



R R B - N

C B T - I

QUANTITATIVE APTITUDE - 1





EDITION - DEC 2019

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Average

Average: A number that expresses the Centre Value of a Set of data.

$$\text{Average} = \frac{\text{Sum of Numbers}}{\text{Total Numbers}}$$

★ Average is also Called as Mean Sometimes

Eg: Find the average of 33, 49 & 57.

$$= \frac{33 + 49 + 57}{3} = \frac{139}{3} = 46.33 \text{ Ans.}$$

Modern Method to Calculate the average:

② Calculate the average of the following Numbers:

237, 258, 187, 322, 158

Solⁿ: Conceptual Method

$$= \frac{237 + 258 + 187 + 322 + 158}{5}$$

$$= \frac{1162}{5}$$

$$= 232.4 \text{ Ans.}$$

Exam Method

237, 258, 187, 322, 158

Let Avg is 200

237, 258, 187, 322, 158

$$\begin{array}{ccccc} \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ +37 & +58 & -13 & +122 & -42 \end{array}$$

$$200 + \frac{162}{5} = 232.4$$

Find the average of even numbers from 12 to 116.

Soln → 12, 14, ----- 114, 116

$$\frac{12 + 116}{2} = 64 \text{ Ans}$$

Find the odd numbers b/w 9 & 33.

Soln → 9, 11 ----- 31, 33

$$\frac{9 + 33}{2} = 21 \text{ Ans}$$

Eg: Find the average of the given Series

3, 7, 11, ----- 91, 95, 99

Soln → 3, 7, 11 ----- 91, 95, 99
 \swarrow \searrow \swarrow \searrow
 4 4 4 4

∴ the Difference b/w the number is always Same. (i.e - 4)

$$\frac{3 + 99}{2} = \frac{102}{2} = 51 \text{ Ans}$$

Average of Square of First n natural Numbers :

$$= \frac{(n+1)(2n+1)}{6}$$

Eg: : Find average of Square of 1 to 16.

$$\text{Soln} - = \frac{(16+1)(32+1)}{6} = \frac{17 \times 33}{6} = \frac{181}{2} = 90.5 \text{ Ans}$$

★ Average of Cube of First n natural numbers:
 $= \frac{n(n+1)^2}{4}$

Eg: Find the average of Cube of 1 to 12.

$$\text{Soln} - \frac{12 \cdot (12+1)^2}{4} = 3 \cdot 169 = 507.$$

Solved Examples

Problems based on numbers

Q.1 Find the average of the numbers from 3 to 147.

Sol:

$$\frac{\text{First number} + \text{last number}}{2}$$

$$3, 4, 5, \dots, 145, 146, 147$$

$\begin{array}{ccc} \vee & & \vee \\ 1 & & 1 \end{array}$

$$= \frac{3+147}{2} = 75 \text{ Ans}$$

Q.2 Find the average of first 15 multiples of 4.

Sol:

$$4, 8, 12, \dots, 15 \times 4 = 60$$

$\begin{array}{ccc} \vee & & \vee \\ 4 & & 4 \end{array}$

$$= \frac{\text{First number} + \text{last number}}{2} = 32 \text{ Ans}$$

Q.3 If the average of the "m" number is n^2 & average of n numbers is m^2 , then find the average of $(m + n)$ numbers".

Sol:

$$\text{avg. of } m \text{ members} = \frac{\text{Sum of } m \text{ members}}{m}$$

$$n^2 = \frac{\text{Sum of } n \text{ numbers}}{n}$$

$$\text{Sum} = mn^2$$

$$\text{avg. of } n \text{ members} = \frac{\text{Sum of } n \text{ numbers}}{n}$$

$$\text{Sum} = nm^2$$

$$\text{avg. of } (m+n) \text{ numbers} = \frac{mn^2 + nm^2}{m+n}$$

$$= \frac{mn(m+n)}{(m+n)}$$

$$= mn \text{ Ans}$$

Q. 4 Three natural numbers are such that the second number is twice the first & third is thrice the second & average of all three numbers is 147. Find the largest number.

sol:



$$\frac{x + 2x + 6x}{3} = 147$$

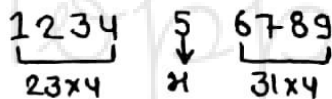
$$\frac{9x}{3} = 147$$

$$x = 49$$

$$\begin{aligned} \text{Largest number} &= 49 \times 6 \\ &= 294 \text{ Ans} \end{aligned}$$

Q. 5 The average of 9 numbers is 27. The average of first 4 of them is 23 & the average of last four is 31. Find the middle number.

sol:



$$23 \times 4 + x + 31 \times 4 = 27 \times 9$$

$$92 + x + 124 = 243$$

$$x = 27$$

- Sum of first 4 numbers $23 \times 4 = 92$

- Sum of last four numbers $31 \times 4 = 124$

- Middle Number = x

- Sum of all numbers $= 9 \times 27 = 243$

combined Average

Q.1 The average cut. of 23 men is 90 & the average cut. of 27 women is 77. what is the average cut. of combined class.

sol:

$$\begin{aligned}
 \text{Combined average} &= \frac{n_1 w_1 + n_2 w_2}{n_1 + n_2 + n_3} \\
 &= \frac{23 \times 90 + 27 \times 77}{23 + 27} \\
 &= \frac{2070 + 2079}{50} = \frac{4149}{50} = 82.94 \text{ Ans}
 \end{aligned}$$

Q.2 Average score class P, Q, R is 83, 76 & 85 number of student in class P, Q & R is 27, 36 & 45, then find the combined average of the class P, Q & R.

sol:

P	Q	R
avg: 83	76	85
Ratio: $\frac{27}{3}$	$\frac{36}{4}$	$\frac{45}{5}$

Let assumed avg = 80

Now +3	-4	+5
x3	x4	x5

$$9 - 16 + 25 = 18$$

$$= 18/12 = 1.5$$

$$= 80 + 1.5$$

$$= 81.5 \text{ Ans}$$

Helping hand:

(i) Let a number be avg. near by the numbers 83, 76, 85
i.e = 80

(ii) Take diff -

$$83 - 80 = +3$$

$$76 - 80 = -4$$

$$85 - 80 = 5$$

(iii) Multiply With the ratio

$$(+3 \times 3) + (-4 \times 4) + (5 \times 5)$$

$$= 9 - 16 + 25 = \textcircled{18}$$

(iv) $\frac{18}{3+4+5}$

(Ratio of Students)

$$= 18/12 = 1.5$$

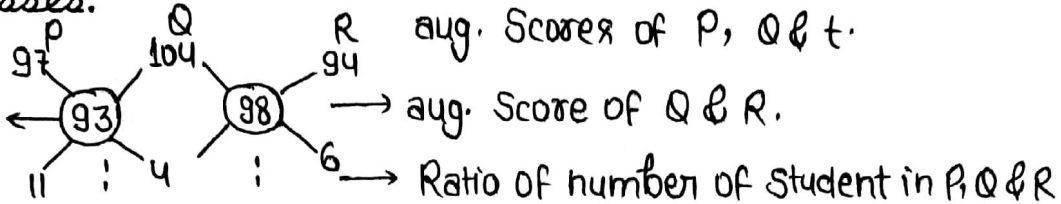
(v) Add in the the Assumed mean

$$= 80 + 1.5 \text{ Ans}$$

Q.3 The average score of class P, Q, R is 97, 104 & 934 respectively. Average score of P & Q is 93 & the average score of Q & R is 98. Find the combined average of all classes.

sol:

Aug.
Score
of
PQ.



Let assumed avg = 100

P Q R
97 104 94

Use of Allegation Method

$$\begin{array}{ccc}
 100 & & \\
 -3 & +4 & -6 \\
 \times 11 & \times 4 & \times 6 \\
 \hline
 -33 & +16 & -36
 \end{array}
 \Rightarrow \frac{-53}{11+4+6} \Rightarrow \frac{-53}{21}$$

Corrected Avg = $100 - 2.5 = 97.5$ Ans.

including, Excluding or Replacing

Q.1 The average age of 30 students is 9 years. If the age of the teacher is also included then average become 10. Find the age of teacher.

sol:

Basic Method

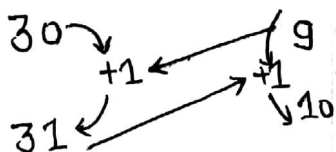
Sum of age of students + age of teacher = New Avg.
total Count

$$\frac{30 \times 9 + H \times 1}{31} = 10 \Rightarrow 270 + H = 310$$

H = 40

Advance Approach

Member Aug.



$$\begin{aligned}
 \text{Age of teacher} &= 9 \times 1 + 31 \times 1 \\
 &= 40 \text{ yrs.}
 \end{aligned}$$

Helping Hand

- Age of teacher
- = Aug. of student \times no. of member Included
- + total member \times Aug. Increased

Q. 2 Average of 40 staff members is 18 years. If 20 new member were joined, Average increased by 6 months. Find the sum of new members.

sol:

Members	Aug.
40	18
↓ +20	↓ +0.5
60	18.5

$$\begin{aligned}
 \text{Sum of new members} &= 18 \times 20 + 60 \times .5 \\
 &= 360 + 30 \\
 &= 390 \text{ Ans}
 \end{aligned}$$

IF Avg. of New members asked = $\frac{390}{20} = 19.5$

Basic Approach

$$\begin{aligned}
 40 \times 18 + \text{Sum of new members} &= 60 \times 18.5 \\
 720 + H &= 1110 \Rightarrow H = 390
 \end{aligned}$$

Q. 3 If the average age of 24 students & 1 teacher is 15 years. If the teacher's age is excluded their average is decreased by 1 year. Find the age of teacher.

sol:

Member	Aug.
25	15
↓ -1	↓ -1
24	14

$$= 1 \times 15 + 24 \times 1 = 39 \text{ yrs}$$

Q. 4 the average of 25 members is 18.75. If one number is excluded average become 16. Find the excluded number.

sol:

Exam method

Member	Aug.
25	18.75
↓ 1	↓ 2.75
24	16

$$24 \times 2.75 + 18.75 \times 1 = 84.75 \text{ Ans}$$

Basic Method

$$\begin{aligned}
 25 \times 18.75 - 24 \times 16 \\
 &= 468.75 - 384 \\
 &= 84.75 \text{ Ans}
 \end{aligned}$$

Q. 5 Average wt. of 40 person is increased by 0.75 kg when a person of 50 kg is replaced by new person. Find the wt. of new person.

sol: When Average Increased

$$\begin{aligned}
 \text{New Person wt.} &= \text{old Person wt} + \text{Avg.} \times \text{Increasing} \\
 &= 50 + 40 \times 0.75 \\
 &= 60 \text{ Kg.}
 \end{aligned}$$

• Replacing the Persons, If a Person is replaced New Person =
 New Person = old Person + old Avg. \times Avg. Increased.
 but wt.

• When avg. decreased, by a person replaced (use about formula with (-) sign)

• When avg. remains same by replacing the person then but of old person & new person is same

Misread Problems

Q. 1 The average of 25 observations is 13. it was later found that an observation 73 was wrongly entered as 48. The new average is -

sol: Basic Method -

$$\begin{aligned}
 \text{Total Incorrect Sum} &= 25 \times 13 \\
 &= 325
 \end{aligned}$$

$$\begin{aligned}
 \text{Correct Sum} &= 325 - 48 + 73 \\
 &= 350
 \end{aligned}$$

$$\text{Correct avg} = \frac{350}{25} = 14$$

Exam Approach

$$\text{New Avg} = \text{Pre Avg.} + \frac{\text{Difference}}{\text{total numbers}}$$

$$= 13 + \frac{73-48}{25}$$

$$= 13 + 1 = 14 \text{ Ans}$$

Q. 2 The average marks of 14 students was calculated as 71. But later it is found that there was an error in noting the mark. of 2 students as 42. instead 56 & 74 instead of 32. what is correct average of the students.

sol:

$$\begin{aligned}
 & 71 + \frac{56 + 32 - 42 - 74}{14} \\
 & = 71 - \frac{28}{14} = 69 \text{ Ans}
 \end{aligned}$$

Miscellaneous Problems:

Q. 1 The average age of a family of 4 members 3 years ago is 21 years. A baby is born & now the average age of family is same as before. Find the age of the baby.

sol:

$$\text{Average Age 3 years ago} = 21$$

$$\begin{aligned}
 \text{Sum age 3 years ago} &= 21 \times 4 \\
 &= 84
 \end{aligned}$$

$$\begin{aligned}
 \text{Sum of Present age} &= 84 + 3 \times 4 \\
 &= 96
 \end{aligned}$$

$$\begin{aligned}
 \text{Sum of Present age of 5 members} &= \text{new avg} \times 5 \\
 &= 21 \times 5 \\
 &= 105
 \end{aligned}$$

$$\begin{aligned}
 \text{Age of baby} &= 105 - 96 \\
 &= 9 \text{ years Ans}
 \end{aligned}$$

SIMPLIFICATION

* Fraction

$1 = 100\%$

$\frac{1}{2} = 50\%$

$\frac{1}{3} = 33.33\%$

$\frac{1}{4} = 25\%$

$\frac{1}{5} = 20\%$

$\frac{1}{6} = 16.66\%$

$\frac{1}{7} = 14.28\%$

$\frac{1}{8} = 12.5\%$

$\frac{1}{9} = 11.11\%$

$\frac{1}{10} = 10\%$

$\frac{1}{11} = 9.09\%$

$\frac{1}{12} = 8.33\%$

$\frac{1}{13} = 7.69\%$

$\frac{1}{14} = 7.14\%$

$\frac{1}{15} = 6.66\%$

$\frac{1}{16} = 6.25\%$

$\frac{1}{17} = 5.88\%$

$\frac{1}{18} = 5.56\%$

$\frac{1}{19} = 5.26\%$

$\frac{1}{20} = 5\%$

$\frac{3}{8} = 37.5\%$

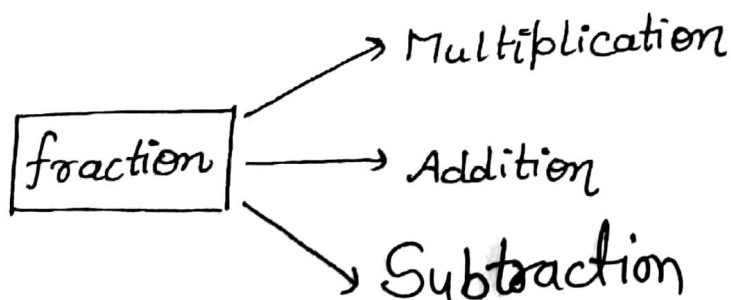
$\frac{5}{8} = 62.5\%$

$\frac{7}{8} = 87.5\%$

$\frac{5}{6} = 83.33\%$

$\frac{11}{12} = 91.67\%$

संजीवनी



शख भी बिकेगी; सोने के भाव, जल कर ली देख

Multiplication form:

$$(a) \frac{1}{7} = 14.28\%$$

$$\left(\times \frac{1}{2} \right)$$

$$\rightarrow \frac{1}{14} = 7.14\%$$

$$(b) \frac{1}{4} = 25\%$$

$$\left(\times \frac{1}{2} \right)$$

$$\rightarrow \frac{1}{8} = 12.5\%$$

$$\left(\times \frac{1}{2} \right)$$

$$\rightarrow \frac{1}{16} = 6.25\%$$

$$(c) \frac{1}{6} = 16.66\%$$

$$\left(\times \frac{1}{2} \right)$$

$$\rightarrow \frac{1}{12} = 8.32\%$$

$$(d) \frac{1}{11} = 9.09\%$$

$$\left(\times 2 \right)$$

$$\rightarrow \frac{2}{11} = 18.18\%$$

Addition form:

$$(a) 107.69\%$$

$$\rightarrow 100\% + 7.69\%$$

$$= 1 + \frac{1}{13} = 1\frac{1}{13}$$

$$(b) 116.66\%$$

$$\rightarrow 100\% + 16.66\%$$

$$= 1 + \frac{1}{6} = 1\frac{1}{6}$$

$$(c) 137.5\%$$

$$\rightarrow 100\% + 37.5\%$$

$$= 1 + \frac{3}{8} = 1\frac{3}{8}$$

$$(d) 162.5\%$$

$$\rightarrow 100\% + 62.5\%$$

$$= 1 + \frac{5}{8}$$

$$= 1\frac{5}{8}, \frac{13}{8}$$

Subtraction form:

(a) 90.91%.

→ 100% - 9.09%.

$$\rightarrow 1 - \frac{1}{11}$$

$$= \frac{10}{11} \text{ Ans}$$

(b) 87.5%.

→ 100% - 12.5%.

$$\rightarrow 1 - \frac{1}{8}$$

$$= \frac{7}{8} \text{ Ans}$$

(c) 92.86%.

→ 100% - 7.14%.

$$1 - \frac{1}{14}$$

$$= \frac{13}{14} \text{ Ans}$$

Eg:- [1] 28.56% of 35 + 87.5% of 32 = x

$$= (2 \times \frac{1}{7}) \times 35 + (100\% - 12.5\%) \times 32 = x$$

$$= \frac{2}{7} \times 35 + (1 - \frac{1}{8}) \times 32$$

$$= \frac{2}{7} \times 35 + \frac{7}{8} \times 32$$

$$= 10 + 28 = 38 \text{ Ans}$$

[2] 37.5% of 64 + 16.66% of 24 = $\sqrt{729}$ + x

$$= 3(12.5\%) \times 64 + (\frac{1}{6}) \times 24 = 27 + x$$

$$= 3 \times \frac{1}{8} \times 64 + \frac{1}{6} \times 24 = 27 + x$$

$$= 24 + 4 = 27 + 26$$

$$\boxed{26 = 1}$$

3. 48% of 2434

$$\swarrow$$

$$50\% - 2\%$$

$$= 1217 - 48.68$$

$$= 1168.32 \text{ Ans}$$

$$100\% = 2434$$

$$50\% = 1217$$

$$1\% = 24.34$$

$$2\% = 48.68$$

4. 45% of 2460

$$\swarrow$$

$$50\% - 5\%$$

$$1230 - 123$$

$$= 1107 \text{ Ans}$$

$$100\% \rightarrow 2460$$

$$50\% \rightarrow 1230$$

$$5\% \rightarrow 123$$

5. 55% of 525

$$\swarrow$$

$$50\% + 5\%$$

$$262.5 + 26.25$$

$$= 288.75 \text{ Ans}$$

$$100\% \rightarrow 525$$

$$50\% \rightarrow 262.5$$

$$5\% = 26.25$$

6. 26% of 1248

$$\swarrow$$

$$25\% + 1\%$$

$$312 + 12.48$$

$$= 324.48 \text{ Ans}$$

$$100\% \rightarrow 1248$$

$$25\% \rightarrow \frac{1}{4} \times 1248 = 312$$

$$1\% = 12.48\%$$