Averages

QUANTITATIVE APTITUDE

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Averages

Average is defined as the sum of the observations divided by the number of observations.

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

Q. The average age of a cricket team of eleven players is 27 years. If two more players are included in the team the average becomes 26 years, then the average age (in years) of the two included players is:

A. Average age of eleven players is = 27 years

⇒ Sum of age of 11 players = 27 × 11 = 297 years

⇒ If two players are included in the team, then average age of 13 players = 26 years

⇒ Sum of age of 13 players = 13 × 26 = 338 years

⇒ Sum of age of two players (included) = 338 - 297 = 41 years

∴ Average age of two players (included) = 41/2 = 20.5 years

Q. The average age of a cricket team of eleven players is 27 years. If two more players are included in the team the average becomes 26 years, then the average age (in years) of the two included players is:

A. Let the average expenditure of all be Rs. x

According to problem,

$$\Rightarrow \text{Average expenditure} = \frac{\text{Total expenditure}}{\text{Number of person}}$$

⇒ 25x = 24 × 30 + x + 48

⇒ x = 32

∴ Total money spent by all of them = 25 × 32 = Rs 800

Important Formulae

Points to Remember

Average of first n natural numbers	=	$\frac{n+1}{2}$
Average of squares of first n natural numbers	=	$\frac{(n+1)(2n+1)}{6}$
Average of cubes of first n natural numbers	=	$\frac{n(n+1)^2}{4}$
Average of first n even numbers	=	$n+1$
Average of squares of first n even numbers	=	$\frac{2(n+1)(2n+1)}{3}$
Average of cube of first n even numbers	=	$2n(n+1)^2$
Average of first n odd numbers	=	n
Average of squares of first n odd numbers	=	$\frac{(2n+1)(2n-1)}{3}$
Average of cube of first n odd numbers	=	$n(2n^2 - 1)$

Q. The average of 3 consecutive even numbers is 10, then the third number is by what percent more than the first number?

A. Let the first number be x.

So, the second and the third number will be (x + 2) and (x + 4) respectively.

According to the question

⇒ x + x + 2 + x + 4 = 10 × 3

⇒ x = 8

The first number be 8.

⇒ The second number be = 8 + 2 = 10

⇒ The third number be = 8 + 4 = 12

∴ Required percentage = [(12 – 8)/8] × 100 = 50%

Testbook Trick

In the above question, following shortcut can be applied:

Average of any consecutive series is the middle term (median).

⇒ For example 8, 10, 12 in this series middle term is 10 which also average of the series.

∴ Required percentage = [(12 – 8)/8] × 100 = 50%

Q. The average of the first 15 odd numbers is by what percent less/more than the average of the first 15 even numbers?

A. As we know,

⇒ Average of the first n odd numbers = n

⇒ Average of the first n even numbers = n + 1

⇒ Average of the first 15 odd numbers = 15

⇒ Average of the first 15 even numbers = 15 + 1 = 16

∴ Required percentage = [(16 – 15)/16] × 100 = 6.25%

Q. Find the average of cubes of the first 10 odd numbers.

A. The average of cubes of first n odd numbers = $n(2n^2 - 1)$

∴ The average of cubes of first 10 odd numbers = $10(2 \times (10)^2 - 1) = 10 \times 199 = 1990$

Important Questions based on Real Life Situations

Q. A cricketer had a certain average of runs for his 43 innings. In his 44^{th} innings, he is bowled out for no score on his part. This brings down his average by three runs. Find his new average of runs.

A. Concept:

Total runs = Number of wickets × Average

$$\text{Average of bowler} = \frac{\text{Total runs}}{\text{Number of wickets}}$$

Solution:

Let the average of runs be x

Total runs = Number of innings × Average

⇒ 43 × x = 44 × (x – 3)

⇒ x = 132

New average = x – 3 = 132 – 3 = 129

Q. The average age of a family of 6 members is 25 years. If the age of the youngest member of the family is 8 years, then find the average age of the members of the family just before the birth of the youngest member.

A. Total age of a family of 6 members = 6 × 25 = 150 years

⇒ Total age of a family of 6 members before 8 years = 150 – (8 × 6) = 102 years

∴ The average age of the family just before the birth of the youngest = 102/(6 – 1) = 20.4 years

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Q. In a hostel, 52 students are living. If 18 students are joined in this hostel than average expenditure will be 3 rupees less whenever total expenditure 510 rupees will be increased. Find the total expenditure of initially.

A. Let the average expenditure of initially students be x,

⇒ 52x + 510 = (52 + 18) × (x – 3)

⇒ 18x = 720

⇒ x = 40

∴ Total expenditure of 52 students = 52 × 40 = 2080