



RRB-NTPC

CBT-I , CBT-II

QUANTITATIVE APTITUDE - I



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Average

Average: A number that express 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

Sol ⁿ : Conceptual Method	Exam Method
$= \frac{237 + 258 + 187 + 322 + 158}{5}$	237, 258, 187, 322, 158
$= \frac{1162}{5}$	Let Avg is 200
$= 232.4 \text{ Ans.}$	$ \begin{array}{cccccc} 237, & 258, & 187, & 322, & 158 \\ \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ +37 & +58 & -13 & +22 & -42 \\ \hline 200 + \frac{162}{5} = 232.4 \end{array} $

Helping Hand

(a) - Let a number nearby these numbers 237, 258, 187, 187, 322, 158.

Let = 200.

(b) - the the, Difference of numbers from 200 With Sign.

+32, +58, -13, +122, -42

Result = 162

(c) - Divide the result by total Count of numbers (5)

$$= \frac{162}{5} = 32.4$$

(d) - Add this Number to assumed number.

= 200 + 32.4

= 232.4 Ans



Average of Consecutive natural numbers Consecutive even number / Consecutive odd numbers having some difference.

= $\frac{\text{First Number} + \text{Last Number}}{2}$

Eg:- Find the average of the natural numbers b/w 3 & 149.

Soln- Natural numbers b/w - 3 & 149.

4, 5 148.

$$= \frac{4 + 148}{2} =$$

= 76 Ans

Find the average of even numbers from 12 to 116.

Soln \rightarrow 12, 14, ----- 114, 116

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

Find the odd numbers b/w 9 & 33.

Soln \rightarrow 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 \rightarrow

$$\begin{array}{ccccccc} 3, & 7, & 11, & \dots & 91, & 95, & 99 \\ \underbrace{\quad}_{4} & \underbrace{\quad}_{4} & & & \underbrace{\quad}_{4} & \underbrace{\quad}_{4} & \\ \end{array}$$

\because 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:

$$= n \frac{(n+1)^2}{4}$$

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:

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

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

$\begin{array}{c} \vee \quad \vee \quad \vee \\ 3 \quad 4 \quad 5 \end{array}$

 $\begin{array}{c} \vee \quad \vee \quad \vee \\ 145 \quad 146 \quad 147 \end{array}$

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

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

Sol:

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

$\begin{array}{c} \vee \quad \vee \\ 4 \quad 8 \end{array}$

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

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:

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

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

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

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

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

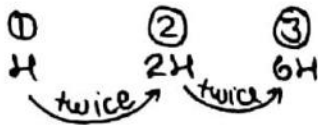
$$\text{avg. of } (m+n) \text{ numbers} = \frac{mn^2 + nm^2}{m+n}$$

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

$$= mn \text{ Ans}$$

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:



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

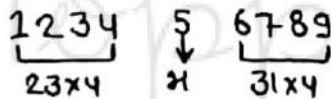
$$\frac{9H}{3} = 147$$

$$H = 49$$

Largest + number = 49×6
 $= 294$ Ans

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:



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

$$92 + H + 124 = 243$$

$$H = 27$$

- Sum of first 4 numbers $23 \times 4 = 92$
- Sum of last four numbers $31 \times 4 = 124$
- Middle Number = H
- 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:

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

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

$$\begin{aligned}
 &(+3 \times 3) + (-4 \times 4) + (5 \times 5) \\
 &= 9 - 16 + 25 = \textcircled{18}
 \end{aligned}$$

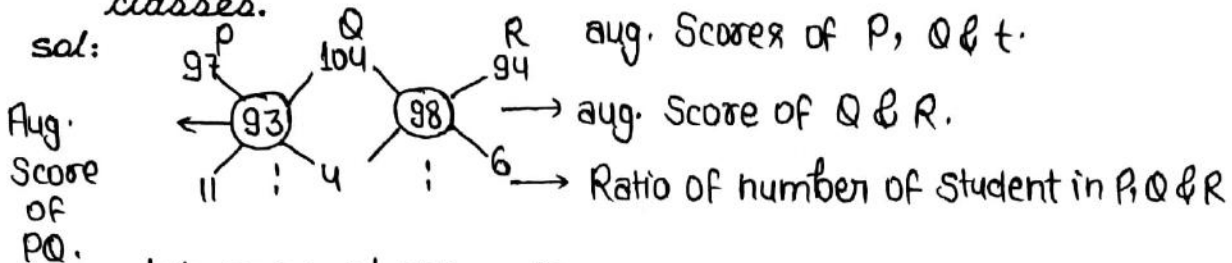
(iv) $\frac{18}{3+4+5}$ (Ratio of Students)

$$= 18/12 = 1.5$$

(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 & 94 respectively. Average score of P & Q is 93 & the average score of Q & R is 98. Find the combined average of all classes.



Let assumed avg = 100

P	Q	R	
97	104	94	
			Use of Allegation Method
	100		
-3	+4	-6	
x11	x4	x6	$\Rightarrow \frac{-53}{11+4+6} \Rightarrow \frac{-53}{21}$
-33+16-36			

Corrected Aug = $100 - 2.5 = 97.5$ 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.

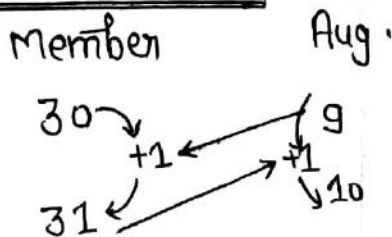
sol: Basic Method

$$\frac{\text{Sum of age of students} + \text{age of teacher}}{\text{total Count}} = \text{New Aug.}$$

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

$H = 40$

Advance Approach



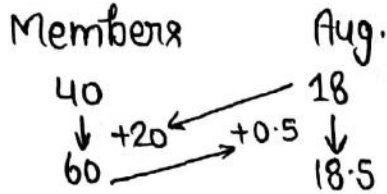
$$\text{Age of teacher} = 9 \times 1 + 31 \times 1 = 40 \text{ yrs.}$$

Helping Hand

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

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

sol:



$$\begin{aligned}
 \text{Sum of new members} &= 18 \times 20 + 60 \times 0.5 \\
 &= 360 + 30 \\
 &= 390 \text{ Ans}
 \end{aligned}$$

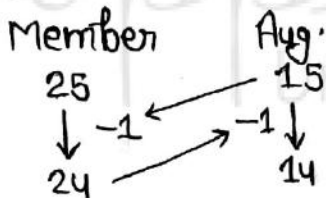
IF Avg. of New members asked = $\frac{390}{20} = 19.5$

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:

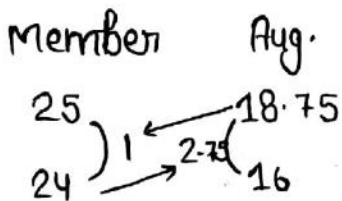


$$= 1 \times 15 + 24 \times 1 = 39 \text{ yrs}$$

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

sol:

Exam method



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

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

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

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

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

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

$1 = 100\%$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

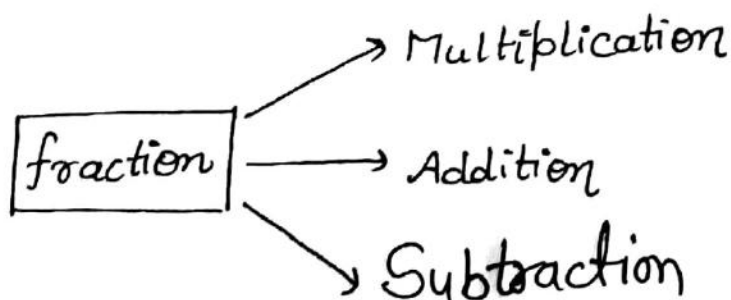
$\frac{5}{8} = 62.5\%$

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

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

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

संजीवनी



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

Multiplication form:

(a) $\frac{1}{7} = 14.28\%$
 $\left(\begin{array}{l} \times \frac{1}{2} \\ \rightarrow \end{array} \right) \frac{1}{14} = 7.14\%$

(b) $\frac{1}{4} = 25\%$
 $\left(\begin{array}{l} \times \frac{1}{2} \\ \rightarrow \end{array} \right) \frac{1}{8} = 12.5\%$
 $\left(\begin{array}{l} \times \frac{1}{2} \\ \rightarrow \end{array} \right) \frac{1}{16} = 6.25\%$

(c) $\frac{1}{8} = 12.5\%$
 $\left(\begin{array}{l} \times \frac{1}{2} \\ \rightarrow \end{array} \right) \frac{1}{16} = 6.25\%$

(d) $\frac{1}{11} = 9.09\%$
 $\left(\begin{array}{l} \times 2 \\ \rightarrow \end{array} \right) \frac{2}{11} = 18.18\%$

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%.

$$\rightarrow 100\% - 9.09\%$$

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

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

(b) 87.5%.

$$\rightarrow 100\% - 12.5\%$$

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

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

(c) 92.86%.

$$\rightarrow 100\% - 7.14\%$$

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

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

Eg:- $\square 1. 28.56\% \text{ of } 35 + 87.5\% \text{ of } 32 = x$

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

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

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

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

$\square 2. 37.5\% \text{ of } 64 + 16.66\% \text{ of } 24 = \sqrt{729} + x$

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

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

$$= 24 + 4 = 27 + x$$

$$\boxed{x = 1}$$

3. 48% of 2434

$$\begin{array}{l} \wedge \\ 50\% - 2\% \end{array}$$

$$= 1217 - 48.68$$

$$= 1168.32 \text{ Ans}$$

$$100\% = 2434$$

$$50\% = 1217$$

$$1\% = 24.34$$

$$2\% = 48.68$$

4. 45% of 2460

$$\begin{array}{l} \wedge \\ 50\% - 5\% \end{array}$$

$$1230 - 123$$

$$= 1107 \text{ Ans}$$

$$100\% \rightarrow 2460$$

$$50\% \rightarrow 1230$$

$$5\% \rightarrow 123$$

5. 55% of 525

$$\begin{array}{l} \wedge \\ 50\% + 5\% \end{array}$$

$$262.5 + 26.25$$

$$= 288.75 \text{ Ans}$$

$$100\% \rightarrow 525$$

$$50\% \rightarrow 262.5$$

$$5\% = 26.25$$

6. 26% of 1248

$$\begin{array}{l} \wedge \\ 25\% + 1\% \end{array}$$

$$312 + 12.48$$

$$= 324.48 \text{ Ans}$$

$$100\% \rightarrow 1248$$

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

$$1\% = 12.48\%$$

7. $67.66\% \text{ of } 3369$

\swarrow
 $66.66\% + 1\%$
 $2246 + 33.69$
 $= 2279.69$ Ans

66.66%

$\hookrightarrow \frac{2}{3} \times 3369$
 $= 2 \times 1123$
 $= 2246$

Brahmastro-2

$x\% \text{ of } y = y\% \text{ of } x$

$\frac{x}{100} \times y = \frac{y}{100} \times x$ Both are same

How it's works :

***56% of 50**

$\rightarrow 56\% \text{ of } 50 = 50\% \text{ of } 56$

\downarrow
 Dimag ko Sochna
 Padega.

\downarrow
 Kuch bhi nahi Sochna,
 Direct

$= 28$ Ans.