y$

[Based on SCMHRD Ent. Exam., 2003]

11. There were 35 students in a hostel. If the number of students increases by 7, the expenses of mess increase by ₹42 per day while the average expenditure per head diminshes by Re 1. Find the original expenditure of the mess.

(*a*) ₹320 (*b*) ₹420

(*c*) ₹160 (*d*) ₹158

12. Manmohan calculated the average of 10, 'three digit numbers'. But due to mistake he reversed the digits of a number and thus his average increased by 19.8. The difference between the unit digit and hundreds digit of that number is:

(*a*) 8 (*b*) 4

(*c*) 2 (*d*) Cannot be determined

13. The average age of a husband and wife was 23 when they were married 5 years ago. The average age of the husband, the wife and a child who was born during the interval, is 20 years now. How old is the child now?

(*a*) 9 months (*b*) 1 year

(*c*) 3 years (*d*) 4 years

14. There are twice the number of two wheelers as there are three wheelers and the number of 4 wheelers are equal to the number of two wheelers. The average number of wheels per vehicle is:

(*a*) 3 (*b*) 4

(*c*) 5 (*d*) None of these

15. If p, q, r be three positive numbers such that $p > q > r$ when the smallest number is added to the difference of the rest two numbers, then the average of the resultant number and the original numbers except to the smallest number is 21 more than the average of all the three original numbers. The value of $(p - q)$ is:

(*a*) 7 (*b*) 14

(*c*) 63 (*d*) 42

16. The average marks of a students in 10 papers are 80. If the highest and the lowest scores are not considered, the average is 81. If the highest score is 92, find the lowest?

(*a*) 55 (*b*) 60

(*c*) 62 (*d*) Cannot be determined

17. The average age of Sachin and Ganguly is 35 years. If Kaif replaces Sachin, the average age becomes 32 years and if Kaif replaces Ganguly, then the average age becomes 38 years. If the average age of Dhoni and Irfan be half of the average age of Sachin, Ganguly and Kaif, then the average age of all the five people is:

(*a*) 28 years (*b*) 32 years

(*c*) 25 years (*d*) None of these

18. The average of any 5 consecutive odd natural numbers is k. If two more such numbers, just next to the previous 5 numbers are added, the new average becomes:

(*a*) $\frac{2}{7}(k+1)$ (*b*) $2k - 3$

(*c*) $2k + 1$ (*d*) $k + 2$

19. The average age of A and B is 20 years. If C were to replace A, the average would be 19 and if C were to replace B, the average would be 21. What are the ages of A, B and C?

(*a*) 22, 18, 20 (*b*) 18, 19, 20

(*c*) 22, 20, 17 (*d*) Cannot be determined

20. Given the set of n numbers, $n > 1$, of which one is $1 - (1/n)$, and all the others are 1. The arithmetic mean of the n numbers is:

(*a*) 1 (*b*) $n - \frac{1}{n}$

(*c*) $n - \frac{1}{n^2}$ (*d*) $1 - \frac{1}{n^2}$

[Based on FMS, 2010]

21. In a B-School, there are three levels of faculty positions, i.e., Professor, Associate Professor and Assistant Professor. It is found that the sum of the ages of all faculty present is 2160, their average age is 36; the average age of the Professor and Associate Professor is 39; of the Associate Professor and Assistant Professor is $32\frac{8}{11}$; of the Professor and Assistant Professor is $36\frac{2}{3}$. Had each Professor been 1 year older, each Associate Professor 6 year older and each Assistant Professor 7 year older, then their average age would increase by 5 years. What will be the number of faculty at each level and their average ages?

(*a*) (16, 24, 20:45, 35, 30 year)

(*b*) (18, 24, 20:42, 38, 30 year)

(*c*) (16, 20, 24:50, 30, 30 year)

(*d*) None of these

[Based on IIFT, 2010]

22. a, b, c, d and e be non-negative real numbers such that $a + b + c + d + e = 10$. Let, X be the maximum of the numbers

$a+b$, $b+c$, $c+d$ and $d+e$. The least possible value of X lies in the 'interval':

(*a*) [0, 2] (*b*) [2, 3]
(*c*) [3, 4] (*d*) [4, 5]

[Based on XAT, 2007]

23. Professor *Bee* noticed something peculiar while entering the quiz marks of his five students into a spreadsheet. The spreadsheet was programmed to calculate the average after each score was entered. Professor *Bee* entered the marks in a random order and noticed that after each mark was entered, the average was always an integer. In ascending order, the marks of the students were 71, 76, 80, 82 and 91. What were the fourth and fifth marks that Professor *Bee* entered?

(*a*) 71 and 82 (*b*) 71 and 76
(*c*) 71 and 80 (*d*) 76 and 80

[Based on XAT, 2011]

24. 'Mr. Haque's total annual gross salary, which was ₹10 lakhs per year in 2007, has been reduced by 10% in 2008. In 2007 his family expenditure for food items was 40% of the total annual gross salary. The prices of average food items have increased by 5% between 2007 and 2008. Assuming that the family consumed the same amount of food in 2008, the percentage expenditure on food items, calculated on total annual gross salary in 2008, is approximately:

(*a*) 43% (*b*) 45%
(*c*) 47% (*d*) 49%

[Based on JMET, 2009]

25. Consider a sequence of seven consecutive integers. The average of the first five integers is n. The average of all the seven integers is:

(*a*) n
(*b*) $n+1$
(*c*) $k \times n$, where k is a function of n
(*d*) $n+\left(\frac{2}{7}\right)$

[Based on CAT, 2000]

26. Let $x < 0$ 50, $0 < y < 1$, $z > 1$. Given a set of numbers, the middle number, when they are arranged in ascending order, is called the median. So the median of the numbers x, y and z would be:

(*a*) Less than one (*b*) Between 0 and 1
(*c*) Greater than one (*d*) Cannot say

[Based on CAT, 1993]

Answer Keys

Difficulty Level-1

1. (*a*)	**2.** (*c*)	**3.** (*c*)	**4.** (*a*)	**5.** (*b*)	**6.** (*b*)	**7.** (*a*)	**8.** (*d*)	**9.** (*a*)	**10.** (*c*)	**11.** (*a*)	**12.** (*a*)	**13.** (*b*)
14. (*d*)	**15.** (*b*)	**16.** (*d*)	**17.** (*c*)	**18.** (*b*)	**19.** (*c*)	**20.** (*c*)	**21.** (*c*)	**22.** (*c*)	**23.** (*b*)	**24.** (*a*)	**25.** (*d*)	**26.** (*a*)
27. (*a*)	**28.** (*a*)	**29.** (*d*)	**30.** (*a*)	**31.** (*c*)	**32.** (*b*)	**33.** (*c*)	**34.** (*b*)	**35.** (*c*)	**36.** (*b*)	**37.** (*a*)	**38.** (*b*)	**39.** (*b*)
40. (*c*)	**41.** (*c*)	**42.** (*a*)	**43.** (*b*)	**44.** (*a*)	**45.** (*d*)	**46.** (*c*)	**47.** (*d*)	**48.** (*b*)	**49.** (*d*)	**50.** (*c*)	**51.** (*a*)	**52.** (*c*)
53. (*d*)	**54.** (*d*)	**55.** (*c*)	**56.** (*b*)	**57.** (*a*)	**58.** (*b*)	**59.** (*a*)	**60.** (*b*)	**61.** (*a*)	**62.** (*b*)	**63.** (*d*)	**64.** (*d*)	

Difficulty Level-2

1. (*b*)	**2.** (*b*)	**3.** (*b*)	**4.** (*c*)	**5.** (*d*)	**6.** (*b*)	**7.** (*c*)	**8.** (*a*)	**9.** (*a*)	**10.** (*a*)	**11.** (*b*)	**12.** (*c*)	**13.** (*d*)
14. (*a*)	**15.** (*c*)	**16.** (*b*)	**17.** (*a*)	**18.** (*d*)	**19.** (*a*)	**20.** (*d*)	**21.** (*a*)	**22.** (*a*)	**23.** (*c*)	**24.** (*c*)	**25.** (*b*)	**26.** (*b*)

Explanatory Answers

Difficulty Level-1

1. (*a*) $6 \times 10.5 + 6 \times 11.4 - 11 \times 10.9$
$= 63 + 68.4 - 119.9$
$= 131.4 - 119.9 = 11.5.$

2. (*c*) Let average cost of petrol per litre be ₹x.

$$\therefore \quad x = \frac{12000}{\frac{4000}{7.50} + \frac{4000}{8} + \frac{4000}{8.50}} = 7.98.$$

3. (*c*) $$\frac{197 \times 63 + 591 \times 51}{197 + 591} = \frac{197 \times 63 + 591 \times 51}{788}$$

$$= \frac{63}{4} + \frac{3}{4} \times 51 = \frac{63 + 153}{4} = \frac{216}{4}$$

$= 54$ kg.

4. (*a*) Suppose strength of the class $= x$

$\therefore \quad 5x + 10 + 15 = 5.5\,(x + 2)$

$\Rightarrow \qquad 0.5x = 14 \Rightarrow x = 28.$

5. (*b*) $a + b + c = 3M$

$(a + b + c)^2 = a^2 + b^2 + c^2 + 2\,(ab + bc + ca)$
$= a^2 + b^2 + c^2$

$\Rightarrow a^2 + b^2 + c^2 = (3M)^2 = 9M^2$

$\Rightarrow$ Mean of a^2, b^2 and $c^2 = \frac{9M^2}{3} = 3M^2.$

6. (*b*) The given sets are formed by taking 1, 3, 5, ... odd numbers starting from the second odd number onwards (i.e., 3 onwards), in the successive sets. So, there are $(2n - 1)$ successive odd numbers in A_n

$\therefore$ Total number of odd numbers in all the sets from A_1 to A_n (both inclusive)

$$= \sum_{1}^{n}(2i - 1) = 2\sum_{1}^{n} i - \sum_{1}^{n} 1$$

$$= n(n + 1) - n = n^2$$

$\therefore$ The number of odd numbers in all the sets from A_1 to A_{20} is $= 400$(starting from 3). Therefore, the 400th odd number (starting from 3) is $2(400) + 1 = 801$. This is the last number in A_{20}

Similarly, the last odd number in A_{19} is the 361^{st} odd number starting from $3 = (361)\,(2) + 1 = 723$

$\therefore$ The first odd number in A_{20} is 725

$\therefore$ The average of the numbers of

$$A_{20} = \frac{725 + 801}{2} = 763.$$

7. (*a*) $(A - 3) + (B - 3) = 36 \Rightarrow A + B = 42$
Also $A + B + C = 66 \Rightarrow C = 24.$

8. (*d*) Let the three numbers be X, Y and Z.

$$\therefore \quad \frac{X + Y + Z}{3} = 135 \Rightarrow X + Y + Z = 405$$

Let X be the largest number

$\therefore \qquad X = 180 \Rightarrow Y + Z = 225$

$Y - Z = 25$

$\therefore \qquad Y = 125,$

$Z = 100$ (smallest number).

9. (*a*) Let X and Y be the two numbers

$$\therefore \quad \frac{\frac{X + Y}{2}}{X} = \frac{3}{5}$$

$$\Rightarrow \quad \frac{X + Y}{2X} = \frac{3}{5}$$

$$\Rightarrow \quad 5X + 5Y = 6X \Rightarrow X = 5Y$$

$$\Rightarrow \quad \frac{X}{Y} = \frac{1}{5}.$$

10. (*c*) Let the distance between X and Y be x Km.

$\therefore$ Time taken from X to Y @ 40 Km/h $= \frac{x}{40}$ hrs

Time taken from Y to X @ 60 Km/h $= \frac{x}{60}$ hrs

$$\therefore \text{ Average speed} = \frac{2x}{\frac{x}{40} + \frac{x}{60}} = 48 \text{ Km/h}.$$

11. (*a*) Let the consecutive numbers be $x, x + 1, x + 2, x + 3, x + 4$

$$\text{Average} = \frac{5x + 10}{5} = x + 2$$

$$\text{Average of 7 numbers} = \frac{5x + 10 + x + 5 + x + 6}{7}$$

$$= \frac{7x + 21}{7} = x + 3$$

$\therefore$ The average increased by 1.

12. (*a*) $$\frac{20 \times 10 + 240}{25} = \frac{200 + 240}{25} = \frac{440}{25}$$

$= 17.6$ miles/hr.

13. (*b*)

14. (*d*) The distance of 800 miles was covered in $5 + 4 = 9$ hrs.

$\therefore$ Average speed of $W = \frac{800}{9} = 88\frac{8}{9}$ miles per hour.

15. (*b*) Let the average score of the 1st 18 innings be x

$\therefore \quad 18x + 98 = 19(x + 4)$

$\Rightarrow \quad x = 22$

Average score after 19th innings $= x + 4 = 26$.

16. (*d*) $11 \times 90 - 5 \times 87 - 5 \times 84$

$= 990 - 435 - 420 = 135$.

17. (*c*) Out of 330 marks, the student is required to obtain 165 marks, i.e., 50%

$\therefore$ In first paper, because of scoring 54 marks only, he has to score 111 marks out of 150 in the 2nd paper, i.e., 74%

18. (*b*) Let the average age of the whole team be x

Total age $= 11x$

Total age of 9 players $= 11x - (28 + 25)$

Average of 9 players $= \dfrac{11x - 3}{9} = x - 1$

$\Rightarrow \quad x = 22$ years.

19. (*c*) Suppose his average after 12 inning $= x$

Then, $\dfrac{12 + 96}{13} = x + 5$

$x = 31$

$\therefore$ Required average $= x + 5 = 31 + 5 = 36$.

20. (*c*) For $\dfrac{3n}{4}$ numbers average is $36 + 4$ and for $\dfrac{n}{4}$ numbers average is $36 - 4$

$$\text{New average} = \frac{\frac{3n}{4} \times 40 + \frac{n}{4} \times 32}{n} = 30 + 8 = 38.$$

21. (*c*) Total age of 14 persons $= \dfrac{111}{4} \times 14$ years

Total age of 12 persons

$$= \left(\frac{1554}{4} - 84\right) = \frac{1218}{4} = 304.5$$

Average age of 12 persons

$$= \frac{304.5}{12} = 25.375 \text{ years.}$$

22. (*c*) $A + B + C = 12{,}000 \times 3$

$B + C + D = 15{,}000 \times 3$

$\Rightarrow \quad D - A = 3000 \times 3$

$D - A = 9000$

also, $\quad D = 2A$

$\Rightarrow \quad D = 18{,}000$ and $A = 9{,}000$

Therefore average salary of B and C

$$= \frac{(45{,}000 - 18{,}000)}{2} = 13{,}500.$$

23. (*b*) The total score by a batsman $= 100 \times 36$

$= 3600$

$\therefore$ The correct total score $= 3600 - 40 + 90 = 3650$

$\therefore$ Percentage error $= \dfrac{3650 - 3600}{3650} \times 100 = \dfrac{5000}{3650}$

$= 1.36\%$

24. (*a*) $\therefore$ Required percentage $= \dfrac{21 - 15}{15} \times 100$

$= \dfrac{600}{15} = 40\%$

25. (*d*) Let number of students be n and average weight w.

According to the given condition, $\dfrac{nw + 50}{n + 1} = w + 1$

$\Rightarrow \quad n + w = 49 \qquad (1)$

and $\dfrac{nw + 50 + 50}{n + 2} = w + 1.5$

$\Rightarrow \quad 1.5n + 2w = 97 \qquad (2)$

On solving Eqs. (1) and (2), we get

$w = 47$.

26. (*a*) Total marks of a student in 8 subjects

$= 8 \times 87 = 696$

Total marks of a student in 6 subjects $= 6 \times 85 = 510$

$\therefore$ Remaining marks of 2 subjects $= 186$

Let the second highest marks be x, then highest marks is $x + 2$.

$\therefore \quad x + x + 2 = 186$

$\Rightarrow \quad 2x = 184$

$\Rightarrow \quad x = 92$

$\therefore$ Highest marks is $x + 2 = 94$.

27. (*a*) Let first number be x, then

$$\frac{x + (x + 1) + (x + 2) + (x + 3) + (x + 4)}{5} = 41$$

$\Rightarrow \quad 5x + 10 = 205$

$\Rightarrow \quad 5x = 195$

$\Rightarrow \quad x = 39$

$\therefore$ Product of A and $E = x \times (x + 4)$

$= 39 \times 43 = 1677$.

28. (*a*) Let woman and her daughter ages be $2x$ and x.

Also, $\dfrac{2x + x}{2} = 42$

$\therefore \quad = 3x - 84$

$\Rightarrow \quad x = 28$

Hence, daughter's age be 28 years.

29. (*d*) Total weight of 29 students $= 29 \times 48 = 1392$ kg

If teachers weight is included, then total weight

$= 30 \times 48.5 = 1455$ kg

$\therefore$ Weight of teacher

$= 1455 - 1392$

$= 63$ kg.

30. (*a*) Total marks obtained by the candidates
$= 120 \times 35 = 4200$
Let passed students be x, then
$4200 = x \times 39 + (120 - x)15$
$\Rightarrow \quad 4200 = 24x + 1800$
$\Rightarrow \quad 2400 = 24x$
$\Rightarrow \quad x = 100.$

31. (*c*) Let other two observations be x_1 and x_2.
$\therefore \quad 4 = \dfrac{1+2+6+x_1+x_2}{5}$
$\Rightarrow \quad x_1 + x_2 = 11$
and $\quad 5.2 = \dfrac{\left[\begin{array}{c}(4-1)^2+(4-2)^2+(4-6)^2 \\ +(4-x_1)^2+(4-x_2)^2\end{array}\right]}{5}$
$\Rightarrow \quad 26 = 9 + 4 + 4 + (x_2 - 7)^2 + (4 - x_2)^2$
$\Rightarrow \quad 9 = 2x^2{}_2 - 22x_2 + 49 + 16$
$\Rightarrow x^2{}_2 - 11x_2 + 28 = 0$
$\Rightarrow (x_2 - 4)(x_2 - 7) = 0$
$\Rightarrow x_2 = 4, 7 \Rightarrow x_1 = 7, 4$
Hence, other observations are 4, 7.

32. (*b*) Total of eleven results $= 11 \times 50 = 550$
Total of first six results $= 49 \times 6$
$= 294$
Total of last six results $= 52 \times 6$
$= 312$
$\therefore$ Required six results $= 294 + 312 - 550$
$= 56.$

33. (*c*) Given $\dfrac{\text{Mon} + \text{Tue} + \text{Wed} + \text{Thu}}{4} = 48°$
$\therefore \quad 42° + \text{Tue} + \text{Wed} + \text{Thu} = 192°$
$\Rightarrow \quad \text{Tue} + \text{Wed} + \text{Thu} = 150° \qquad (1)$
and, $\dfrac{\text{Tue} + \text{Wed} + \text{Thu} + \text{Fri}}{4} = 52°$
$\Rightarrow \quad 150° + \text{Fri} = 208°$
[from Eq. (1)]
$\Rightarrow \quad \text{Fri} = 58°.$

34. (*b*) Let total capital be ₹x.
$\therefore$ Required average
$$= \frac{\frac{x}{4} \times 3\% + \frac{2x}{3} \times 5\% + \frac{x}{12} \times 11\%}{x}$$
$$= \left(\frac{3}{4} + \frac{10}{3} + \frac{11}{12}\right)\%$$
$$= \left(\frac{9 + 40 + 11}{12}\right)\%$$
$$= \left(\frac{60}{12}\right)\% = 5\%$$

35. (*c*) Let the average of 12 innings be x.
Also, $\dfrac{12x + 96}{13} = x + 5$
$\Rightarrow \quad 12x + 96 = 13x + 65$
$\Rightarrow \quad x = 31$
$\therefore$ Required average $= \dfrac{12 \times 31 + 96}{13}$
$$= \frac{468}{13} = 36.$$

36. (*b*) Let the original average expenditure be ₹x.
Then,
$40(x - 2) - 30x = 40$
$\Rightarrow \quad 10x = 120 \Rightarrow x = 12$
$\therefore$ Original expenditure $= 30 \times 12 = ₹360.$

37. (*a*) Required correct mean $= \dfrac{78.4 \times 25 + 96 - 69}{25}$
$$= \frac{1960 + 27}{25} = \frac{1987}{25} = 79.48.$$

38. (*b*) Total present age of the family of 6 members
$= 6 \times 22 = 132$ years
Total age of the family of 6 members 7 years ago
$= (132 - 7 \times 6) = 90$ years
$\therefore$ Average age of the family at the birth of the youngest member $= \dfrac{90}{5} = 18$ years.

39. (*b*) Let the total number of boys and girls be B and G respectively.
$\therefore \quad$ Total score of boys $= 71\,B$
Total score of girls $= 73\,G$
Total score of the class $= 71.8(B + G)$
$\therefore \quad 71B + 73G = 71.8(B + G)$
$\Rightarrow \quad 0.8B = 1.2G$
$\Rightarrow \quad \dfrac{B}{G} = \dfrac{1.2}{0.8} = \dfrac{3}{2}.$

40. (*c*) Total salary of 75 workers = ₹426000
Total salary of 25 workers = ₹135000
Total salary of 30 workers = ₹171000
$\therefore$ Total salary of remaining 20 workers
$= 426000 - (135000 + 171000)$
$= 120000$
$\therefore$ Mean salary of 20 workers $= \dfrac{120000}{20} = ₹6000.$

41. (*c*) Total expenditure for the year

$= [2200 \times 3 + 2250 \times 4 + 3120 \times 5]$

$= 6600 + 9000 + 15600 = ₹31200$

Total saving = ₹1260

Total income = expenses + savings

$= 31200 + 1260 = ₹32460$

Average income

$= \frac{32460}{12} = ₹2705.$

42. (*a*) $480 \times 7 = 3360$

$480 \times 8 = 3840$

∴ Maximum number of pants that can be purchased is 7.

Balance Amount = 3620 – 3360 = 260

In ₹260, two shirts can be purchased.

43. (*b*) Total weight of 45 students = $45 \times 52 = 2340$

Total weight of 5 students who leave

$= 5 \times 48 = 240$

Total weight of 5 students who join

$= 5 \times 54 = 270$

Hence new total weight of 45 students

$= 2340 - 240 + 270 = 2370$

$\therefore$ Average $= \frac{2370}{45} = 52\frac{2}{3}$ kg.

44. (*a*) Let the numbers be F, S and T.

According to the question,

$F = 2S$, $S = 2T$ and $\frac{F+S+T}{3} = 21$

or, $F + S + T = 63$ (1)

Now, putting the value of F and T in (1), we have

$28 + S + \frac{S}{2} = 63$

or, $S = \frac{63 \times 2}{7} = 18$

$\therefore$ $F = 2S$

$= 2 \times 18 = 36$

and, $T = \frac{S}{2} = \frac{18}{2} = 9$

∴ largest number is 36.

45. (*d*) Let the three numbers be x, y and z.

$\therefore$ $\frac{x+y+z}{3} = 135$

i.e., $x + y + z = 405$ (1)

Let z be the largest number

$\therefore$ $z = 180$

$\Rightarrow$ $x + y = 225$ (2)

Also, $x - y = 25$ (3)

Solving (2) and (3), we get $x = 125$, $y = 100$.

46. (*c*) Let x be the highest score and y be the lowest score.

$\therefore$ $x + y = 40 \times 50 - 38 \times 48$

$= 2000 - 1824 = 176$

$x - y = 172$

$\therefore$ $x = 174$, $y = 2$.

47. (*d*) Suppose ninth person spent ₹x.

Total money spent by nine persons = $96 + x$

$\therefore$ $x = \frac{96+x}{9} + 8$

$\Rightarrow$ $9x = 96 + x + 72$

$\Rightarrow$ $x = 21$

$\therefore$ Total money spent = $96 + x = 117$.

48. (*b*) Suppose the third number is x.

$\therefore$ First number $= \frac{x}{2}$

and second number $= \frac{1}{2}\left(\frac{x}{2}\right) = \frac{x}{4}$

According to the question,

$\frac{\frac{x}{2} + \frac{x}{4} + x}{3} = 56$ or, $\frac{x}{2} + \frac{x}{2} + x = 168$

or, $7x = 672$

$\therefore$ $x =$

Hence, the numbers are $\frac{}{2}$, $\frac{}{4}$, 96.

49. (*d*) Suppose

$a = 2n - 5$, $b = 2n - 3$, $c = 2n - 1$, $d = 2n + 1$,

$e = 2n + 3$

∴ Their average

$= \frac{(2n-5) + (2n-3) + (2n-1) + (2n+1) + (2n+3)}{5}$

$= \frac{10n - 5}{5} = 2n - 1 = c.$

50. (*c*) According to the question,

$\frac{A+B+C}{3} = 84$

or, $A + B + C = 252$ (1)

$\frac{A+B+C+D}{4} = 80$

or, $A + B + C + D = 320$ (2)

and, $\frac{B+C+D+(D+3)}{4} = 79$

or, $B + C + 2D + 3 = 316$

or, $B + C + 2D = 313$ (3)

Subtracting (1) from (2),

$D = 320 - 252 = 68$ kg

Subtracting (3) for (2),

$A - D = 7$

$A = D + 7 = 68 + 7 = 75$ kg.

51. (*a*) Max. marks = 180 + 150 = 330

If the required percentage of marks is x% in the second paper, then according to the question, 30% of 180 + x% of 150 = 50% of 330

or $$\frac{30}{100}\times 180+\frac{x}{100}\times 150=\frac{50}{100}\times 330=165$$

or $$54+\frac{3}{2}x=165$$

or $$\frac{3}{2}x=111$$

$$x=74\ \%$$

52. (*c*) Let $A_1, A_2, \ldots, A_9$ be the numbers.

Let $$A_1+A_2+\ldots+A_9=9M$$
$$A_1+A_2+A_3=3P$$
$$A_4+A_5+\ldots+A_9=6N$$

Then, $$9M=3P+6N$$
$$3M=P+2N.$$

53. (*d*) Let a, b, c, d, e and f be six numbers, such that

$$a=e+m$$
$$b=e-k$$
$$c=e-l$$
$$d=e-j$$
$$f=e+p$$

Then, the sum of deviations of a, b, c, d, e and f from e is $(m-k+l-j+p)$

The mean of a, b, c, d, e and f is given by

$$\frac{a+b+c+d+e+f}{6}$$
$$=\frac{e+m+e-k+e-l+e-j+e+e+p}{6}$$
$$=\frac{6e+(m-k-l-j+p)}{6}$$
$$=\frac{6e+\text{Sum of deviations}}{6}$$

Using the similar logic, the required mean

$$=\frac{20\times 23+70}{20}=26.5$$

Hence, option (*d*).

54. (*d*) Total runs upto 20 innings = 20 × 44.5 = 890 runs

Let he scores x runs in the 21st innings then

Average after 21 innings = $\frac{890+x}{21}$

$\Rightarrow$ $45=\frac{890+x}{21}$ $\Rightarrow 945=890+x$

or $x=55$ runs.

55. (*c*) Total 6 numbers $\rightarrow 6\times 30=180$

1st 4 numbers $\rightarrow 4\times 25=100$

last 3 numbers $\rightarrow 3\times 35=105$

4th number = 205 – 180 = 25.

56. (*b*) Let a, b, c and d be the number of students in class A, B, C, and D, respectively.

Then, total marks in section $A = 45a$

Total marks in section $B = 50b$

Total marks in section $C = 72c$

Total marks in section $D = 80d$

Now, average marks of the students of sections A, B, C and $D = 60$

$$\therefore \frac{45a+50b+72c+80d}{a+b+c+d}=60$$

$$\Rightarrow 45a+50b+72c+80d=60a+60b+60c+60d$$

$$\Rightarrow 15a+10b-12c-20d=0$$

$$\Rightarrow 15a+10b=12c+20d \quad (1)$$

Also,avarage marks of the students in sections A and $B = 48$

$$\Rightarrow \frac{45a+50b}{a+b}=48$$

$$\Rightarrow 45a+50b=48a+48b$$

$$\Rightarrow 3a=2b \quad (2)$$

and avarage marks of students in sections B and $C = 60$

$$\Rightarrow \frac{50b+72c}{b+c}=60$$

$$\Rightarrow 50b+72c=60b+60c$$

$$\Rightarrow 12c=10b \quad (3)$$

Putting the value of 12c from Eq. (3) in Eq. (1), we get

$$15a+10=10b+20d$$

$$\Rightarrow 15a=20d$$

$$\Rightarrow a:d=20:15=4:3$$

57. (*a*) Let there be 'n' number of officers in the organisation. Then,

$$n\times 10000+(400-n)2000=400\times 3000$$

$$10n+800-2n=1200$$

$$\Rightarrow 8n=400$$

$$\Rightarrow n=50$$

58. (*b*) Total score of 8 subjects = 87 × 8 = 696

Total score of 6 subjects = 85 × 6 = 510

$\therefore$ Score of remaining two subjects = 696 – 510 = 186

Now, let the highest and the next highest score are x. and $x-2$, then

$(x)+(x-2)=186$

$\Rightarrow 2x=188 \Rightarrow x=94,$

which is the highest score.

59. (*a*) Let there be 'n' number of officers in the organisation. Then,

$$n\times 10000+(400-n)2000=400\times 3000$$

$$10n+800-2n=1200$$

$$\Rightarrow 8n=400$$

$$\Rightarrow n=50$$

60. (*b*) Total score of 8 subjects = 87 × 8 = 696

Total score of 6 subjects = 85 × 6 = 510

$\therefore$ Score of remaining two subjects = 696 – 510 = 186

Now, let the highest and the next highest score are x and x – 2, then

$(x)+(x-2)=186$

$\Rightarrow \quad 2x=188 \quad \Rightarrow \quad x=94,$

which is the highest score.

61. (*a*) Let the number of boys in the class be x.

and number of girls in the class = 20

We are given,

$18(x+20)=20\times x+20\times 15$

$\Rightarrow 18x+360=20x+300$

$\Rightarrow 20x=60$

$\therefore \quad x=30$

62. (*b*) Let the five numbers be x_1, x_2, x_3, x_4, x_5.

Average of 5 numbers = 61

$\Rightarrow \frac{x_1+x_2+x_3+x_4+x_5}{5}=61$

$\Rightarrow x_1+x_2+x_3+x_4+x_5=305$

Now, $\frac{x_1+x_3}{2}=69$

$\Rightarrow x_1+x_3=138$

And $\frac{x_2+x_4}{2}=69$

$\Rightarrow x_2+x_4=138$

Now, $x_1+x_3+x_2+x_4+x_5=305$

$\Rightarrow 138+138+x_5=305$

$\Rightarrow x_5=305-276$

$\therefore x_5=29$

63. (*d*) Average weight of 19 men = 74 kg

Total weight of 19 men = $74\times 19=1406$ kg

Average weight of 38 women = 63

Total weight of 38 women = $38\times 63=2394$

Average weight of men and women together

$=\frac{2394+1406}{38+19}$

$=\frac{3800}{57}=66.66\sim 67kg.$

64. (*d*) Correct average

$=\frac{(24\times 56)+(48+59+67)-(44+45+61)}{24}$

$=\frac{1344+174-150}{24}=\frac{1368}{24}=57$

DIFFICULTY LEVEL-2

1. (*b*) For first nine months his salary is ₹380 per month. For next 12 months, it was ₹420. For next 12 months it was ₹460 and for the last three months it was ₹500.

$\therefore$ His average salary of last 36 months

$=\frac{[9(380)+12(420+460)+3(500)]}{36}=₹430$

$\therefore$ His pension is ₹215 per month.

2. (*b*) If t is the number of hrs the hiker walked on the first day, then $t+2$ is the number of hrs he walked on the second day.

$\therefore$ $t+t+2=18$, or $t=8$. If s was the hiker's average speed in Km/h on the first day, then $s+1$ was his average speed on the second day. So, the total distance hiked in 2 days was $(8)\times(s)+(10)\times(s+1)$.

Therefore, $8s+10(s+1)=64$

$\Rightarrow \qquad 18s=54 \quad$ or $\quad s=3$ Km/h.

3. (*b*) Total marks of those 3 students must be

$(44\times 100-97\times 43.92)=139.96.$

$\therefore$ Average of those 3 students $=\frac{139.76}{3}=46.6.$

4. (*c*) Since, we want to find the minimum attendance in third semester, we will take the attendance in fourth semester 100%

Let the required % of attendance be x

$\frac{60+70+x+100}{4}=80$

$\Rightarrow \qquad x=320-230=90.$

5. (*d*) (Agarkar + Sehwag + Sachin + Dravid + Ganguly) make $=39\times 5=195$ runs.

With respect to scoring runs

Dravid = Ganguly + 7

Ganguly = Agarkar – 9

Sehwag = Dravid + Ganguly

Sehwag + Sachin = 110

⇒ Agarkar, Dravid, Ganguly, Sehwag and Sachin scored 32, 30, 23, 53 and 57 runs respectively

6. (*b*) Average of first 7 numbers will be the 4th number = X (Given)

Average of all the 11 numbers will be the 6th number, i.e., $X + 4$.

7. (*c*) Suppose temperature on 1st day = $7K$

Suppose temperature on 5th day = $8K$

∴ Temperature on

$$M + T + W + Th = 232$$

Average temperature on

$$T + W + Th + F = 240$$

$$\therefore \quad 232 - 7K = 240 - 8K$$

$$\Rightarrow \quad K = 8$$

∴ Temperature on 5th day = 64°.

8. (*a*) Let each side of the square field be x Km

∴ Average speed of the plane

$$= \frac{4x}{\frac{x}{800} + \frac{x}{600} + \frac{x}{400} + \frac{x}{200}}$$

$$= \frac{4 \times 2000}{3 + 4 + 6 + 12} = \frac{9600}{25}$$

$$= 384 \text{ Km/h.}$$

9. (*a*) Suppose the number of candidates passed = x

$$\therefore \quad 39x + 15\,(120 - x) = 120 \times 15$$

$$\Rightarrow \quad 24x = 120 \times 35 - 120 \times 35$$

$$= 120\,(35 - 15) = 120 \times 20$$

$$\Rightarrow \quad x = 100.$$

10. (*a*) On Monday, the payment = ₹x

On Tuesday, the payment = ₹$(x + 3y)$

On Wednesday, the payment = ₹$(x + 2y)$

On Thursday, the payment = ₹$(x + y)$

On Friday, the payment = ₹$(x + 2y)$

∴ Average daily earnings during the five-day week

$$= \frac{5x + 8y}{5} = x + \frac{8y}{5}.$$

11. (*b*) Let the average expenditure per student be ₹x

Therefore, original total expenses = ₹$35x$

New average expenditure per student = ₹$(x - 1)$

New average expenditure per student = ₹$(x - 1)$

New total expenses = ₹$(35x + 42)$

$$\therefore \quad \frac{35x + 42}{42} = (x - 1)$$

$$\Rightarrow \quad 35x + 42 = 42x - 42$$

or $x = 12$, therefore original expenditure of the mess $= 35 \times 12 =$ ₹420.

12. (*c*) Remember $\dfrac{\begin{matrix} abc \\ -\,cba \end{matrix}}{99(a - c)}$

where abc and cba are the three digit numbers and $(a, c) \neq 0$

Again since the difference in average = 19.8

Therefore, the difference in total = $19.8 \times 10 = 198$

Thus, $99 \times (a - c) = 198$

$$\Rightarrow \quad (a - c) = 2.$$

13. (*d*) Present total age of husband and wife

$$= (23 \times 2 + 5 \times 2) = 56 \text{ years}$$

Present total age of husband, wife and child

$$= 20 \times 3 = 60 \text{ years}$$

∴ age of child = $(60 - 56) = 4$ years.

14. (*a*)

	No. of 2 wheelers	No. of 3 wheelers	No. of 4 wheelers
	$2x$	x	$2x$
No. of wheels	$2 \times 2x$	$3 \times x$	$2x \times 4$
	$= 4x$	$= 3x$	$= 8x$

Therefore average number of wheels

$$= \frac{4x + 3x + 8x}{5x} = 3.$$

15. (*c*) $\dfrac{[r + (p - q)] + p + q}{3} = 21 + \dfrac{p + q + r}{3}$

$$\Rightarrow \quad \frac{2p + r}{3} - 21 = \frac{p + q + r}{3}$$

$$\Rightarrow \quad \frac{p - q}{3} = 21$$

$$\Rightarrow \quad p - q = 63.$$

16. (*b*) Total marks in 10 papers = 800

Total marks in 8 papers = 648

Total of highest and lowest marks = 152

lowest marks = $152 - 92$

$= 60.$

17. (*a*)

		Average	Total
$S+G$	$\rightarrow$	35	70
$K+G$	$\rightarrow$	32	64
$S+K$	$\rightarrow$	38	76
$S+K+G$	$\rightarrow$	35	105
$D+I$	$\rightarrow$	$\frac{35}{2}$	35

$$\therefore \quad \frac{S+K+G+D+I}{S} = \frac{105+35}{5} = 28.$$

18. (*d*) The 5 consevtice odd numbers whose average is k are $(k-4)\ (k-2),\ k,\ (k+2)\ (k+4)$

Again the average of $(k-4)$, $(k-2)$, (k), $(k+2)$, $(k+4)$, $(k+6)$, $(k+8)$ is $(k+2)$

Alternatively: Consider some appropriate numbers.

19. (*a*) Total age of A and $B = 20 \times 2 = 40$ years

Total age of B and $C = 19 \times 2 = 38$ years

Total age of A and $C = 21 \times 2 = 42$ years

$$\text{Total age of } (A+B+C) = \frac{40+38+42}{2}$$

$$= 60 \text{ years.}$$

Therefore, ages of A, B and $C = 22$ years, 18 years and 20 years, respectively.

20. (*d*) Sum of numbers $= \left(1-\frac{1}{n}\right) + 1 + 1 + 1 \ldots (n-1)$ times

$$= 1 - \frac{1}{n} + (n-1) = n - \frac{1}{n}$$

$\therefore$ Arithmetic mean of n numbers

$$= \frac{n-\frac{1}{n}}{n} = \frac{n^2-1}{n^2} = 1 - \frac{1}{n^2}.$$

21. (*a*) Let the number of professors, associates and assistant professors be a, b and c, respectively.

Let their average ages $= p$, q and r, respectively.

So, $ap + bq + cr = 2160$ (1)

$$\frac{ap+bq}{a+b} = 39 \tag{2}$$

$$\frac{bq+cr}{b+c} = \frac{328}{11} \tag{3}$$

$$\frac{ap+cr}{a+c} = \frac{362}{3} \tag{4}$$

$$a(p+1) + b(q+6) + c(r+7) = 2460 \tag{5}$$

Solving these,

$$a = 16,\ b = 24,\ c = 20,\ p = 45,\ q = 35,\ r = 30.$$

22. (*a*) $a+b+c+d+e = 10$

$$\text{Average} = \frac{10}{5} = 2$$

$$a = 0 \text{ to } 4$$

Least value of x: $0 \le x \le 2$

$$b = 0 \text{ to } 4 \qquad [\because \text{ average} = 2]$$

$$c = 0 \text{ to } 4$$

$$d = 0 \text{ to } 4$$

$$e = 0 \text{ to } 4.$$

23. (*c*) The marks of the 5 students and the remainder that they leave when divided by 3 are tabulated below.

Marks	71	76	80	82	91
Remainder	2	1	2	1	1

After the first 3 marks are entered, the total has to be a multiple of 3. The remainders can only be 1, 1, 1. (2, 1, 1 or 2, 2, 1 would not produce a multiple of 3)

$\therefore$ The fourth and fifth marks to be entered were 71 and 80.

24. (*c*) Haque's salary in 2008 = 900000 rupees

Expenditure on food in 2007 = 400000 rupees

Expenditure on food in 2008

$$= 400000 + 400000 \times \frac{5}{100}$$

$$= 420000 \text{ rupees}$$

$\therefore$ Percentage expenditure on food items in 2008

$$= \frac{420000}{900000} \times 100$$

$$= 46.67 \approx 47\%$$

25. (*b*) Average of first five integers

$$= \frac{1+2+3+4+5}{5} = \frac{15}{5} = 3 = n \text{ (given)}$$

and, average of first seven integers

$$= \frac{1+2+3+4+5+6+7}{7}$$

$$= \frac{28}{7} = 4 = (3+1) = (n+1).$$

26. (*b*) Given $x < 0.50,\ 0 < y < 1,\ z > 1$. It is therefore clear that, value of x and y range between 0 and 1, hence median will also lie between 0 and 1.