yoursmahboob.wordpress.com

# 2 AVERAGES

In MAT, CET, FMS and other entrance exams the questions are directly asked from this chapter and they are very moderate, but in CAT this chapter constitutes a very low proportion of questions *i.e.*, they are rarely asked based on direct formula. As in last 10-12 years on an average 1 question per year has appeared in CAT and each question was almost of applied nature and blended with the logical reasoning.

So, when we said that on an average there was 1 question was asked per year in the last decade (*i.e.*, 10 years), it means we can conclude that almost 10 questions were asked by CAT in the last 10 years.

In general average is the central value of the given data. For example if the heights of three persons $A, B$ and $C$ be 90 cm, 110 cm and 115 cm respectively, then the average height of $A$, $B$ and $C$ together will be $\frac{90+110+115}{3} = 105$ cm.

So we can say that the height of each person viz. $A$, $B$ and $C$ is near about 105 cm. Thus in layman's language it can be said that every one is almost 105 cm tall.

Basically the average is the arithmetic mean of the given data. For example if the $x_1, x_2, x_3, x_4 \ldots x_n$ be any 'n' quantities (*i.e.*, data), then the average (or arithmetic mean) of these '$n$' quantities

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

## PROPERTIES OF AVERAGES

**1.** The average of any two or more quantities (or data) necessarily lies between the lowest and highest values of the given data. *i.e.*, if $x_l$ and $x_h$ be the lowest and highest (or greatest) values of the given data $(x_1, x_2, \ldots x_l, \ldots x_h, \ldots x_n)$ then $x_l <$ Average $< x_h$; $x_l \neq x_h$

$$i.e., \quad x_l < \frac{(x_1 + x_2 + x_3 + x_l \ldots + x_h \ldots + x_n)}{n} < x_h$$

**EXAMPLE 1** *The average of 8, 9, 12, 13, 15, 9 is :*
*(a) 11 (b) 6 (c) 16 (d) 18*

**SOLUTION** From the above mentioned property (1) we can say that options (b), (c) and (d) are invalid since 6, 16, and 18 are out of range *i. e.*, either below 8 (which is the least value) or above 15 (which is the highest value of the data).
So, option (a) can be acceptable only.

**Alternatively :**

$$\text{Average} = \frac{8+9+12+13+15+9}{6} = \frac{66}{6} = 11$$

**EXAMPLE 2** *A has 8 pencils, B has 10 pencils and C has 15 pencils, then the average number of pencils with them :*
*(a) 8 (b) 10*
*(c) 15 (d) lies between 9 and 15*

**SOLUTION** Average number of pencils $= \frac{8+10+15}{3} = 11$

So, option (d) is correct.

**2.** If each quantity is increased by a certain value '$K$' then the new average is increased by $K$.

**EXAMPLE 3** *A, B, C, D, E are the five electronic shops in the Nana market, which have 20, 30, 60, 80 and 50. T.V. sets with them respectively, then the average number of T.V. sets in each shop is :*
*(a) 24 (b) 48 (c) 50 (d) 60*

**SOLUTION** Average number of T.V. sets

$$= \frac{20+30+60+80+50}{5}$$

$$= 48$$

So option (b) is correct.

**EXAMPLE 4** *In the previous example, if each of A, B, C, D and E have imported 12 new T.V. sets, then the average number of T.V. sets is :*
*(a) 50 (b) 56 (c) 60 (d) 144*

**SOLUTION** Average number of T.V. sets

$$= \frac{(20+12)+(30+12)+(60+12)+(80+12)+(50+12)}{5}$$

$$= \frac{300}{5} = 60$$

Compiled By Jasjeet

yoursmahboob.wordpress.com



**Alternatively :**

$$\frac{(20+30+60+80+50)+(12+12+12+12+12)}{5}$$

$$=\frac{(240)+(5\times 12)}{5}=48+12=60$$

Thus, the new average will be 60.

**EXAMPLE 5** *The average number of shirts with Salman, Ambani and Dalmiya is 60, if all of them reached a shopping mall (AMBI) in Gurgaon and purchased 6 shirts each of them then the average number of shirts each of them now has :*

*(a) 66* *(b) 63*
*(c) 62* *(d) can't be determined*

**SOLUTION** Required average = Old average + New average
$= 60 + 6 = 66$

**3.** If each quantity is decreased by a certain value $K$, then the new average is also decreased by $K$.

**EXAMPLE 6** *A, B, C, D, E, F are the only six families in Indira nagar. A, B, C, D, E and F has 7, 8, 10, 13, 6, and 10 members in their families respectively.*
*If 1 member from all the six families left their respective families to accomodate themselves in the hostel of IIM Lucknow, then the average number of members now in each family of Indira nagar is :*

*(a) 8* *(b) 9* *(c) 10* *(d) 13*

**SOLUTION** Required average =

$$\frac{(7-1)+(8-1)+(10-1)+(13-1)+(6-1)+(10-1)}{6}$$

$$=\frac{(7+8+10+13+6+10)}{6}-\frac{(6\times 1)}{6}$$

$$=9-1=8$$

**EXAMPLE 7** *Last year Sahara, Tata, Singhania and Birla each has 250 industries. This year everyone has sold out 10 factories due to the recession of the economy and poor turnout. The average number of industries which each of them now has :*

*(a) 260* *(b) 240*
*(c) 25* *(d) none of these*

**SOLUTION** Required average = Old average – New average
$= (250) - (10) = 240$

**4.** If each quantity is multiplied by a certain value $K$, then the new average is the product of old average with $K$.

**EXAMPLE 8** *In a flower shop there were 6 flowers in each bouquet. If the seller has doubled the number of flowers in each bouquet then the new average of flowers in each bouque is :*

*(a) 12* *(b) 8*
*(c) 3* *(d) none of these*

**SOLUTION** Now required average = Old average × Multiplicand
$= 6 \times 2 = 12$

**5.** If each quantity is divided by a certain quantity '$K$', then the new average becomes $\frac{1}{K}$ times of the initial average, where $K \neq 0$.

**EXAMPLE 9** *The average of 100, 200, 300, 400, ..., 1000 is 550. If each number is divided by 5, then the new average will be equal to :*

*(a) 450* *(b) 45*
*(c) 55* *(d) none of these*

**SOLUTION** Actual average

$$=\frac{(100+200+300+\ldots+1000)}{10}=550$$

the new average $=\frac{550}{5}=110$

Hence, (d) is correct.

**6.** If '$A$' be the average of $x_1, x_2, x_m, \ldots y_1, y_2, \ldots, y_n$. where $x_1, x_2, \ldots, x_m$ be the below $A$ and $y_1, y_2, y_3, \ldots, y_n$ be the above $A$, then

$$(A-x_1)+(A-x_2)+\ldots(A-x_m)$$
$$=(y_1-A)+(y_2-A)+\ldots(y_n-A)$$

*i.e.*, the surplus above the average is always equal the net deficit below average.

**EXAMPLE 10** *The salary of A, B, C, D, E is Rs. 8000, Rs. 5000, Rs. 11000, Rs. 7000, Rs. 9000 per month respectively, then the average salary of A, B, C, D and E per month is :*

*(a) Rs. 7000* *(b) Rs. 8000*
*(c) Rs. 8500* *(d) Rs. 9000*

**SOLUTION** Average salary

$$=\frac{8000+5000+11000+7000+9000}{5}$$

= Rs. 8000

**NOTE** The average salary = Rs. 8000
and the sum of salaries above Rs. 8000 = 11000 + 9000
= 20,000

Therefore, the average surplus $=\left(\frac{20000}{2}\right)-8000=2000$

again, the sum of salaries below Rs. 8000 = 5000 + 7000
= 12,000

Therefore, the average deficit $=8000-\left(\frac{12000}{2}\right)=2000$

Hence the surplus above the average
= deficit below the average = 2000

**Alternatively :** Let the average be 10,000

Then,

10,000 – 8,000 = 2,000
10,000 – 5,000 = 5,000
10,000 – 7,000 = 3,000 and 11,000 – 10,000 = 1,000
10,000 – 9,000 = 1,000 Surplus = 1,000
Deficit → 11000

∴ Net difference = Surplus – deficit
= 1,000 – 11,000 = – 10,000

∴ Average variation $=\frac{-10,000}{5}=-2000$

Hence, the actual average = assumed average
+ average variation
= 10,000 – 2,000 = 8,000

Compiled By Jasjeet

yoursmahboob.wordpress.com



**EXAMPLE 11** *The average of 6 numbers 13, 17, 25, 11, 26, 10 is :*
*(a) 20 (b) 17 (c) 15 (d) 25*

**SOLUTION** Let the average be 20.

then $20 - 13 = 7$, $20 - 17 = 3$, $20 - 11 = 9$, $20 - 10 = 10$ — $\underline{29}$ (deficit)

and $20 - 25 = 5$, $20 - 26 = 6$ — $\underline{11}$ (Surplus)

The net difference (surplus – deficit) = $(11 - 29) = -18$

Therefore average variation $= \frac{-18}{6} = -3$

Hence, the actual average $= 20 + (-3) = 17$

**NOTE** This method is very helpful in Data Interpretation section where there are very large values are to be calculated and most of the time we need just the lumpsum value.

**7. Weighted average :** When the average of groups or sets, instead of individuals, having different number of elements is being calculated, then it is called the weighted average. Since in this case the number of elements is different for the different sets thus they carry different weightage. If the number of elements in $n$ different groups be $K_1, K_2, K_3, K_4, \ldots, K_n$ and the averages of the respective groups be $A_1, A_2, A_3, A_4 \ldots A_n$ then the

$$\text{weighted average} = \frac{K_1A_1 + K_2A_2 + K_3A_3 + \ldots K_nA_n}{K_1 + K_2 + K_3 + \ldots K_n}$$

**EXAMPLE 12** *The average salary of 12 employees of STAR plus is Rs. 18,000 per month and 15 employees of NDTV is Rs. 16,000 per month. The average salary of all the 27 employees is :*
*(a) Rs. 17,000 (b) Rs. 16,500*
*(c) Rs. 16,888.88 (d) none of these*

**SOLUTION** Required average salary =

$$\frac{12 \times 18{,}000 + 15 \times 16{,}000}{12 + 15} = \frac{4{,}56{,}000}{27} = \text{Rs. } 16{,}888.88$$

**EXAMPLE 13** *The number of students at i 4 IIM in morning batch, evening batch and weekends batch is 30, 40 and 60 respectively and their respective averages ages (in years) are 22, 21 and 25, then the average age of all the students (combined) is :*
*(a) $22\frac{1}{13}$ years (b) $23\frac{1}{13}$ years*
*(c) 24.5 years (d) none of these*

**SOLUTION** $\frac{30 \times 22 + 40 \times 21 + 60 \times 25}{130} = \frac{3000}{130} = 23\frac{1}{13}$ years

**8. Problems based on ages :**

(i) If the average age of '$n$' members of a family is $x$ years then $K$ years back, the average age of the family is $(x - K)$ years, provided that no any person is expired or born in $K$ years period.

(ii) If the present age of '$n$' members of a family is $x$ years then $K$ years later the average age of the same family will be $(x + K)$ years.

**EXAMPLE 14** *The average age of 7 members of Patel's family is 25 years. The average age of the same family 3 years ago was :*
*(a) 21 years (b) 22 years*
*(c) 25 years (d) none of these*

**SOLUTION** Present average age of family = 25 years

3 years ago average age of family = 25 – 3 = 22 years

**EXAMPLE 15** *The average age of all the 16 professors of Lucknow University is 52 years. Four years later the average age of all the 16 professors will be, if there is no any retirement or recruitment :*
*(a) 68 (b) 64*
*(c) 56 (d) none of these*

**SOLUTION** Present average age = 52 years

4 years later the average age = 52 + 4 = 56 years

**EXAMPLE 16** *6 months ago the present age of the student of class $10^{th}$ was 14 years. 6 months hence, the age of the same students will be :*
*(a) 15 years (b) $15\frac{1}{2}$ years*
*(c) 20 years (d) none of these*

**SOLUTION** Since the time difference between two dates is 1 year, hence the average age will be increased by 1 year.

Thus the average age of the class 6 months hence will be 15 years.

**EXAMPLE 17** *The average age of Priyambada's family consisting of 5 members 3 years ago was 35 years. One year ago a new baby was born in this family. Three years hence the average age of the family will be :*
*(a) 36 years (b) $34\frac{5}{6}$ years*
*(c) $35\frac{4}{5}$ years (d) none of these*

**SOLUTION** 3 years ago total age of 5 members

$= 5 \times 35 = 175$ years

At the time of birth of new baby the total age of family

$= 175 + (2 \times 5)$

$= 185$ years

The present age of family $= 185 + (1 \times 6) = 191$ years

3 years hence, the average age of family

$$= \frac{191 + (3 \times 6)}{6} = 34\frac{5}{6} \text{ years}$$

**EXAMPLE 18** *10 years ago the average age of all the 25 teachers of the Girls college was 45 years. 4 years ago, the principal has retired from her post at the age of 60 year. So after one year a new principal whose age was 54 years recruited from outside. The present average age of all the teachers is, if principal is also considered as a teacher :*
*(a) $54\frac{18}{25}$ years (b) $55\frac{17}{25}$ years*
*(c) $49\frac{1}{2}$ years (d) none of these*

**SOLUTION** 10 years ago average age of 25 teachers = 45 years

4 years ago (just before the reteriment of principal) average age of 25 teachers = 45 + 6 = 51 years

and the same time total age of 25 teachers = 51 × 25

= 1275 years

Compiled By Jasjeet

yoursmahboob.wordpress.com



and the total age of remaining 24 teachers when just the principal has retired

$= 1275 - 60 = 1215$ years

1 year later (*i.e.*, 3 years ago from present) total age of 24 teachers (just before the recruitment of new principal)

$= 1215 + (1 \times 24) = 1239$ years

and the total age of 25 teachers including new principal just after the recruitment

$= 1239 + 54 = 1293$ years

Thus the present age of all the 25 teachers

$= 1293 + (3 \times 25) = 1368$ years

Hence, the present average age of the 25 teachers

$$= \frac{1368}{25} = 54\frac{18}{25} \text{ years}$$

**Alternatively :** 10 years ago, the average age of 25 teachers $= 45$ years

Let us assume that the principal has not retired from her post then the present average age of all the 25 teachers,

$= 45 + 10 = 55$ years

Thus the total age of all the 25 teachers

$= 55 \times 25 = 1375$ years

Now assume that the new principal has replaced the old principal 4 years ago instead of 3 years ago, when the age of new principal would have been 53 years. Thus the age of new principal was 7 years less than the age of old principal, which results in the reduction of total age of the group of 25 teachers by 7 years.

Thus the actual total age of the 25 teachers (presently)

$= 1375 - 7 = 1368$ years

Hence, the present average age of the 25 teachers

$$= \frac{1368}{25} = 54\frac{18}{25} \text{ years}$$

**EXAMPLE 19** *The ratio of the ages of the father and the daughter at present is 3 : 1. Four years ago the ratio was 4 : 1. The average age of the father and daughter 2 years hence will be :*

*(a) 24 (b) 26 (c) 25 (d) 36*

**SOLUTION** Let the present ages of father be $3x$ and daughter be $x$.

So the 4 years ago father's age and daughter's age was $(3x - 4)$ and $(x - 4)$

Therefore $\left(\frac{3x-4}{x-4}\right) = \frac{4}{1}$

$\Rightarrow \quad x = 12$ years and $3x = 36$ years

Hence, the present average age of father and daughter $= 24$ years and the average age 2 years hence will be 26 years.

## 9. Problems based on income/salary

Income = Expenditure + Savings

**EXAMPLE 20** *The average salary of Rajesh, Bahadur and Amir is Rs. 8000 per month. The average expenditure of the Rajesh, Bahadur and Amir per month is Rs. 5000. The average savings of all the 3 persons per month is :*

*(a) Rs. 3000 (b) Rs. 5000*
*(c) Rs. 2500 (d) Rs. 9000*

**SOLUTION** Average saving

= Average Income – Average Expenditure

$= 8000 - 5000 = 3000$

**EXAMPLE 21** *The average salary of A, B and C is Rs. 10,000 and average expenditure of A is Rs. 6000 then the average savings of B and C is :*

*(a) Rs. 5500 (b) Rs. 4500*
*(c) Rs. 4000 (d) can't be determined*

**SOLUTION** Total income = Total Expenditure + Total savings

We can not find the average savings of $B$ and $C$, since data is insufficient.

**EXAMPLE 22** *The average salary of A, B is Rs. 6000 and that of C, D and E is Rs. 8000. The average salary of all the 5 people is :*

*(a) Rs. 7200 (b) Rs. 7000*
*(c) Rs. 7500 (d) can't be determined*

**SOLUTION** Required average salary =

$$\frac{6000 \times 2 + 8000 \times 3}{(2+3)} = \frac{36000}{5} = \text{Rs. } 7200$$

**EXAMPLE 23** *The average salary of all the 60 employees in an office is Rs. 12,000 per month. If the number of executives is twice the number of non executive employees, then the average salary of all the non executive employees is :*

*(a) Rs. 9000 (b) Rs. 8000*
*(c) Rs. 6000 (d) can't be determined*

**SOLUTION** $\frac{\text{No. of executives}}{\text{No. of non-executives}} = \frac{2}{1}$

Therefore number of executives = 40

and number of non-executive employees = 20

Now, go through the options

Total salary = 40 × salary of executive + 20 × salary of non-executive

$60 \times 12000 = 40 \times k + 20 \times l$, here $k$, $l$ are unknowns

So we can't determine the required average salary.

**EXAMPLE 24** *In the above problem, if the average salary of non-executives be $\frac{2}{5}$th of the average salary of executives, then the average salary of non-executive employees is :*

*(a) Rs. 9000 (b) Rs. 8000*
*(c) Rs. 6000 (d) data insufficient*

**SOLUTION** By options : $60 \times 12000 = 20 \times 6000 + 40 \times 15000$

Hence option (c) is correct.

**Alternatively :** $60 \times 12000 = 20 \times x + 40 \times \frac{5}{2}x$

$\Rightarrow \quad x = 6000$

## 10. Problems based on speed, time and distance :

**Case 1:** When the distance travelled in different time slots or parts is same *i.e.*, if a person or vehicle moves $x$ km at a speed of $u$ km/hr and further he goes or comes back the same distance $x$ km at a speed of $v$ km/hr. Then the average speed $= \frac{2uv}{(u+v)}$.

If there are 3 parts of distance $x$ km travelled with 3 different speeds *i.e.*, if a person goes first $x$ km @ speed of $u$ km/hr and next $x$ km @ $v$ km/hr and the last $x$ km @ $w$ km/hr.

Then the average speed $= \frac{3uvw}{(uv + vw + wu)}$.

Compiled By Jasjeet

yoursmahboob.wordpress.com



**NOTE** In this type of questions the average speed is independent of the distance travelled.

**General Formula :** Average speed $= \dfrac{\text{Total distance}}{\text{Total time}}$

The above two formulae are derived with the help of the general formula of average speed.

**Proportion Method :** If the half of the distance is covered at $u$ km/hr and the rest half of the journey is covered at $v$ km/hr then the average speed can be found as follows :

**Step 1.** Divide the difference of $u$ and $v$ in the ratio of $u : v$ (where $u < v$)

**Step 2.** $u + \dfrac{(u \sim v) \times u}{(u+v)}$

or $v - \dfrac{(u \sim v)\, v}{u+v}$

**Case 2.** When the distances travelled at different speeds are different then we calculate the average speed with the help of general formula of average speed. *e.g.*, A person first goes $x_1$ km at the speed of $u$ km/hr and $x_2$ km at the speed of $v$ km/hr and $x_3$ km at the speed of $w$ km/hr and so on, then the

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

$$= \frac{x_1 + x_2 + x_3 + \ldots}{t_1 + t_2 + t_3 + \ldots}$$

$$= \frac{x_1 + x_2 + x_3 + \ldots}{\dfrac{x_1}{u} + \dfrac{x_2}{v} + \dfrac{x_3}{w} + \ldots}$$

**EXAMPLE 25** *Einstien goes from Ahmedabad to Lucknow at the speed of 40 km/hr and returned at the speed of 60 km/hr. The average speed of Einstien during the whole journey is :*

*(a) 48 km/hr* *(b) 24 km/hr*
*(c) 50 km/hr* *(d) none of these*

**SOLUTION** $\dfrac{2 \times 40 \times 60}{(40+60)} = \dfrac{4800}{100} = 48$ km/hr

**Alternatively:** $40 \xleftrightarrow{20} 60$, $\downarrow 2$, $\downarrow 3$

So the average speed $= 40 + \dfrac{2}{5}(20) = 48$ km/hr

or Average Speed $= 60 - \dfrac{3}{5}(20) = 48$ km/hr

**EXAMPLE 26** *Sri Krishna took the chariot and started his journey from Mathura to Gokul by his chariot at the speed of 40 km/hr and then, the same distance he travelled on his foot at the speed of 10 km/hr from Gokul to Brindaban. Then he returned from Brindaban to Mathura via Gokul at the speed of 24 km/hr riding on the horse. The average speed of the whole trip is :*

*(a) 20 km/hr* *(b) 25 km/hr*
*(c) 19.2 km/hr* *(d) 18.5 km/hr*

**SOLUTION** Since the distance from Mathura to Gokul is same as that of Gokul to Brindaban.

So the average speed from Mathura to Brindaban

$$= \frac{2 \times 40 \times 10}{(40+10)} = 16 \text{ km/hr}$$

Again since he returned on the same path, so the distance from Mathura to Brindaban is same in both the directions. Thus the required average speed $= \dfrac{2 \times 16 \times 24}{(16+24)} = 19.2$ km/hr

**EXAMPLE 27** *Anoop travels first $\frac{1}{3}$rd of the total distance at the speed of 10 km/hr and the next $\frac{1}{3}$rd distance at the speed of 20 km/hr and the last $\frac{1}{3}$rd distance at the speed of 60 km/hr. The average speed of Anoop is :*

*(a) 15 km/hr* *(b) 18 km/hr*
*(c) 25 km/hr* *(d) 30 km/hr*

**SOLUTION** Since all the three distances are same, hence the average speed

$$= \frac{3 \times 10 \times 20 \times 60}{(200 + 1200 + 600)} \qquad \left(= \frac{3uvw}{uv + vw + wu}\right)$$

$$= \frac{36000}{2000} = 18 \text{ km/hr}$$

**EXAMPLE 28** *Columbus started his journey from Lucknow to Kolkata, which is 200 km, at the speed of 40 km/hr then he went to Bangalore which is 300 km, at the speed of 20 km/hr. Further he went to Ahmedabad which is 500 km, at the speed of 10 km/hr. The average speed of Columbus is :*

*(a) $14\frac{2}{7}$ km/hr* *(b) $14\frac{5}{7}$ km/hr*
*(c) 15.6 km/hr* *(d) none of these*

**SOLUTION** Average speed $= \dfrac{\text{Total distance}}{\text{Total time}}$

$$= \frac{(200 + 300 + 500)}{\left(\dfrac{200}{40} + \dfrac{300}{20} + \dfrac{500}{10}\right)}$$

$$= \frac{1000}{70} = \frac{100}{7} = 14\frac{2}{7} \text{ km/hr}$$

$$= 14.2857 \text{ km/hr}$$

## 11. Some Important Concepts

**1.** $a + b = k$ and $b + c = l$ and $a + b + c = m$

then $[(a+b) + (b+c)] - (a+b+c) = (k+l) - m$

or $b = k + l - m$

**2.** $a + b = k$, $d + e = l$ and $a + b + c + d + e = m$

then $c = (a + b + c + d + e) - [(a+b) + (d+e)]$

$= m - [k + l]$

**EXAMPLE 29** *The average weight of all the 11 players of Indian cricket team is 50 kg. If the average of first six lightest weight players is 49 kg and that of the six heaviest players is 52 kg. The average weight of the player which lies in the sixth position in the list of players when all the 11 players are arranged in the order of increasing or decreasing weights :*

*(a) 56 kg* *(b) 52 kg*
*(c) 51 kg* *(d) none of these*

Compiled By Jasjeet

yoursmahboob.wordpress.com





**SOLUTION** Let $A, B, C, D, E, F, G, H, I, J, K$ be the 11 players in the order of increasing weight then,

$$A + B + C + D + E + F = 49 \times 6 = 294$$
$$F + G + H + I + J + K = 52 \times 6 = 312$$
$$\text{and } A + B + C + D + E + F + G + H + I + J + K = 50 \times 11 = 550$$

Therefore $F = (A + B + C + D + E + F) + (F + G + H + I + G + K) - (A + B + C + D + \ldots J + K)$
$= 294 + 312 - 550 = 56$

Hence the average weight of $F = 56$ kg.

**EXAMPLE 30** *The average presence of students in a class on Monday, Tuesday and Wednesday is 30 and on the Wednesday, Thursday, Friday and Saturday is 28 then number of students who attended the class on Wednesday is, if the average number of students on all the six days is 27 :*

*(a) 24 (b) 25 (c) 20 (d) 40*

**SOLUTION** Since $W = (M + T + W) + (W + Th + F + S) - (M + T + W + Th + F + S)$
$= (30 \times 3) + (28 \times 4) - (27 \times 6)$
$= 202 - 162 = 40$

**EXAMPLE 31** *The average age of A, B, C, D and E is 40 years. The average age of A and B is 35 years and the average age of C and D is 42 years. The average age of E is :*

*(a) 46 (b) 48*
*(c) 32 (d) none of these*

**SOLUTION** $A + B + C + D + E = 40 \times 5 = 200$
$A + B = 35 \times 2 = 70$
$C + D = 42 \times 2 = 84$

Therefore $E = (A + B + C + D + E) - [(A + B) + (C + D)]$
$= 200 - (70 + 84) = 46$

Thus the average age of $E = 46$ years.

**EXAMPLE 32** *The average temperature on Monday, Tuesday and Wednesday is 38°C. The average temperature on Tuesday, Wednesday and Thursday is 43°C. If the average temperature on Monday and Thursday is 18.5°C. The average temperature on Monday is :*

*(a) 11°C (b) 21°C (c) 35°C (d) 27°C*

**SOLUTION** $(M + T + W) = 38 \times 3 = 114$ ...(i)
$(T + W + Th) = 43 \times 3 = 129$ ...(ii)

Therefore $Th - M = 15$ [(ii) – (i)]
and $Th + M = 37$

Thus the temperature on Monday is 11°C and on Thursday is 26°C.

**12. Average of Some Important Series of Numbers :**

(i) Average of first '$n$' natural numbers $= \frac{n+1}{2}$

(ii) Average of first '$n$' even numbers $= (n+1)$

(iii) Average of first '$n$' odd numbers $= n$

(iv) If there are $(p+q)$ elements in a set or group but the average of $p$ elements is $r$ and the average of $q$ elements is $s$, then the average of all the elements of the set (or group) is $\frac{(pr+sq)}{(p+q)}$.

Compiled By Jasjeet

yoursmahboob.wordpress.com

# EXERCISE

## LEVEL 1

1. The average weight of a class of 20 students is 45 kgs. A new student whose weight is 40 kgs replaces an old student of this class. Hence, the average weight of the whole class decreases by 1 kg. The weight of the replaced student is :
(a) 55 kgs (b) 50 kgs
(c) 60 kgs (d) none of these

2. The average length of first 3 fingers is 3 inches and the average length of the other 2 fingers *i.e.*, thumb and the index finger is 2.8 inches. If the length of the index fingers is 3 inches then the length of the thumb is :
(a) 2 inches (b) 2.6 inches
(c) 3 inches (d) none of these

3. Three types of rice whose rates are Rs. 38, Rs. 43 and Rs. 49 per kg are blended together to make a 15 kg of new blend of rice in which there are 8 kgs, 4 kgs 3 kgs of the respective types of rice. The average price of the new blend of rice is :
(a) Rs. 41.53 (b) Rs. 43
(c) Rs. 40 (d) Rs. 43.3

4. Pankaj went to the post-office at the speed of 60 km/hr while returning for his home he covered the half of the distance at the speed of 10 km/hr, but suddenly he realized that he was getting late so he increased the speed and reached the home by covering rest half of the distance at the speed of 30 km/hr. The average speed of the Pankaj in the whole length of journey is :
(a) 5.67 km/hr (b) 24 km/hr
(c) 22.88 km/hr (d) 5.45 km/hr

5. 123 typists typed 984 papers in 1/15 hour. The number of papers typed per minute by an average typist is :
(a) 1 (b) 2
(c) 3 (d) 5

6. The cost of the Red, Green and Blue colours per kg is Rs. 20, Rs. 15 and Rs. 18 respectively. Rang Mahal is a renowned building in which these three colours are being used in the ratio of 3 : 2 : 4. The average cost of all the three colours used per kg is :
(a) 18 (b) 20
(c) 17.66 (d) can't be determined

7. Rajeev earns 3/2 times in January, April, July and October than his average earning of Rs. 600 per month in the rest of the months. So his savings in the January, April, July and October goes to 5/4 times that of the rest months saving of Rs. 400 per month in the year. The average expenditure of per month is :
(a) Rs. 266.66 (b) Rs. 250
(c) Rs. 233.33 (d) Rs. 433.33

8. The average of 3 prime numbers lying between 47 and 74 is 191/3. The greatest possible difference between any two out of the 3 prime numbers is :
(a) 12 (b) 14
(c) 18 (d) can't be determined

9. The average of 9 numbers is 11. If each of these 9 numbers is multiplied by 5 and then 5 is added to each of these resultant numbers, then the new average is :
(a) 20 (b) 30
(c) 60 (d) 50

10. The average score of Dhoni after 48 innings is 48 and in the 49th innings Dhoni scores 97 runs. In the 50th innings the minimum number of runs required to increase his average score by 2 than it was before the 50th innings :
(a) 99 (b) 149
(c) 151 (d) can't be determined

11. The average age of Sachin and Ganguli is 35 years. If Kaif replaces Sachin, the average age becomes 32 years and if Kaif replaces Ganguli, then the average age becomes 38 years. If the average age of Dhoni and Irfan be half of the average age of Sachin, Ganguli 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

12. Out of these five people (in question no. 11) whose age is the greatest?
(a) Sachin (b) Ganguli
(c) Kaif (d) can't be determined

13. In a village the average age of $n$ people is 42 years. But after the verification it was found that the age of a person had been considered 20 years less than the actual age, so the new average, after the correction, increased by 1. The value of $n$ is :
(a) 21 (b) 20
(c) 22 (d) none of these

14. The average rainfall in the months of January and February is 6 cm and in the months of March to June is 5 cm and July to October is 10 cm and in the November and December, it is 6 cm. The average rainfall for the whole year is :
(a) 7 (b) 5.5
(c) 7.5 (d) none of these

15. On an average 300 people watch the movie in Sahu Cinema hall on Monday, Tuesday and Wednesday and the average number of visitors on Thursday and Friday is 250. If the average number of visitors per day in the week be 400, then the average number of people who watch the movie in weekend (*i.e.*, on Saturday and Sunday) is :

Compiled By Jasjeet

yoursmahboob.wordpress.com


(a) 500 (b) 600
(c) 700 (d) none of these

16. The average weight of 11 players of Indian cricket team is increased by 1 kg, when one player of the team weighing 55 kg replaced by a new player. The weight of the new player is :
(a) 55 kg (b) 64 kg
(c) 66 kg (d) none of these

17. The average age of a family of 6 members 4 year ago was 25 years. Mean while a child was born in this family and still the average age of the whole family is same today. The present age of the child is :
(a) 2 years (b) $1\frac{1}{2}$ years
(c) 1 year (d) data insufficient

18. Amitabh's average expenditure for the January to June is Rs. 4200 and he spends Rs. 1200 in January and Rs 1500 in July. The average expenditure for the months of February to July is :
(a) Rs. 4250 (b) Rs. 4520
(c) Rs. 4060 (d) none of these

19. The average of $a$, 11, 23, 17 is 15 and the average of $a$, $b$, 12, 25 is 16. The value of $\frac{a}{b}$ is :
(a) 1/3 (b) 1/2
(c) 2/3 (d) 3/4

20. The average salary is being paid to all its employees by the Biotech corporation is Rs. 15,500. The average salary of the senior employees is Rs. 18000 per month and the average salary of the junior employees is Rs. 12,000 per month. If there are only two levels of employees viz junior and senior level, then what fraction of the total employees is the junior level employees are :
(a) $\frac{7}{10}$ (b) $\frac{5}{12}$
(c) 5/10 (d) none of these

21. The average of any 5 consecutive odd numbers $a$, $b$, $c$, $d$, $e$ is :
(a) $\frac{(abcde)}{5}$ (b) $\frac{bd}{3}$
(c) $\left(\frac{a+c+e}{5}\right)$ (d) none of these

22. The average age of 30 students of a class is 30 years. When the average age of class teacher is also included, the average age of the whole class increases by 1 year. The age of the class teacher is :
(a) 31 years (b) 60 years
(c) 61 years (d) none of these

23. There were five sections in MAT paper. The average score of Pooja in first 3 sections was 83 and the average in the last 3 sections was 97 and the average of all the sections (*i. e.*, whole paper) was 92, then her score in the third section was :
(a) 85 (b) 92
(c) 88 (d) none of these

24. The average age of 18 pupils of Dronacharya was 25 years. If the age of Dronacharya was also included, the average age of 19 people becomes 26 years. The average age of the Dronacharya at that time was :
(a) 33 (b) 44
(c) 50 (d) 51

25. The average of 7 consecutive odd numbers if the smallest of those numbers is denoted by $k$ :
(a) $k+4$ (b) $k+7$
(c) $k+6$ (d) $7k$

26. If the average marks of $\frac{1}{4}$th class is 85% and that of $\frac{1}{3}$rd class is 70% and the average marks of the rest class is 56%, then the average of the whole class is (for the given subjects) :
(a) 67.916% (b) 72.33%
(c) 69.165% (d) can't be determined

27. The average length of any four fingers of my left hand is 600 mm. Then the average length of all the five fingers of my left hand is :
(a) 800 mm (b) 750 mm
(c) 480 mm (d) can't be determined

28. The average of $4\frac{3}{5}, 2\frac{2}{3}, 6\frac{8}{9}, 7\frac{7}{15}, 3\frac{5}{9}$ is :
(a) $5\frac{3}{225}$ (b) $5\frac{8}{225}$
(c) $6\frac{3}{45}$ (d) $25\frac{8}{45}$

29. The average of 1000.0001, 100.001, 10.01, 1.1 is :
(a) 277.777 (b) 322.222
(c) 11.11 (d) 233.333

30. The average of 7 consecutive numbers which are positive integers is 10. The average of lowest and highest such numbers is :
(a) 7 (b) 10
(c) 15 (d) data insufficient

31. The average of first 100 natural number is :
(a) 100 (b) 50
(c) 50.50 (d) 55

32. The average of first 50 odd natural numbers is :
(a) 50 (b) 55
(c) 51 (d) 101

33. The average of first 99 even numbers is :
(a) 9999 (b) 100
(c) 9801 (d) 9009

34. The average of $a$, $b$ and $c$ is 79 and the average of $a$ and $c$ is also 79. Then the value of $b$ is :
(a) 0 (b) 79
(c) $-79$ (d) none of these

35. The average value of property of Mittal, Ambani and Singhania is Rs. 11111 crore. The property of Singhania is as less as the property of Mittal is greater than the average property of both the Singhania and Mittal. The value of property of Ambani is :
(a) Rs. 111 crore (b) Rs. 11111 crore
(c) Rs. 3703.7 crore (d) can't be determined

36. I went to Delhi @ speed of 200 km/hr but suddenly I returned to the same place @ speed of 600 km/hr. What is my average speed :
(a) 300 km/hr (b) 400 km/hr
(c) 366.66 km/hr (d) none of these

37. The average of $A$ and $B$ is 400 and the average of $C$ and $D$ is 600 the average of $A$, $B$, $C$ and $D$ is :
(a) 500 (b) 450
(c) 525 (d) 625

Compiled By Jasjeet

yoursmahboob.wordpress.com





**38.** The average weight of liquid in 100 bottles is 500 gm. The total weight of all the bottles is 20 kg. The average weight of a bottle with liquid is :
(a) 0.65 kg (b) 0.7 kg
(c) 70 ml (d) none of these

**39.** The average score of Sehwag in 10 innings was 77 runs. In the $11^{th}$ innings he had scored zero runs. The overall average score of Sehwag in all the 11 innings was :
(a) 77 (b) 7.7
(c) 11 (d) none of these

**40.** The average age of 3 children of Arihant Singh is 12 years and their ratio of ages is 3 : 4 : 5. The average age of the youngest and eldest child is if he had only 3 children :
(a) 12 (b) 21
(c) 8 (d) 9

**41.** The average income of all the Infosys employees is Rs. 20,000 per month. Recently the company announced the increment of Rs. 2,000 per month for all the employees. The new average of all the employees is :
(a) Rs. 22,000 (b) Rs. 40,000
(c) Rs. 22,00 (d) data insufficient

**42.** The average age of 10 students in a class is 20 years, if a new student is also included, then the new average age of all the students increases by 1 year. The age of the new student is :
(a) 21 years (b) 30 years
(c) 31 years (d) none of these

**43.** The average weight of 20, four wheelers is 180 kg. If an old car is removed from this group of four wheelers, the new average weight decreases by 2 kg. The weight of the removed car is :
(a) 220 (b) 218
(c) 182 (d) none of these

**44.** The average price of 3 diamonds of same weights is Rs. 5 crore, where the average price of the two costliest diamonds is double the price of the cheapest diamond. The price of the cheapest diamond is :
(a) 3 crore (b) 5 crore
(c) 1.66 crore (d) can't be determined

**45.** In the previous question, the price of the costliest diamond is :
(a) 5 crore (b) 6 crore
(c) 8 crore (d) can't be determined

**46.** Praveen gets 40 marks out of 50 in Computer Science, 70 out of 100 in Manufacturing science and 142 out of 150 in proffessional communication. The average marks of Praveen (in percent) in all the three subjects is :
(a) 84% (b) 76%
(c) 71% (d) 60%

**47.** The average of all the prime and composite numbers upto 100 is :
(a) 51 (b) 49.50
(c) 50.50 (d) 55

**48.** The average of all the perfect squares upto 100 is :
(a) 38.5 (b) 1000
(c) 100 (d) 385

**49.** The average of all the non-negative integers upto 99 is :
(a) 50.49 (b) 49.50
(c) 50.50 (d) 99

**50.** The average of 7, 14, 21, 28 ... 77 is :
(a) 7 (b) 11
(c) 42 (d) 66

**51.** The average weight of $A$, $B$, $C$ and $D$ is 40 kg. A new person $E$ is also included in the group, then the average weight of the group is increased by 1 kg. Again a new person $F$ replaces $A$, then the new average of 5 persons becomes 42. The average weight of $B$, $C$, $D$, $F$ is :
(a) 42 (b) 41.25
(c) 42.5 (d) none of these

**52.** The average of 3 consecutive natural numbers (which are in increasing order) is $k$. If two more consecutive number, just next the first set of numbers, is added, then the new average becomes :
(a) $k + 2$ (b) $k + 1$
(c) $\frac{2k+1}{2}$ (d) $2k - 1$

**53.** 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) $k + 2$

**54.** The average weight of the 5 officers of a regiment is 42 kg. If a senior officer was replaced by a new officer and thus the average increased by 500 gm, the weight of the new officer is :
(a) 44.5 kg (b) 45 kg
(c) 42.5 kg (d) none of these

**55.** The average age of 6 servants in my farm house is 28 years. A new and young servant replaces an old servant, then the new average reduces by 1 year, the age of the new servant is :
(a) 26 years (b) 22 years
(c) 35 years (d) can't be determined

**56.** In the above question (no. 55) if the age of the replaced servant was 31 years, then the age of the new servant is :
(a) 25 years (b) 35 years
(c) 24 years (d) none of these

**57.** The average income of $A$, $B$ and $C$ is Rs. 12,000 per month and the average income of $B$, $C$ and $D$ is Rs. 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 Rs.) :
(a) 8,000 (b) 18,000
(c) 13,500 (d) 9,000

**58.** The average price of 80 computers in an electronic shop is Rs. 30,000. If the highest and lowest price computers are sold out then the average price of the remaining 78 computers is Rs. 29,500. The cost of the highest price computer is Rs. 80,000. The cost of lowest price computer is :
(a) Rs. 19,000 (b) Rs. 20,000
(c) Rs. 29,000 (d) can't be determined

**59.** A has 50 coins of 10 paise denominations. While $B$ has 10 coins of 50 paise denominations. $C$ has 20 coins of 25 paise denominations while $D$ has 25 coins of 20 paise denominations. The average number of paise per person is :
(a) 450 paise (b) 500 paise
(c) 600 paise (d) can't be determined

Compiled By Jasjeet

yoursmahboob.wordpress.com


60. A travel agency has three types of vehicles viz. four seater, autorickshaw, 10 seater maxi cab and 20 seater minibus. The rate of each passanger (irrespective of its age or weight or seniority) for the auto rickshaw is Rs. 12 and for the maxicab is Rs. 15 and for the minibus is Rs. 8 for the one round. The average occupancy of the seats is 100%, 80% and 75% respectively. If he has only one vehicle of each kind, then the average earning for one round of each vehicle is :
(a) Rs. 96 (b) Rs. 90
(c) Rs. 86 (d) Rs. 70

## LEVEL 2

1. A train normally covers a certain distance at a speed of 60 km/hr. However, if it were to halt for a fixed time interval in each hour its average speed reduced to 50 km/hr. What is the time interval for which the train halt in each hour?
(a) 10 minutes (b) 20 minutes
(c) 6 minutes (d) 12 minutes

2. 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

3. Progressive express left for New Delhi, increasing its speed in each hour. It started its journey from Lucknow, but after four hours of its journey it met with accident. Its speed in the fourth hour was $\frac{7}{5}$ times that of the third hour and the speed in the third hour was $\frac{10}{7}$ times that of the second hour and in the second hour it was $\frac{7}{5}$ times that of the first hour. If it would have been travelled with the half of the speed that of the third hour, then it would have gone 160 km less in the same time (*i. e.*, in four hours). The average speed of the train during the journey of 4 hours was :
(a) 50 km/hr (b) 90 km/hr
(c) 80 km/hr (d) can't be determined

4. In a Mock CAT 123 students appeared and the average score obtained was 120. But later it was found that the top three students were repeaters, so their score has been eliminated and then the new average score was found to be decreased by 1.5. Also, it is known that all the students obtained the marks in integers and the scores of the toppers were distinct. If the second highest topper has scored more than 185 marks, then the highest possible score of the third highest topper is :
(a) 166 (b) 167
(c) 168 (d) 170

5. The average age of all the 100 employees in an office is 29 years, where $\frac{2}{5}$ employees are ladies and the ratio of average age of men to women is 5 : 7. The average age of female employees is :
(a) 18 years (b) 35 years
(c) 25 years (d) none of these

6. There are two houses in Parliament. One is Lok Sabha and the other one is Rajya Sabha and the member of Parliaments (MPs) in both the houses is 300 and 200 respectively. The average age of the members of Lok Sabha and Rajya Sabha is 40 years and 50 years respectively. A member of the Rajya Sabha when elected for the Lok Sabha also, he left the Rajya Sabha and becomes the member of the Lok Sabha. Thus the average age of both the houses increases. Which one of the following statements is true?
(a) The age of this member is greater than 50 years
(b) The age of this member is less than 40 years
(c) The age of this member is greater than 40 but less than 50 years
(d) none of these

***Directions for questions 7, 8 and 9 :*** *Eight years ago there were 5 members in the Arthur's family and then the average age of the family was 36 years. Mean while Arthur got married and gave birth to a child. Still the average age of his family is same now.*

7. The present age of his wife is :
(a) 25 years (b) 26 years
(c) 32 years (d) data insufficient

8. The age of his wife at the time of his child's birth was. If the difference between the age of her child and herself was 26 years :
(a) 25 years (b) 26 years
(c) 20 years (d) can't be determined

9. The age of Arthur at the time of his marriage was :
(a) 22 years (b) 23 years
(c) 26 years (d) can't be determined

10. Eleven years earlier the average age of a family of 4 members was 28 years. Now the age of the same family with six members is yet the same, even when 2 children were born in this period. If they belong to the same parents and the age of the first child at the time of the birth of the younger child was same as there were total family members just after the birth of the youngest members of this family, then the present age of the youngest member of the family is :
(a) 3 years (b) 5 years
(c) 6 years (d) none of these

11. Mr. Patel walked 6 km to reach the station from his house, then he boarded a train whose average speed was 60 km/hr and thus he reached his destination. In this way he took total of 3 hours. If the average speed of the entire journey was 32 km/hr then the average speed of walking is :
(a) 3 km/hr (b) 4.5 km/hr
(c) 4 km/hr (d) none of these

***Directions for question numbers 12 and 13:*** *During the winter session all the women which constitutes $\frac{1}{5}$th strength of the Lok Sabha, left the house (i.e., parliament) due to the*

Compiled By Jasjeet

yoursmahboob.wordpress.com



*rejection of their demand. Actually they were asking for the 50% reservation of seats for the women in the Lok Sabha. Thus the average age of the remaining members of the house (i.e, the Lok Sabha) increases by $\frac{1}{4}$th than it was earlier when all the members (i.e., men and women) were present.*

**12.** The total strength of the Lok Sabha is :
(a) 300 MPs (b) 475 MPs
(c) 526 MPs (d) none of these

**13.** If the average age of women be 30 years then the average age of male members in the Lok Sabha will be :
(a) 26 (b) 34
(c) 40 (d) none of these

**14.** An artist in a circus moves along the hexagonal path of each side 20 metres in such a way that for the first 20 metres he goes with a speed of 20 m/s and the next 20 metres with a speed of 10 m/s. Similarly he continues for the rest of the hexagonal path with the same alternating speeds *i. e.*, 20 m/s and 10 m/s. The average speed of the artist per round of the circus is :
(a) 13.33 m/s (b) 23.66 m/s
(c) $39\frac{1}{3}$ m/s (d) 15 m/s

**15.** The average of 26, 29, $n$, 35 and 43 lies between 25 and 35. If $n$ is always an integer and greater than the average of the given integers then the value of $n$ is :
(a) $33 < n < 47$ (b) $34 < n < 43$
(c) $33 < n < 42$ (d) none of these

**16.** The average of 4 distinct prime numbers $a, b, c, d$ is 35, where $a < b < c < d$. $a$ and $d$ are equidistant from 36 and $b$ and $c$ are equidistant from 34 and $a, b$ are equidistant from 30 and $c$ and $d$ are equidistant from 40. The difference between $a$ and $d$ is :
(a) 30 (b) 14
(c) 21 (d) can't be determined

**17.** There are four numbers whose product is 9261000 and each of these four numbers is formed by 3 distinct prime numbers. The average of all the four numbers is :
(a) 61.75 (b) 67.25
(c) 82.33 (d) data insufficient

**18.** A number is such that when it is multiplied by 8, it gives another number which is as much above from 270 as the original number (itself) is below 270. The average of the original number and the resultant number is :
(a) 33.75 (b) 190
(c) can't be determined (d) none of these

**19.** In the above question (no. 18) the average of the original no. and 270 is :
(a) 165 (b) 185
(c) 135 (d) none of these

**20.** In a particular week the average number of people who visited the Tajmahal is 40. If we exclude the holidays then the average is increased by 16. Further if we exclude also the day on which the maximum number of 112 people visited the Tajmahal, then the average becomes 42. The number of holidays in the week is :
(a) 1 (b) 2
(c) 3 (d) data insufficient

**21.** The average age of all the 20 students of a class is 24. The minimum age of a student is 18 and the maximum age of another student in the same class is 30 years. When the two students whose average age was 26 years resticated from the class but later on one of the resticated student was readmitted. Now the average age of the class is :
(a) 23.89 years (b) 28.39 years
(c) 25 years (d) can't be determined

**22.** In a set of prime and composite numbers, the composite numbers are twice the number of prime numbers and the average of all the numbers of the set is 9. If the number of prime numbers and composite numbers are exchanged then the average of the set of numbers is increased by 2. If during the exchange of the numbers the average of the prime numbers and composite numbers individually remained constant, then the ratio of the average of composite numbers to the average of prime numbers (initially) was :
(a) $\frac{7}{13}$ (b) $\frac{13}{7}$
(c) 9/11 (d) none of these

**23.** The total age of all the guests in the party was 540 years. If a South Indian couple (guests) left the party, then the average of the remaining guests still remained unchanged, where the age of both the husband and wife (the South Indian couple) was same, then the average age of this couple and the total number of guests in the party, respectively, can be :
(a) 18, 27 (b) 20, 27
(c) 15, 38 (d) can't be determined

**24.** In the command hospital Lucknow the sum of the ages of all the 29 people *i. e.*, physicians, surgeons and nurses is 696. If the age of each physician, each surgeon and each nurse be 1 year, 6 years and 3 years more, then the average age of the whole staff would have been 3 years more. If the number of surgeon is a square root of a two digit number which is also a perfect cube, then the number of nurses in the hospital is :
(a) 12 (b) 15
(c) 16 (d) none of these

**25.** The average expenditure of Sarvesh for the January to June is Rs. 4200 and he spents Rs. 1200 in January and Rs. 1500 in July. The average expenditure for the months of February to July is :
(a) 4250 (b) 4520
(c) 4060 (d) none of these

**26.** The average marks of Sameer decreased by 1, when he replaced the subject in which he has scored 40 marks by the other two subjects in which he has just scored 23 and 25 marks respectively. later he has also included 57 marks of Computer Science, then the average marks increased by 2. How many subjects were there initially?
(a) 6 (b) 12
(c) 15 (d) can't be determined

**27.** In a combined family the average age of 4 males and 7 females is 42 and 20 years respectively. If two persons whose average age is 13 years have left the family and other three

Compiled By Jasjeet

yoursmahboob.wordpress.com



people joined the family whose respective ages are 11, 15 and 28 years, then the average age of the new family is increased by :

(a) 4 years (b) 1 year
(c) 3 years (d) none of these

28. A teacher gave sum to his class to find the average of $n$ numbers viz. 1, 2, 3, 4, 5, 6 ... etc. But when the teacher checked the solution, he has found that during the calculation a student just missed a number for the addition thus his average of the $n$ numbers was 15. The value of $n$ is :

(a) 30 (b) 26
(c) 31 (d) not unique

29. The average earning of a group of persons is Rs. 50 per day. The difference between the highest earning and lowest earning of any two persons of the group is Rs. 45. If these two people are excluded the average earning of the group decreases by Re. 1. If the minimum earning of the person in the group lies between 42 and 47 and the number of persons initially in the group was equal to a prime number, with both its digits prime. The number of persons in the group initially was :

(a) 29 (b) 53
(c) 31 (d) none of these

30. There are three categories of jobs $A$, $B$ and $C$. The average salary of the students who got the job of $A$ and $B$ categories is 26 lakh per annum. The average salary of the students who got the job of $B$ and $C$ category is 44 lakh per annum and the average salary of those students who got the job of $A$ and $C$ categories is 34 lakh per annum. The most appropriate (or closest) range of average salary of all the three categories (if it is known that each student gets only one category of jobs *i. e.*, $A$, $B$ and $C$) :

(a) lies between 30 and 44 (b) lies between 28 and 34
(c) lies between 34 and 43 (d) lies between 29 and 48

31. Out of the five integral numbers $C$ is the average of $A$ and $D$. $B$ is greater than $C$ and less than $D$. Also $B$ is the average of $A$ and $E$. The middle most number in the sequence is :

(a) $A$ (b) $B$
(c) $C$ (d) $D$

32. The average age of Donald, his wife and their two children is 23 years. His wife is just 4 year younger than Donald himself and his wife was 24 years old when his daughter was born. He was 32 years old when his son was born. The average age of Donald and his daughter is :

(a) 25 years (b) 22.5 years
(c) 26 years (d) can't be determined

33. There are only five people in the Aman Verma's family. Aman, his wife, a son and two daughters. The younger daughter's age is $\frac{4}{5}$th of the elder daughter's age. The age of eldest daughter is $\frac{3}{8}$ times that of her father Aman and the age of the son is $\frac{1}{5}$th that of his father Aman. 4 years ago the age of her wife was 8 times that of his son and now the sum of the ages of the younger daughter and wife is same as the sum of the ages of Aman and his son. The average age of the family is :

(a) 22.22 years (b) 25.4 years
(c) 21.2 years (d) none of these

34. The average weight of a political party is decreased by 1, when some new politicians joined the party, whose strength is $\frac{1}{4}$th of the existing (or old) politicians and the total weight of the new politicians is 209 kgs. What is the new average weight of all the politicians if it is known that in any case the number of politicians always must be greater than 50 but less than 100 :

(a) 15 kgs (b) 16 kgs
(c) 18 kgs (d) 19 kgs

35. Ravi went to Kanpur from Lucknow by his four wheeler. During the journey he had to use the spare wheel (*i. e.*, stepney). Thus he finished his 160 km journey. The average distance covered by the wheels of his car is :

(a) 40 km (b) 120 km
(c) 128 km (d) 48 km

36. There are 6 consecutive odd numbers in increasing order. The difference between the average of the squares of the first 4 numbers and the last four numbers is 64. If the sum of the squares of the first and the last element (*i. e.*, odd numbers) is 178, then the average of all the six numbers is :

(a) 7 (b) 8
(c) 9 (d) 10

37. The average age of board of directors of a company, having 10 directors was 48 years. Coincidentally when a director aged 53 resigned from the board of directors, another director died on the same day. So a new director joined the board of directors aged 34. Next year in the same month the average age of all the 9 directors was found to be 46 years. The age of the late (*i. e.*, dead) director at the time of his death was :

(a) 56 years (b) 53 years
(c) 57 years (d) 61 years

38. In an office the average weight of 24 employees is 60 kg. If $n$ employees were included whose average weight was 54 kg, then the total number of employees in the office, (given that the new average weight of all the $(24 + n)$ employees is a whole number) :

(a) 36 (b) 30
(c) 34 (d) 25

39. The average age of 100 nurses in a nursing home in 1982 was 50 years. In 1984, 20 nurses retired from their job, whose average age was 60 years. After a huge gap in 1987, 40 nurses were employed whose average age was 38 years. The average age of all the nurses in 1990 was :

(a) 53 years (b) 51 years
(c) 48.5 years (d) data insufficent

***Directions for question numbers 40, 41, 42, 43 and 44:*** *Bhartiya Idol is a talent search programme launched and run by TV Tarana. In this programme each participating candidate has to appear for the audition in such a manner that a candidate will play the Antakchhary with its aspiring opponent until he fails, otherwise he can continue and become winner. If a candidate fails on his part, he will have to leave*

Compiled By Jasjeet

yoursmahboob.wordpress.com



*the contest and in place of it another candidate will start off with the same existing opponent. The number of points a candidate scores is equal to the number of times he responds correctly to his opponents. The candidate who finishes the game (or who wins over the last opponent) will be declared as a winner, even if he/she has scored less points and started as the last participant. The points scored individually by all the 10 candidates are as shown below. Besides if a person loses the contest only if he/she responds incorrectly.*

| | Participant | Points |
|---|---|---|
| 1. | Rajesh | 8 |
| 2. | Radhe | 10 |
| 3. | Harish | 7 |
| 4. | Prajakta | 12 |
| 5. | Aditya | 25 |
| 6. | Rahul | 24 |
| 7. | Shekhar | 18 |
| 8. | Amit Tandon | 23 |
| 9. | Amit Sana | 29 |
| 10. | Abhijeet | 30 |

**40.** The average score of all the 10 participants is :
(a) 21.5 (b) 18.6
(c) 18.3 (d) none of these

**41.** A candidate can face maximum '$n$' opponents. The value of '$n$' is :
(a) 3 (b) 4
(c) 1 (d) can't be determined

**42.** The average score of five participants who started earlier :
(a) 23 (b) 12
(c) 19.5 (d) cant't be determined

**43.** If Abhijeet has not started off earlier and he is the winner then the minimum number of participants who has lost the game before he has started off :
(a) 4 (b) 6
(c) 5 (d) none of these

**44.** For the above question the maximum possible average of the opponents of Abhijeet could be :
(a) 13.5 (b) 9.25
(c) 13.0 (d) 17.5

**45.** In an NGO, the daily average wages of 20 illiterate employees is decreased from Rs. 25 to Rs. 10, thus the average salary of all the literate educated and illiterate employees is decreased by Rs. 10 per day. The number of educated employees working in the NGO is :
(a) 15 (b) 20
(c) 10 (d) data insufficient

**46.** Mr. Tyagi while going from Meerut to Saharanpur covered half the distance by train at the speed of 96 km/hr then he covered half of the rest distance by his scooter at the speed of 60 km/hr and finally he covered the rest distance at the speeed of 40 km/hr by car. The average speed at which Mr. Tyagi completed his journey is :
(a) 64 km/hr (b) 56 km/hr
(c) 60 km/hr (d) 36 km/hr

**47.** There are four types of candidates in our coaching preparing for the CAT. The number of students of Engineering, Science, Commerce and Humanities is 40, 60, 50 and 30 respectively and the respective percentage of students who qualified the CAT is 80%, 75%, 60% and 50% respectively the overall percentage of successful candidates in our institute is :
(a) 67.77% (b) 66.66%
(c) 68.5% (d) none of these

**48.** Mr. 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) can't be determined

**49.** Once my peon went to the office of SKYLINE COURIER with 4 different envelopes. The clerk in the office measured the weights in all possible pairs. The weights obtained are 59 gm, 61 gm, 62 gm, 63 gm, 64 gm and 66 gm. The weight of the heaviest envelope is :
(a) 35 gm (b) 36 gm
(c) 34 gm (d) can't be determined

**50.** The average expenditure of the hotel when there are 10 guests is Rs. 60 per guests and the average expenditure is Rs. 40 when there are 20 guests. If it is known that there are some fixed expenses irrespective of the number of guests then the average expenditure per guest when there are 40 guests in the hotel :
(a) Rs. 30 (b) Rs. 25
(c) Rs. 20 (d) can't be determined

## Final Round

***Directions for question numbers 1 to 15:*** *There are 3 sets of natural numbers 1 to 100. Set A contains all the natural numbers which are prime, upto 100. Set B contains all the non-prime even natural numbers upto 100. Set C contains all the non-prime odd natural numbers upto 100 i.e.,*
$A = \{2, 3, 5, 7, 11, \ldots 89, 97\}$
$B = \{4, 6, 8, 10, 12, \ldots 98, 100\}$
$C = \{1, 9, 15, 21, 25, 27, 33 \ldots 95, 99\}$

**1.** The average of all the elements of $A$, $B$ and $C$ is :
(a) 49.50 (b) 50.50
(c) 55 (d) none of these

**2.** The average of all the elements of $B$ is :
(a) 52 (b) 48
(c) 49 (d) none of these

**3.** If the average (factually correct) of the set $A$ is 42.46, then the average of the Set $C$ is :
(a) 52 (b) 49.87
(c) 55.46 (d) can't be determined

**4.** The average of the elements of the Set $A$ and $C$ combined is :
(a) 49.0588 (b) 49.0372
(c) 50 (d) none of these

Compiled By Jasjeet

yoursmahboob.wordpress.com



5. If an element less than 50 belongs to Set A is transferred to Set B, then the average of Set B :
(a) increases (b) decreases
(c) remains constant (d) can't say

6. If any two elements, greater than 50, belong to Set A are transferred to Set C, then the average of Set C :
(a) remains constant (b) decreases
(c) increases (d) can't say

7. Any 10 elements of the Set A are transferred to the Set B, then the average of Set B :
(a) increases (b) decreases
(c) remains constant (d) can't say

8. If a least and a greatest element of Set C are transferred from Set C to Set A then the average of Set A :
(a) increases (b) decreases
(c) remains constant (d) can't be determined

9. If a smallest and a greatest element of the Set B is transferred to Set A, then the averages of $A$, $B$, $C$ respectively :
(a) decreases, decreases, increases
(b) decreases, constant and increased
(c) increases, constant, constant
(d) can't be determined

10. If an element 2 is also included in the Set B, then the average of B :
(a) decreases by 3 (b) increases by 2
(c) decreases by 1 (d) can't be determined

11. The average of all the perfect squares of the Set C is :
(a) 35 (b) 33
(c) 30.5 (d) none of these

***Directions for question number 12, 13, 14:*** *5 elements below 25 from the Set A are transferred to Set B, and 10 elements lying between 25 and 50 from the Set B are transferred to Set C and 15 elements above 50 from the Set C are transferred to Set A.*

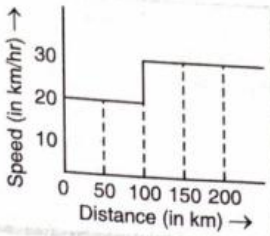
12. The overall average of all the elements of $A$, $B$ and $C$ is :
(a) 39.8 (b) 50.50
(c) 71.2 (d) can't be determined

13. The maximum increase in the average of set :
(a) A (b) B
(c) C (d) can't say

14. When we intended to minimise the loss in average of Set B then the new average of Set B is :
(a) 54.4772 (b) 45.74
(c) 51.84 (d) can't be determined

15. If 10-10 elements are transferred from Set A to Set B, then Set B to Set C and then from Set C to Set A but the received elements can not be transferred to the next set. *e.g.* the elements obtained from Set A can not be transferred to C through Set B. The average of which Set is maximum :
(a) A (b) B
(c) C (d) can't say

***Directions for question numbers 16 and 17:*** *In the following graph the relation between speed and distance is given :*




16. The average speed for the first 200 kms. (in km/hr)
(a) 24 (b) 25
(c) 26 (d) 40

17. The average speed for the first 150 km :
(a) 15 (b) 18
(c) 25 (d) none of these

18. Abhay working in Tele Bharti as a salesperson. His monthly salary is just Rs. 200. But he gets the bonus as per the given rule. If he sells the simcards of Rs. $x$ then his bonus will be Rs. $\left[\left(\frac{x}{100}\right)^2 + 10\right]$. In the first quarter of the year his average sale was Rs. 3000 per month. In the next 5 months his average sale was Rs. 5000 per month. In the last four months his average sale was Rs. 8000 per month. What is the average earning per month for the whole year?
(a) Rs. 3350 (b) Rs. 3610
(c) Rs. 3560 (d) none of these

19. The price of Shirts at Sahara Ganj is defined as Rs. $(100 + 10x^2)$, where $x$ is the number of shirts. Mallika purchased 5 shirts from the above shop. The average price of a shirt is :
(a) Rs. 70 (b) Rs. 50
(c) Rs. 75 (d) none of these

20. In the above question if the sister of Mallika purchased $k$ shirts but the average price was same as that of Mallika. The value of $k$ could be :
(a) 6 (b) 4
(c) 2 (d) none of these

21. There are 10 compartments in passenger train which carries on an average 20 passengers per compartment. If atleast 12 passengers were sitting in each compartment and no any compartment has equal number of passengers then maximum how many passengers can be accomodated in any compartment :
(a) 64 (b) 45
(c) 56 (d) none of these

22. 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 wheel per vehicle is :
(a) 3 (b) 4
(c) 5 (d) none of these

23. Sone lal has '$n$' magical eggs whose average weight is '$k$' gm. Each of the '$n$' eggs produces '$n$' eggs next day such that the average weight of '$n$' eggs produced is same as that of the parental (previous generation) egg for each '$n$' groups individually *i.e.*, each egg produces '$n$' eggs in its next generation and the average weight of all the '$n$' eggs of next generation is same as the weight of the mother egg. This process is continued without any change in pattern. What is the total weight of all the eggs of $r^{th}$ generation, where the initial number of eggs with Sone Lal are considered as the eggs of first generation :
(a) $rnk$ (b) $n^r k$
(c) $nk^r$ (d) $n^{r+1}k$

Compiled By Jasjeet

yoursmahboob.wordpress.com



***Directions for question numbers 24 to 27 :*** *A CAT training institute was established on January 1, 2004 with 3, 4, 5 and 6 faculty members in the Logical Reasoning (LR), Data Interpretation (DI), English Language and Quantitative Analysis (QA) areas respectively, to start with. No faculty member retired or joined the institute in the first three months, of the year 2004. In the next four years, the institute recruited one faculty member in each of the four areas. All these new faculty members, who joined the institute subsequently over the years were 25 years old at the time of their joining the institute. All of them joined the institute on April 1. During these four years, one of the faculty members retired at the age of 60. The following diagram gives the area-wise average age (in terms of number of completed years) of faculty members as on April 1 of 2004, 2005, 2006 and 2007.*

| Faculty | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|
| LR | 49.33 | 44 | 45 | 46 |
| DI | 50.5 | 51.5 | 52.5 | 47.8 |
| English | 50.2 | 49 | 45 | 46 |
| Quants | 45 | 43 | 44 | 45 |

**24.** In which year did the new faculty member join as the faculty of English?

(a) 2004 (b) 2005
(c) 2006 (d) 2007

**25.** What was the age of the new faculty member, who joined the faculty of QA, as on April 1, 2007?

(a) 25 (b) 26
(c) 27 (d) 28

**26.** From which area did the faculty member retire?

(a) English (b) LR
(c) DI (d) Quants

**27.** Professors Sarvesh and Manish, two faculty members in the LR area, who have been with the Institute since its inception, share a birthday, which falls on 30th November. One was born in 1951 and the other one in 1954. On April 1, 2009, what was the age of the third faculty member, who has been in the same area since inception?

(a) 47 (b) 50
(c) 51 (d) 52

Compiled By Jasjeet

yoursmahboob.wordpress.com



# Answers

## LEVEL-1

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

## LEVEL-2

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 (a) | 2. (c) | 3. (b) | 4. (b) | 5. (b) | 6. (c) | 7. (d) | 8. (b) | 9. (d) | 10. (a) |
| 11. (c) | 12. (d) | 13. (d) | 14. (a) | 15. (c) | 16. (b) | 17. (a) | 18. (d) | 19. (a) | 20. (b) |
| 21. (d) | 22. (a) | 23. (b) | 24. (d) | 25. (a) | 26. (c) | 27. (d) | 28. (d) | 29. (d) | 30. (a) |
| 31. (b) | 32. (a) | 33. (a) | 34. (a) | 35. (c) | 36. (b) | 37. (a) | 38. (a) | 39. (b) | 40. (b) |
| 41. (b) | 42. (d) | 43. (c) | 44. (a) | 45. (c) | 46. (a) | 47. (a) | 48. (c) | 49. (c) | 50. (a) |

## FINAL ROUND

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 (b) | 2. (a) | 3. (c) | 4. (a) | 5. (b) | 6. (c) | 7. (d) | 8. (a) | 9. (c) | 10. (c) |
| 11. (b) | 12. (b) | 13. (a) | 14. (c) | 15. (d) | 16. (a) | 17. (d) | 18. (b) | 19. (a) | 20. (c) |
| 21. (c) | 22. (a) | 23. (b) | 24. (c) | 25. (c) | 26. (a) | 27. (d) | | | |

Compiled By Jasjeet

yoursmahboob.wordpress.com

# Hints & Solutions

## LEVEL 1

**1.** Initially the total weight $= 20 \times 45 = 900$

Now, the total weight when a student has been replaced $= 20 \times 44 = 880$

It means the weight of the new student is 20 kgs less than the replaced student. Hence the weight of the replaced student $= 40 + 20 = 60$ kgs

**Alternatively:** Since you know that there are total 20 students and when their average weight decreases by 1, it means on an average 1 kg weight is reduced from each of the students. Thus there is 20 kg weight loss, in total. Again this happens due to the student whose weight is 40 kg replaces an old student. Thus we can say that the weight of the old (or existing) student of the class was 60 kg, which is reduced by a 40 kg student.

**2.** The only useful data is that the average length of the thumb and index finger is 2.8 and the length of index finger is 3 inches.

Now the total length of index finger and thumb

$$= 2.8 \times 2 = 5.6 \text{ inches}$$

Thus the length of thumb is $(5.6 - 3) = 2.6$ inches.

**3.** The average price of the new mixture

$$= \frac{(38 \times 8) + (43 \times 4) + (49 \times 3)}{15} = 41.53$$

**4.** Average speed when Pankaj was returning

$$= \frac{2 \times 10 \times 30}{40} = 15 \text{ km/hr}$$

Now the average speed of the whole journey

$$= \frac{2 \times 15 \times 60}{75} = 24 \text{ km/hr}$$

**5.** Use unitary method :

In $\frac{1}{15}$ hours, 123 typists can type 984 papers

In 1 minute, 123 typists can type $\frac{984}{4} = 246$ papers

In 1 minute, 1 typist can type $\frac{246}{123} = 2$ papers

(**Hint :** $\frac{1}{15}$ hours = 4 minutes)

**6.** Average cost $= \frac{20 \times 3x + 15 \times 2x + 18 \times 4x}{9x} = 18$

**7.** Earning in the 8 months $= 600 \times 8 = 4800$

Earning in the 4 months $= \left(600 \times \frac{3}{2}\right) \times 4 = 3600$

Total earning = Rs. 8400

Saving in 8 months $= 400 \times 8 = 3200$

Saving in 4 months $= \left(400 \times \frac{5}{4}\right) \times 4 = 2000$

Total savings = 5200

Total expenditure for 12 months

$$= 8400 - 5200 = 3200$$

Therefore average saving per month $= \frac{3200}{12} = 266.66$

**8.** There are 6 prime numbers between 47 and 74 as given below:

53, 59, 61, 67, 71, 73

There are only two combinations whose average is $\frac{191}{3}$ or whose total sum is 191.

These are, {53, 67, 71} and {59, 61, 71}

We observe that in the first set the difference between greatest and smallest prime number is 18.

Hence choice (c) is correct.

**9.** Go back to the fundamentals and see the property number 4 and 2 of averages.

Hence required average $= 11 \times 5 + 5 = 60$

**10.** The average score after 48th innings = 48

The average score after 49th innings = 49

Since $\frac{(48 \times 48 + 97)}{49} = 49$

Now the requirement of runs $= 49 + (50 \times 2) = 149$

or $(50 \times 51) - (49 \times 49) = 149$

**11.**

| | | 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 |

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

**12.**

Kaif $\rightarrow$ 35

Sachin $\rightarrow$ 41

Ganguli $\rightarrow$ 29

Dhoni < 35 and Irfan < 35

Hence Sachin is the senior person

**13.** It is the same as a person with 20 years more age replaces an existing person of the group (or village)

Since the total age of the village having $n$ persons, is being increased by 20 years and the average age of village is being increased by 1 year, hence there are total 20 people in the village.

**Alternatively :** $(n \times 42) + 20 = (n \times 43)$

$\Rightarrow$ $n = 20$

**14.** Average rainfall $= \frac{2 \times 6 + 4 \times 5 + 4 \times 10 + 2 \times 6}{12} = 7$

**15.** $400 \times 7 = (300 \times 3) + (250 \times 2) + (n \times 2) \Rightarrow 700$

**16.** The new player must be 11 kg heavier than the replaced one. Hence the weight of the new person $= 55 + 11 = 66$ kg.

Compiled By Jasjeet

yoursmahboob.wordpress.com


17.

| | No. of family members | Average age | Total age |
|---|---|---|---|
| 4 years ago | 6 | 25 | 150 |
| Presently | 6 | 29 | 174 |

But the no. of family members (presently) = 7
and average age (presently) = 25
Therefore the total age = $25 \times 7 = 175$
Hence, the age of child = $175 - 174 = 1$ year

18. Amitabh's total expenditure for Jan-June = $4200 \times 6 = 25200$
Expenditure for Febuary-June = $25200 - 1200 = 24000$
Expenditure for the months of Febuary-July
$= 24,000 + 1500 = 25,500$

The average expenditure $= \frac{25,500}{6} = 4250$

19. Total value of $a + 11 + 23 + 17 = 60 \Rightarrow a = 9$
again $a + b + 12 + 25 = 64 \Rightarrow b = 18$
therefore $\frac{a}{b} = \frac{1}{2}$

20. By the method of Alligation

12,000 ⟍ ⟋ 18,000
15,500
2,500 ⟋ ⟍ 3,500

Therefore the ratio of number of Jun. level employee to the senior level employee = 5 : 7
Hence the required fraction $= \frac{5}{(5+7)} = \frac{5}{12}$

**Alternatively:** Go through options

$$\frac{J}{J+S} = \frac{5x}{12x}$$

$$\Rightarrow \quad \frac{J}{S} = \frac{5x}{7x}$$

Therefore $15,500 \times 12x = 12,000 \times 5x + 18,000 \times 7x$
L.H.S. = R.H.S., Hence correct

21. None of $a, b, c$ is correct.
The correct answer can be $\frac{a+b+c+d+e}{5}$
or $\frac{a+e}{2} = \frac{b+d}{2} = c$
where $a, b, c, d, e$ are consecutive odd numbers.

22. $31 \times 31 - 30 \times 30 = 61$ years

23. $a + b + c + d + e = 5 \times 92 = 460$
$a + b + c = 3 \times 83 = 249$
$c + d + e = 3 \times 97 = 291$
$\therefore \; c = (a + b + c) + (c + d + e) - (a + b + c + d + e)$
or $c = 540 - 460$ or $c = 80$

24. $19 \times 26 - 18 \times 25 = 44$ years

25. $\frac{k + k + 2 + k + 4 + k + 6 + k + 8 + k + 10 + k + 12}{7} = k + 6$

26. $\frac{\frac{x}{4} \times \frac{85}{100} + \frac{x}{3} \times \frac{70}{100} + \frac{5x}{12} \times \frac{56}{100}}{x} \times 100 = 67.916$

Here, $x$ is the total number of students in the whole class.

27. Since there are five possibilities or combinations (as ${}^5C_4 = 5$)
therefore average $= \frac{5 \times 600}{4} = 750$ mm

28. $\frac{\frac{23}{5} + \frac{8}{3} + \frac{62}{9} + \frac{112}{15} + \frac{32}{9}}{5} = 5\frac{8}{225}$

29. $\frac{1000.0001 + 100.001 + 10.01 + 1.1}{4} = \frac{1111.1111}{4} = 277.777$

30. $\frac{7 + 8 + 9 + 10 + 11 + 12 + 13}{7} = 10$
$\Rightarrow \quad \frac{7 + 13}{2} = 10$

31. $\left(\frac{1 + 2 + 3 + \ldots 100}{100}\right) = \frac{\left(\frac{100 \times 101}{2}\right)}{100} = 50.50$

32. $\left(\frac{1 + 3 + 5 + 7 + \ldots 99}{50}\right) = \left(\frac{50 \times 50}{50}\right) = 50$

33. $\frac{2 + 4 + 6 + \ldots 198}{99} = \frac{99 \times 100}{99} = 100$

34. $a + b + c = 237$
$a + c = 158$
$\Rightarrow \quad b = 79$

35. $\frac{M + A + S}{3} = 11111$
also $\frac{S + M}{2} = 11111 \quad (\because M - 11111 = 11111 - S)$
$\Rightarrow \quad A = 11111$

36. $\frac{2 \times 200 \times 600}{800} = 300$ km/hr

37. $\frac{A + B + C + D}{4} = \frac{400 \times 2 + 600 \times 2}{4} = 500$

38. Average weight $= \frac{20 + 50}{100} = 0.7$ kg ($\because$ 1 kg = 1000 gm)

39. Average $= \frac{770}{11} = 70$

40. $\frac{3x + 4x + 5x}{3} = 12 \Rightarrow x = 3$
$\therefore$ The ages are 9, 12 and 15 years
and the required average $= \frac{9 + 15}{2} = 12$

41. Since the salary of each employee is being increased therefore the average salary will also increased by Rs. 2000. Thus the required average = 22,000.

42. $11 \times 21 - 10 \times 20 = 31$

43. $20 \times 180 - 19 \times 178 = 218$

44. Let the price of $A > B > C$
then $\frac{A + B}{2} = 2C$
$A + B = 4C$
Now, $A + B + C = 5 \times 3 = 15$ crore
$\Rightarrow \quad 5C = 15$ crore
$\Rightarrow \quad C = 3$ crore

45. Since we don't know about the price of $B$.

Compiled By Jasjeet

yoursmahboob.wordpress.com



**46.** $\left(\frac{40+70+142}{50+100+150}\right)\times 100 = 84\%$

**47.** Since 1 is neither prime nor composite number. Thus there are only 99 number viz. 2, 3, 4, 5, 6, ... 99, 100.

Hence $\left(\frac{2+3+4+5+6+\ldots 100}{99}\right)$

$$=\left(\frac{(1+2+3+4+\ldots 100)-1}{99}\right)$$

$$=\frac{5050-1}{99}=\frac{5049}{99}=51$$

**48.** $\frac{1+4+9+16+\ldots 100}{10}$

$$=\left(\frac{10\times 11\times 21}{6\times 10}\right)$$

$$\left[\because 1^2+2^2+\ldots n^2=\frac{n(n+1)(2n+1)}{6}\right]$$

$= 38.5$

**49.** The non-negative integers upto 99 are 0, 1, 2, 3, ... 99.

Therefore average $=\left(\frac{0+1+2+3+\ldots 99}{100}\right)$

$$=\frac{\left(99\times\frac{100}{2}\right)}{100} \qquad \left[\because 1+2+3+\ldots n=\frac{n(n+1)}{2}\right]$$

$= 49.5$

**50.** $\frac{7+14+21+\ldots 77}{11}=\frac{7(1+2+\ldots 11)}{11}$

$$=\frac{7\times 11\times 12}{11\times 2}=42 \qquad \left[\because 1+2+3\ldots n=\frac{n(n+1)}{2}\right]$$

**Alternatively:** Since all the numbers are in A.P. Further there are odd number of numbers (*i. e.*, 11) in the sequence. Thus the middle most term is the average of the sequence, which is 42.

**51.**

| | Average | Total |
|---|---|---|
| *A, B, C, D* | 40 | 160 |
| *A, B, C, D, E* | 41 | 205 |
| *F, B, C, D, E* | 42 | 210 |

Thus $E = 205 - 160 = 45$

Hence $F, B, C, D = 210 - 45 = 165$

Therefore average of $F, B, C, D = 41.25$

**52.** Three consecuntive natural numbers whose average is $k$ are $(k-1), (k), (k+1)$

The next two numbers will be $(k+2)$ and $(k+3)$

Therefore average of $(k-1), (k), (k+1)(k+2)$ and $(k+3)$ is $(k+1)$

**Alternatively:** Consider any 3 conseculitive natural number *eg.* 4, 5, 6 the average is 5

Again 4, 5, 6, 7, 8 the average is 6.

To verify it consider some different numbers *eg.* 10, 11, 12 average = 11 and 10, 11, 12, 13, 14 average = 12

Hence, proved that the average is increased by 1.

**53.** The 5 consevtive 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.

**54.** The increase in weight $= (5\times 42.5)-(5\times 42) = 2.5$ kg

But we don't know the weight of the replaced officer. So we can't determine.

**55.** The decrease in age $= 6\times(28-27) = 6$ years

But we don't know the age of the old servant which is being replaced. So we cannot determine the average age of new servant.

**56.** The age of new servant $= 31 - 6 = 25$ years

**57.**

$$A+B+C = 12{,}000\times 3$$
$$B+C+D = 15{,}000\times 3$$
$$\Rightarrow \quad D-A = 3000\times 3$$
$$D-A = 9000$$

also $\quad D = 2A$

$\Rightarrow \quad D = 18{,}000$ and $A = 9000$

Therefore average salary of $B$ and $C = \frac{(45{,}000-18{,}000)}{2}$

$= 13{,}500$

**58.** The price of the costliest and cheapest computer

$= (80\times 30{,}000)-(78\times 29{,}500) = 99{,}000$

Therefore the price of the cheapest computer

$= 99{,}000 - 80{,}000 = 19{,}000$

**59.** $\frac{10\times 50+50\times 10+20\times 25+25\times 20}{4}=500$

**60.**

| | Auto Rickshaw | Maxi. cab | Mini. Bus |
|---|---|---|---|
| No. of seats | 4 | 10 | 20 |
| No. of seats occupied | 4 | 8 | 15 |
| Rate per seat | 12 | 15 | 8 |
| Total amount (in Rs.) | 48 | 120 | 120 |

Therefore average earning $=\frac{48+120+120}{3}=96$

## LEVEL 2

**1.** For this type of questions take the LCM of speeds and assume the LCM as the distance

then the time taken @ speed of 60 km/hr $=\frac{300}{60}=5$ hrs

again the time taken @ speed of 50 km/hr $=\frac{300}{50}=6$ hrs

Thus we see that in place of 5 hrs train takes 6 hours. It means the train takes 1 hour extra and this one hour is stopping period in the total time of 6 hours. Thus in 6 hour train halts for 1 hour. So in 1 hour train will stop for $\frac{1}{6}$ hours or 10 minutes.

Compiled By Jasjeet

yoursmahboob.wordpress.com


**Alternatively :** (short cut)

Halting (or stopping) time $= \left(1 - \frac{\text{slower speed}}{\text{faster speed}}\right)$ hours

$= 1 - \frac{50}{60} = \frac{10}{60} = \frac{1}{6}$ hours

$= 10$ minutes

($\because$ 1 hour = 60 minutes)

2. $\frac{[r + (p - q)] + p + q}{3} = 21 + \frac{p + q + r}{3}$

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

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

$\Rightarrow p - q = 63$

3. Let the speed for the first hour be $x$ km/hr

then the speed for the second hour be $\frac{7}{5}x$ km/hr

then the speed for the third hour be $\frac{10}{7} \times \frac{7}{5}x = 2x$ km/hr

then the speed for the fourth hour be $2x \times \frac{7}{5} = \frac{14x}{5}$ km/hr

Therefore total distance in four hours $= x + \frac{7}{5}x + 2x + \frac{14x}{5}$

$= \frac{36x}{5}$ km

$\therefore$ Average speed $= \frac{\text{Total Distance}}{\text{Total Time}} = \frac{\left(\frac{36x}{5}\right)}{4} = \frac{9x}{5}$ km/hr

Again the distance in 4 hours @ speed of $x$ km/hr which is half of the third hour's speed is $4x$ km

Hence $\frac{36x}{5} - 4x = 160$ km

$\Rightarrow x = 50$

Hence, the average speed $= \frac{9 \times 50}{5} = 90$ km/hr

4. The total score of 3 toppers $= 123 \times 120 - 120 \times 118.5 = 540$

The highest possible score of the third highest topper is possible when the score of other two toppers was minimum

So,

$\left.\begin{array}{l} 1^{st} \text{ rankers score} = 187 \text{ (minimum)} \\ 2^{nd} \text{ rankers score} = 186 \text{ (minimum)} \\ 3^{rd} \text{ rankers score} = 167 \text{ (maximum)} \end{array}\right\} 540$

5. Go through options : $40 \times 35 + 60 \times 25 = 29 \times 100$

Since there are 40 ladies and 60 gents

**Alternatively:** $40 \times 7x + 60 \times 5x = 29 \times 100$

$\Rightarrow x = 5 \quad \therefore 7x = 35$

6.

| | Lok Sabha | Rajya Sabha |
|---|---|---|
| No. of MPs | 300 | 200 |
| Ave. Age | 40 | 50 |

Since when a member of Rajya Sabha joins the Lok Sabha and the average age of both the houses increases, it means the average age of this member must lie between 40 and 50. When the age of this member is greater than 40, then the average age of the Lok Sabha increases.

Again when the age of this member is less than 50, then after leaving it, the average age of the Rajya Sabha increases.

***Solutions for question numbers 7, 8 and 9:***

| | No. of family members | Average | Total |
|---|---|---|---|
| 8 years ago → | 5 | 36 | 180 |
| Presently → | (if) 5 | (36 + 8 ) = 44 | 220 |
| | 7 | 36 | 252 |

7. From the above explanation we have no any clue about his wife's age.

8. Since we know that the difference between the age of any two persons remains always constant, while the ratio of their ages gets changed as the time changes.

So, if the age of his child be $x$ (presently)

Then the age of wife be $x + 26$ (presently)

Thus, the total age $= x + (x + 26) = 32 \quad [\because 252 - 220 = 32]$

$\Rightarrow x = 3$

Therefore the age of her child is 3 years and her self is 29 years. Hence her age at the time of the birth of her child was 26 years.

**Alternatively:** As we have mentioned above that the age difference remains always constant. Therefore her age at the time of her child's birth was 26 years.

9. Since there is no clue. So we can't determine.

10.

| | No. of family members | Average | Total |
|---|---|---|---|
| Eleven years earlier | 4 | 28 | 112 |
| Presently | if 4 | 39 | 156 |
| | 6 | 28 | 168 |

Since it is obvious that just after the birth of the youngest member (*i. e.*, child) was 6 family members in the family. Therefore at the time of the birth of the youngest child the elder child's age was 6 years.

Now the sum of their ages $= x + (x + 6) = 12 = (168 - 156)$

$\Rightarrow x = 3$ and $(x + 3) = 9$

11. Go through options

$\frac{6}{4} = 1.5$ hour, when he was walking

Therefore time of journey by train $= 3 - 1.5 = 1.5$

Now, the distance travelled by train $= 1.5 \times 60 = 96 - 6 = 90$

Hence correct.

**Alternatively:** Total distance $= 32 \times 3 = 6 + 60 \times x$

$\Rightarrow x = 1.5$ hours

Thus, the speed of walking $= \frac{6}{1.5} = 4$ km/hr

12. Let the number of total Mps $= n$ and their average age be $x$ then

$n \times x = \frac{4}{5}n \times \frac{5}{4}x + \frac{n}{5} \times y$

$\Rightarrow$ either $n = 0$ or $y = 0$

[Since there are only 80% MPs remained in the house which

Compiled By Jasjeet

yoursmahboob.wordpress.com



is equal to $\frac{4}{5}n$ and the increase in average age $= 20\% = \frac{5}{4}x$]

Thus, there cannot be any possible value of $n$.

**13.** $nx = \frac{4}{5}n \times \frac{5}{4}x + \frac{n}{5} \times 30$

$\Rightarrow \quad n = 0$ which is impossible

So, there is no any woman MP in the Lok Sabha

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

$= \frac{6 \times 20}{9} = 13.33\,\text{m/s}$

Hexagonal path has six sides

**15.** Average of 26, 29, 35 and 43 is 33.25. Also the average of 26, 29, $n$, 35 and 43 lies between 25 and 35 *i. e.*,

$$25 < \frac{26 + 29 + n + 35 + 43}{5} < 35$$

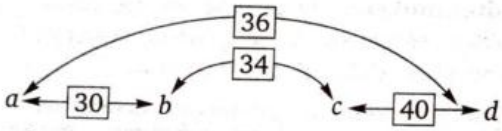
$\Rightarrow \quad 125 < 26 + 29 + n + 35 + 43 < 175$

$\Rightarrow \quad 125 < 133 + n < 175$

$\Rightarrow \quad n < 42$

Since the value of $n$ is an integer and greater than 33.25 then $33 < n < 42$; for every integer $n$.

**16.** Given that $a < b < c < d$




The only possible prime number between 30 and 34 is 31

Hence $\quad b = 31$, therefore $a = 29$

Similarly $\quad c = 37$ and $d = 43$

Therefore $\quad d - a = 43 - 29 = 14$

**17.** $9261000 = 2^3 \times 3^3 \times 5^3 \times 7^3$

$= (2 \times 3 \times 5) \times (2 \times 3 \times 7) \times (2 \times 5 \times 7) \times (3 \times 5 \times 7)$

$= 30 \times 42 \times 70 \times 105$

Therefore the average of 30, 42, 70 and 105 is 61.75.

**18.** Since the number is as below 270 as its multiple is as above 270. It means these two numbers are equidistant from 270. Hence their average is 270.

**Alternatively :** Let the number be $x$ then.

$270 - x = 8x - 270$

$\Rightarrow \quad x = 60$ and $8x = 480$

Therefore the average of 60 and 480 is 270.

**19.** The average of 60 and 270 is 165

**20.** Number of days in a week = 7

Average number of visitors = 40

Total visitors = 280 (= 7 × 40)

Now, if $n$ be the number of holidays in a week then

$(7 - n) \times 56 = 280 \quad (40 + 16 = 56)$

$\Rightarrow \quad n = 2$

The rest data is redundant or useless, since our problem is solved here without using it.

**Alternatively :** Go through options

$40 \times 7 = 280 = 56 \times 5$ hence proved.

**21.** Since we don't know their ages individually so we cannot calculate the average of the class when a student of unknown age readmitted in the class.

**22.** Let the average of prime numbers be $P$ and average of composite numbers be $C$.

Again the number of prime numbers be $x$, then the number of composite numbers be $2x$.

Then $\quad \frac{Px + 2Cx}{3x} = 9 \Rightarrow P + 2C = 27 \quad ...(1)$

and $\quad \frac{2Px + Cx}{3x} = 11$

$\Rightarrow \quad 2P + C = 33 \quad ...(2)$

on adding eq. (1) and (2)

we get $\quad P + C = 20$

and on subtracting eq. (1) from (2)

we get $\quad P - C = 6$

Therefore $\quad P = 13$ and $C = 7$

Thus $\quad \frac{C}{P} = \frac{7}{13}$

**23.** Solve through option $\frac{540}{27} = 20$

$$\frac{540 - (2 \times 20)}{25} = \frac{500}{25} = 20$$

Hence option (b) is correct.

**24.** Number of members in the staff × average age = Total age

$29 \times 24 = 696$

$29 \times 27 = 783$

hence change in total age = 87

| | Physician | Surgeon | Nurse |
|---|---|---|---|
| No. of members | $(21 - x)$ | 8 | $x$ |
| Increase in average age | 1 | 6 | 3 |
| Increase in total age | $(21 - x)$ | 48 | $3x$ |

Since $\quad P + S + N = 29$

therefore if there would be $x$ nurses then there must be $(21 - x)$ physicians.

Again total change (or increase) in age

$= (21 - x) + 48 + 3x = 87$

$\Rightarrow \quad x = 9$

**25.** Total exp. Jan-June = 4200 × 6 = Rs. 25200

Total exp. Feb-June = 25200 − 1200 = Rs. 24000

Total exp. Feb-July = 24000 + 1500 = Rs. 25500

The average expenditure Feb-July $= \frac{25500}{6} = 4250$

**26.** Let the number of subjects be $n$ and average marks be $x$, then total marks = $nx$

Again $\quad (n + 1)(x - 1) = (nx - 40) + (23 + 25)$

$\Rightarrow \quad x - n = 9 \quad ...(1)$

Further $(n + 2)(x + 1) = (nx - 40) + (23 + 25) + 57$

$\Rightarrow \quad nx + 2x + n + 2 = nx + 65$

$2x + n = 63 \quad ...(2)$

Solving equations (1) and (2), we get

$n = 15$ and $x = 24$

**27.** Initially, the total age of family $= 4 \times 42 + 7 \times 20 = 308$

and the average age $= \frac{308}{11} = 28$

Compiled By Jasjeet

yoursmahboob.wordpress.com


Now, the total age of family = 308 + 28 (as 15 + 28)

$= 308 + 28 = 336$

Now, the new average of the family $= \frac{336}{12} = 28$

Since the average age of the original family and that of new family is same (*i.e.*, 28)

Hence, the average age of the new family is increased by 0 year.

**28.** Let there be $n$ number and he missed a number $k$, then the average (which he has calculated) $= \frac{\left(\frac{n(n+1)}{2} - k\right)}{n} = 15$

$$n^2 - 29n = 2k$$

$\Rightarrow$ $$n(n-29) = 2k$$

Thus at $n = 29$ or $n < 29$, the expression is invalid since the value of $k$ is neither zero nor negative, which is actually a natural number. So for the least possible valued of $n = 30$

$$k = 15$$

and for $$n = 31, k = 31$$

Again for $n > 31$, $k$ is beyound the range *i. e.*, greater than $n$. Since $k$ can not be greater than $n$. Hence there are only two values of $k$. So there is no unique value of $n$.

**29.** Let there be $n$ people (initially) in the group, then the total earning of the group $= n \times 50$

Again $n \times 50 = (n-2) \times 49 + (2x + 45)$

$\Rightarrow n = 2x - 53$; where $x$ is the lowest earning of any person.

Now, since $42 < x < 47$ and $n \in$ prime numbers

Then the only possible value of $n = 37$ for $x = 45$

**30.** Let the number of students who got the jobs of $A$, $B$ and $C$ categories is $a$, $b$ and $c$ respectively,

then the total salary $= \frac{26(a+b) + 44(b+c) + 34(c+a)}{2(a+b+c)}$

$$= \frac{60a + 70b + 78c}{2(a+b+c)}$$

$$= \frac{30(a+b+c) + (5b + 9c)}{a+b+c}$$

$$= 30 + \text{some positive value}$$

So the minimum salary must be Rs. 30 lakh and the maximum salary can not exceed 44, which is the highest of the three.

**31.**

$$D - C - A \quad \ldots(1)$$

$$D > B > C \quad \ldots(2)$$

from (1) and (2)

$$D > B > C > A \quad \ldots(3)$$

Again $$E - B - A$$

but $B > A$, from (3)

So $E > D > B > C > A$ [Since $B$ is the average of $E$ and $A$ so it is equidistant from both $E$ and $A$.]

**32.** Let Donald be denoted by H (Husband)

His wife be denoted by W (Wife)

His daughter be denoted by D (Daughter)

His son be denoted by S (Son)

The average age of 4 persons $= \frac{(H + W + D + S)}{4} = 23$

$\Rightarrow$ $$H + W + D + S = 92$$

Again $$H = W + 4$$

So

| | H | | W | D | S |
|---|---|---|---|---|---|
| At the time when daughter is born | 28 | $\xleftarrow{(+4)}$ | 24 | 0 | × |
| | ↓ | | | | |
| At the time when son is born | 32 | $\xrightarrow{(-4)}$ | 28 | 4 | 0 |

So at the time of birth of his son, total age of his family = 64 years $(32 + 28 + 4 + 0 = 64)$

and presently the total age of his family = 92 years

It means total increase in age of the whole family = 28 years

Thus the average increase in age $= \frac{28}{4} = 7$ years

It means the age of Donald = 39 years

and age of his daughter = 11 years

Therefore the average age of Donald and his daughter is 25 years.

**33.**

| Aman | Wife | Son | El. D | Yg. D |
|---|---|---|---|---|
| $5x$ ← | | → $x$ | $5z$ ← | → $4z$ |
| $8y$ ← | | → | $3y$ | |
| $\Rightarrow$ $40K$ | (W) | $8K$ | $15K$ | $12K$ |

Again since Yg. $D + W = A + S$ $(K = x.y)$

$\Rightarrow$ $12K + W = 40K + 8K$ $W \rightarrow$ Age of wife

$\Rightarrow$ $W = 36K$

Thus 4 years ago

$$(36K - 4) = 8(8K - 4)$$

$\Rightarrow$ $28K = 28 \Rightarrow K = 1$

Therefore, the age of Aman = 40

Wife = 36

Son = 8

Elder daughter = 15

Younger daughter = 12

Hence, the average age of the family $= \frac{111}{5} = 22.22$ years

**34.** Let there be $n$ politicians (initially) in the party and their average weight be $x$ kg, then

$$nx + 209 = \frac{5}{4}n(x-1)$$

$$\frac{n}{4}(x-5) = 209$$

$\Rightarrow$ $$x = \frac{209 \times 4}{n} + 5$$

$$x = \frac{4 \times 11 \times 19}{n} + 5$$

So the possible value of $n$ is 76 $(= 19 \times 4)$

Thus $x = 16$

Therefore the average weight of all the politicians is 15 kg.

**35.** Total distance covered by all the wheels $= 4 \times 160$

Number of wheels used = 5

Therefore average distance covered by each wheel

$$= \frac{4 \times 160}{5} = 128 \text{ km}$$

Compiled By Jasjeet

yoursmahboob.wordpress.com



**36.** Let the numbers be $(a-5), (a-3), (a-1), (a+1), (a+3), (a+5)$

then their average

$$= \frac{(a-5)+(a-3)+(a-1)(a+1)(a+3)(a+5)}{6} = a$$

Again the value of '$a$' can be found by using the last statement

*i. e.*, $(a-5)^2 + (a+5)^2 = 178$

$\Rightarrow$ $a^2 = 64 \Rightarrow a = 8$

**37.**

| | No. of Directors | Average Age | Total Age |
|---|---|---|---|
| Just before death and resignation | 10 | 48 | 480 |
| Just after death and resignation | 9 | | $\{480-(53+x)+34\}$ |
| One year later | 9 | 46 | 414 |

So one year later, after the incident

total age $= \{480-(53+x)+34\} + 9\times 1 = 414$

$\Rightarrow$ $x = 56$ years

where $x$ is the age of the dead person at the time of his death.

**38.** Go through options $= \dfrac{24\times 60 + 12\times 54}{(24+12)}$

$= 58$, which is a whole number.

**39.**

| | Year/ Time | No. of Nurses | Average Age | Total Age |
|---|---|---|---|---|
| | 1982 | 100 | 50 | 5000 |
| Just before retirement | 1984 | 100 | 52 | 5200 |
| Just after retirement | 1984 | 80 | 50 | $(5200-20\times 60) = 4000$ |
| Just before recruitment | 1987 | 80 | 53 | 4240 |
| Just after recruitment | 1987 | $(80+40) = 120$ | 48 | $(4240+38\times 40) = 5760$ |
| | 1990 | 120 | 51 | 6120 |

**40.** Average score

$$= \frac{8+10+7+12+25+24+18+23+29+30}{10} = \frac{186}{10} = 18.6$$

**41.** The candidate who has scored maximum (means continuing for long time and number of responses were maximum) can be such a required person.

Now, consider Abhijeet, whose score was 30.

Again consider Rajesh, Radhe, Harish and one more candidate

since $8+10+7 < 30 \Rightarrow 25 < 30$

So there are exactly 3 persons which can be full time opponents. Further there are 5 (= 30 − 25) more chances. So these chances can be utilised by any other candidate but he or she must be in the beginning or in the ending of the Abhijeet, since the score of all the candidates is greater than 5. Hence there can be maximum $3+1 = 4$ opponents of Abhijeet.

**42.** There is no such an information.

**43.** The minimum number of participants who have lost the game before Abhijeet started will be possible only when the number of participant with Abhijeet be maximum, which is 4. Hence excluding these 4 players (opponents of Abhijeet) and Abhijeet himself there are 5 people left. So minimum 5 players have lost the game (or contest).

**44.** The opponents of Abhijeet (as per the requirement) are Rajesh, Radhe, Harish and Amit Sana

So, the average score $= \dfrac{8+10+7+29}{4} = 13.5$

**45.** Go through options

or Total employs $= \dfrac{(25-10)\times 20}{10} = 30$

Hence number of educated employees $= 30 - 20 = 10$

**46.** Average speed of the later half journey

$$= \frac{2\times 40\times 60}{100} = 48 \text{ km/hr}$$

Now the average speed of the whole journey

$$= \frac{2\times 48\times 96}{144} = 64 \text{ km/hr}$$

**47.** $\dfrac{40\times 0.8 + 60\times 0.75 + 50\times 0.6 + 30\times 0.5}{180}\times 100$

$$= \frac{122}{180}\times 100 = 67.777\ldots\%$$

**48.** Remember $\begin{array}{r} abc \\ -\ cba \\ \hline 99(a-c) \end{array}$

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

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

**49.** If the highest weight be 35 gm, then the second highest weight will be 31 gm. Again if the second highest will be 31, then the third highest will be 33 which is inadmissible, since then $35+33 = 68$ which is not the greatest possible combination. Hence wrong.

Similarly 36 (*i. e.*, option *b*) is also invalid

| Highest | Sec. Highest | Third Highest |
|---|---|---|
| 36 | 30 | 34 |

Thus $36 + 34 = 70 > 66$, hence wrong.

The greatest possible combination can not be greater than 66.

Now, consider option (c)

| Highest | Sec. Highest | Third Highest | |
|---|---|---|---|
| 34 | 32 | 32 ✗ | (since weights are different) |
| | 32 | 31 ✗ | (since 65 is not a combination) |
| | 32 | 30 ✔ | |

So, the highest weight 34

Sec. highest weight 32

Third highest weight 30

Lowest weight 29

Since, all the weights obtained give all the 6 different combinations, hence 34 is the highest possible weight of an envelope.

**50.** Let the fixed expenditure of the hotel be Rs. $x$ and the variable expenditure (which is dependent on the guest) is Rs. $y$, then

$$x + 10y = 600 \quad \ldots(1)$$
$$x + 20y = 800 \quad \ldots(2)$$

$\Rightarrow$ $10y = 200$

$y =$ Rs. 20 and $x = 400$

hence the total expenditure when there are 40 guests

$$= 400 + 40\times 20 = 1200$$

Therefore average expenditure $= \dfrac{1200}{40} =$ Rs. 30

Compiled By Jasjeet

yoursmahboob.wordpress.com

1. Since all the total 100 elements of Sets A, B, C are the natural numbers upto. Thus the average of these first 100 natural numbers is the required average.

$$\therefore \text{ Average} = \frac{1+2+3+4\ldots 100}{100} = \frac{100\times 101}{2\times 100} = 50.50$$

2. Except to 2 there are all the even numbers upto 100

So, the required average $= \dfrac{(2+4+6+\ldots 100)-2}{49}$

$$= \frac{50\times 51-2}{49} = \frac{2548}{49} = 52$$

**NOTE** There are only 49 elements in the Set B. Apply the formula of sum of first even numbers. Also use the property of AP.

3. The total value of all the 25 elements of the Set A

$$= 25\times 42.4 = 1060$$

Since, there are 25 prime numbers upto 100 in the Set A Again in the Set A and C there are 50 odd numbers and one even number. So the sum of all the elements of A and C

$$= (1+3+5+7+\ldots 99)+2$$
$$= (50)^2+2 = 2502$$

Therefore the sum of all the elements of Set C

$$= 2502-1060 = 1442$$

Hence, the average of the Set C $= \dfrac{1442}{26} = 55.4615$

4. The average of all the elements of the Set A and C

$$= \frac{2502}{51} = 49.0588$$

**Solutions for question number 5 to 15 :**

| Set | No. of elements | Average | Least element | Greatest element |
|---|---|---|---|---|
| A | 25 | 42.4 | 2 | 97 |
| B | 49 | 52 | 4 | 100 |
| C | 26 | 55.46 | 1 | 99 |

5. Since the value of element which is transferred to Set B is less than 50, which in turn less than the average of Set B, hence the average of Set B decreases.

**NOTE** If a quantity which is less than the average of the group introduces from outside then the new average of the group decreases.

6. The least possible numbers of Set A which are greater than 50 are 53 and 59 whose average is always greater than the average of C. Hence the average of C will necessarily increases.

7. Can't say, since we don't know which 10 numbers are being transferred. Whether their average is greater, less or equal to the average of B.

8. Definitily increases, since the average of those numbers (*viz.* 1 and 99) is 50 which is greater than the average of Set A.

9. The average of those numbers (*viz.* 4 and 100) is 52. Hence average of A will increase and average of B will remain constant and the average of C remains unaffected because Set C is not involved.

**NOTE** If an element or average of some elements is equal to the average of the group then this element (or subset of elements) does not change the average of the group, when it joins the group or leaves the group.

10. After the insertion of new element *viz.* 2 in the Set B the new average $= \dfrac{2+4+6+\ldots 100}{50} = 51$

Hence, the new average of Set B decreases by 1.

11. The perfect square number of the Set C are 1, 9, 25, 49, 81

Hence, the average of these number $= \dfrac{165}{5} = 33$

12. Since there is no net change (*i. e.*, all the elements even after being transferred are same). Hence their average is also same as in question no. 1.

13. Obviously A. Since the average of all those 15 elements which are joining the Set A is greater than the average of all those 5 elements which are leaving the Set A and this difference in average is largest in companision to Set B or Set C. Even in Set C there is decrease in average.

14. To minimize the loss in average of Set B, we have to transfer the least possible values of the given range and have to bring the highest possible values from the Set A to the Set B.

Thus the absolute decrease in Set B

$$= (26+28+30+32\ldots 44)-(23+19+17+13+11)$$
$$= 350-83 = 267$$

Hence, the decrease in total value of Set B

$$= 2548-267 = 2281$$

Therefore, new average $= \dfrac{2281}{44} = 51.84$

**NOTE** Now there are only 44 elements in Set B.

15. There is no relevent information regarding the numbers which are being transferred from one set to another set.

16. Average speed $= \dfrac{\text{Total distance}}{\text{Total time}}$

$$= \frac{200}{\left(5+\frac{10}{3}\right)} = \frac{200\times 3}{25} = 24 \text{ km/hr}$$

Since for the first 100 km time required is $\dfrac{100}{20} = 5$ hrs and for the last 100 km time required $= \dfrac{100}{30} = \dfrac{10}{3}$ hours

17. The average speed $= \dfrac{150}{5+\frac{5}{3}} = \dfrac{150\times 3}{20} = 22.5$ km/hr

18. Average bonus for the first 3 months $= \left(\dfrac{3000}{100}\right)^2 + 10 = 910$

Average bonus for the next 5 months $= \left(\dfrac{5000}{100}\right)^2 + 10 = 2510$

Average bonus for the last 4 months $= \left(\dfrac{8000}{100}\right)^2 + 10 = 6410$

His average bonus for the whole year

$$= \frac{910\times 3+2510\times 5+6410\times 4}{12} = \text{Rs. } 3410$$

Hence his average earning per month

$$= 3410+200 = \text{Rs. } 3610$$

19. Total price of 5 shirts $= \text{Rs}\,[100+10\times(5)^2] = \text{Rs. } 350$

Hence, the average price $= \dfrac{350}{5} = \text{Rs. } 70$

Compiled By Jasjeet

yoursmahboob.wordpress.com



**20.** Check the option (c).

$$\text{Total price} = 100 + 10 \times (2)^2 = \text{Rs. } 140$$

$$\text{Average price} = \frac{140}{2} = \text{Rs. } 70$$

Hence, the average price is same as that of Mallika.

**21.** Total number of passengers = 10 × 20 = 200

In the 9 compartments the total number of passangers

= 144 (= 12 + 13 + 14 + 15 + 16 + 17 + 18 + 19 + 20)

So the no. of passengers in the 10th coach = 200 − 144 = 56

**22.**

| | No. of 2 wheelers | No. of 3 wheelers | No. of 4 wheelers |
|---|---|---|---|
| No. of wheels | $2x$<br>$2 \times 2x = 4x$ | $x$<br>$3 \times x = 3x$ | $2x$<br>$2x \times 4 = 8x$ |

$$\text{Therefore average number of wheels} = \frac{4x + 3x + 8x}{5x} = 3$$

**23.** The average weight of eggs of first generation is $k$ gm and the no. of eggs is '$n$'.

Let $a_1, a_2, a_3, \ldots a_n$ be the weights of $n$ eggs of the first generation

$$\therefore \quad k = \frac{a_1 + a_2 + a_3 + \ldots a_n}{n}$$

$$\therefore \quad nk = a_1 + a_2 + a_3 + \ldots a_n \quad \ldots(1)$$

where $a_1$ is the average weight of its '$n$' child eggs, $a_2$ is the average weight of its own '$n$' child eggs and so on. child egg is referred to the egg of next generation produced by its mother egg.

$$\therefore \quad a_1 = \frac{a_1 + b_1 + c_1 + \ldots n_1}{n}$$

$$a_2 = \frac{a_2 + b_2 + c_2 + \ldots n_2}{n}$$

$$a_3 = \frac{a_3 + b_3 + c_3 + \ldots n_3}{n} \text{ etc.}$$

Substituting the values of $a_1, a_2, a_3 \ldots$ in equation ...(1)

$$nk = \left(\frac{a_1 + b_1 + c_1 + \ldots}{n}\right) + \left(\frac{a_2 + b_2 + c_2 + \ldots}{n}\right) + \left(\frac{a_3 + b_3 + c_3 + \ldots}{n}\right) + \ldots \left(\frac{a_n + b_n + c_n + \ldots}{n}\right)$$

$$\therefore nk = \frac{(a_1 + b_1 + c_1) + (a_2 + b_2 + c_2 + \ldots) + (a_3 + b_3 + c_3 + \ldots)}{n}$$

⇒ Therefore $n^2k$ is the total weight of all the eggs of second generation.

Similarly, each of $a_1, b_1, c_1, a_2, b_2, c_2 \ldots$ are the average weights of $n$ eggs of their child eggs. Hence in the third generation total weight will be $n^3k$. Thus the total weight of all the eggs of $r^{th}$ generation is $n^rk$.

***Solutions for question number 24 to 27 :*** *Before going for the final solution we need to look for the fundamental concept of averages i.e., if a person of higher age than the average age of the group leaves the group, then the average age of the group decreases. Also if a person of less age than the average age of the existing group joins the group, then the average age of the group decreases.*

*Besides it we also know that the average age of the same group after k years increases by K years.*

*Faculty of LR :*

| Year | No. of faculty | Average age | Total age |
|---|---|---|---|
| 2004 | 3 | 49.33 | 148 |
| 2005 | 4 | 44 | 176 = 148 + 3 + 25 |
| 2006 | 4 | 45 | 180 = 176 + 4 |
| 2007 | 4 | 46 | 184 = 180 + 4 |

*176 = 148 + 3 + 25, implies that due to 3 existing professors their total age will be increased by 3 years after one year time period and 25 years age will be added due to a new entrant in the faculty of LR.*

***Faculty of DI :***

| Year | No. of faculty | Average age | Total age |
|---|---|---|---|
| 2004 | 4 | 50.5 | 202 |
| 2005 | 4 | 51.5 | 206 = 202 + 4 |
| 2006 | 4 | 52.5 | 210 = 206 + 4 |
| 2007 | 5 | 47.8 | 239 = 210 + 4 + 25 |

***Faculty of English :***

| Year | No. of faculty | Average age | Total age |
|---|---|---|---|
| 2004 | 5 | 50.2 | 251 |
| 2005 | 4 | 49 | 196 = 251 + 5 − 60 |
| 2006 | 5 | 45 | 225 = 196 + 4 + 25 |
| 2007 | 5 | 46 | 230 = 225 + 5 |

***Faculty of Quants :***

| Year | No. of faculty | Average age | Total age |
|---|---|---|---|
| 2004 | 6 | 45 | 270 |
| 2005 | 7 | 43 | 301 = 270 + 6 + 25 |
| 2006 | 7 | 44 | 308 = 301 + 7 |
| 2007 | 7 | 45 | 315 = 308 + 7 |

**24.** In the year 2006, a new faculty member joined the English faculty.

**25.** The new faculty member who joined on April 1, 2005 became 27 years old on April 1, 2007.

**26.** From the faculty of English a professor retired on April 1, 2005

**27.** Age of Sarvesh on April 1, 2004 = 52 years + 4 months ≈ 52 years

Similarly age of Manish on April 1, 2004

= 49 years + 4 months ≈ 49 years

∴ Age of the third professor on April 1, 2004

= 148 − (52 + 49) = 47 years

Hence the age of the third professor on April 1, 2009

= 47 + 5 = 52 years

Compiled By Jasjeet

yoursmahboob.wordpress.com

# 3 ALLIGATIONS

As we have studied the normal average in the previous chapter, so here we study particularly weighted average. In this chapter we will learn to find the average of two different groups with different number of elements which is known as weighted average. So alligation method is the simplified technique to solve the complex average problems. In this chapter, various kinds of problems will be discussed, since this chapter works as a means not as an end for.

Basically in the entrance tests or competitive exams like CAT, the problems are not directly asked from this chapter, rather the techniques used in this chapter are applied for the higher level problems of CAT. As the alligation plays a vital role as a time saving method in solving the problems of Ratio Proportion, S.I., C.I. Profit Loss and some other topics, so we need to emphasize on the concept of Alligation and its applications extensively applied.

Remember, in some exams like MAT, IRMA, CET etc., the problems of this chapter are directly asked which you need to solve within seconds, even orally.

**EXAMPLE 1** *The average weight of a class of 40 students is 30 and the average weight of a class of 20 students is 15. Find the average weight of both the combined classes :*

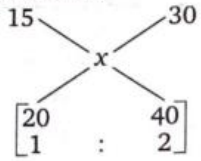
*(a) 20 (b) 25 (c) 17.5 (d) 15*

**SOLUTION** To find the solution of this problem, we can use two widely used techniques :

**1. Weighted average method**

$$\text{The required average} = \frac{40 \times 30 + 20 \times 15}{(40 + 20)} = 25$$

**2. Alligation method :**




In this graphical representation of the solution, $x$ is the weighted average where 15 and 30 are the averages of different class. So remember that the weighted average is always written in middle and the individual averages are written at the top, the smaller one in the left and the greater one in the right just for convenience and the number of elements (or the fixed quantities) are written below correspondingly.

Now, the difference between the two averages is divided in the inverse ratio of the quantities written below. As in the above problem, the difference 15 (= 30 – 15) will be divided in the ratio of 2 : 1 (as 40 : 20) but not in the ratio of 1 : 2, which must be clear from the arrows indicating cross proportion.

So, the value of $x = 15 + \frac{2}{3} \times (30 - 15) = 25$

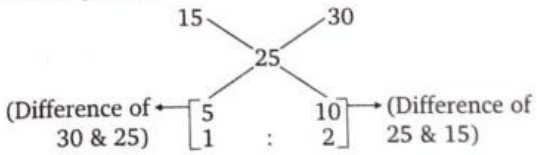
or $x = 30 - \frac{1}{3} \times (30 - 15) = 25$

Therefore, the average weight of both the classes is 25.

**EXAMPLE 2** *If the average weight of a class of students is 15 and the average weight of another class of students is 30, then find the ratio of the students of the first class to the another class of 30 students when the average weight of both the classes is 25 :*

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

**SOLUTION** Let the ratio of the students with 15 students to 30 students be $x : y$, then




Here we know that the averages of individual classes is 15 and 30. Again we know that the averages of both the combined classes is 25. So the difference between 25 and 15 *i. e.*, 10 and 30 & 25, *i.e.*, 5 is written diagonally opposite.

$$\text{Thus the required ratio} = \frac{5}{10} = \frac{1}{2}$$

**EXAMPLE 3** *The average weight of girls is 15 and the average weight of boys is 30 and the average weight of boys and girls both is 25. If the number of boys are 12, then the number of girls is :*

*(a) 4 (b) 6 (c) 10 (d) 18*

Compiled By Jasjeet

yoursmahboob.wordpress.com



**SOLUTION**

$$\begin{array}{ccc} 15 & & 30 \\ & 25 & \\ (30-25)=5 & & 10\ (=25-15) \end{array}$$

Since the ratio of girls to boys is $\frac{5}{10}=\frac{1}{2}$

Hence if there are 12 boys, so there will be 6 girls.

**EXAMPLE 4** *The ratio of number of girls to number of boys is 1 : 2. If the average weight of the boys is 30 kg and the average weight of both the boys and girls be 25 kg, then the average weight of the girls is :*

*(a) 15 kg (b) 20 kg (c) 35 kg (d) 40 kg*

**SOLUTION**

$$\begin{array}{ccc} G & & 30 \\ & 25 & \\ (30-25)=x & & 2x=(25-G) \end{array}$$

$$\Rightarrow \quad \left(\frac{30-25}{25-G}=\frac{x}{2x}\right)$$

So $$\frac{(30-25)}{(25-G)}=\frac{1}{2} \Rightarrow G=15$$

Therefore, the average weight of the girls is 15 kg. In general, if the average of group 1 be $A_1$ and the number of the elements be $n_1$ and the average of the group 2 be $A_2$ & the number of element be $n_2$ then the weighted average

$$A_w=\frac{n_1A_1+n_2A_2}{n_1+n_2}$$

$$\Rightarrow \quad n_1A_w+n_2A_w=n_1A_1+n_2A_2$$

$$\Rightarrow \quad n_1(A_w-A_1)=n_2(A_2-A_w)$$

$$\Rightarrow \quad \frac{n_1}{n_2}=\frac{(A_2-A_w)}{(A_w-A_1)}$$

(known as Alligation Equation)

So this can be represented in the graphical form as given below

$$\begin{array}{ccc} A_1 & & A_2 \\ & A_w & \\ (A_2-A_w)=n_1 & & n_2=(A_w-A_1) \end{array}$$

So all these problems concerned to the topic can be solved either by the formula of weighted average or Alligation equation or graphical representation method, as discussed above.

**EXAMPLE 5** *Two varieties of soda water with different prices is mixed in the ratio of 2 : 3. The price of first soda water is Rs. 10 per litre while the price of second soda water is Rs. 15 per litre, respectively. The average price of the mixture (per litre) is :*

*(a) Rs. 12 (b) Rs. 13 (c) Rs. 14 (d) Rs. 15*

**SOLUTION**

$$\begin{array}{ccc} 10 & & 15 \\ & x & \\ 2 & & 3 \end{array}$$

$$\Rightarrow \quad \frac{(x-10)}{(15-x)}=\frac{3}{2}$$

$$\Rightarrow \quad 2(x-10)=3(15-x)$$

$$\Rightarrow \quad x=13$$

**EXAMPLE 6** *5 kg of superior quality of sugar is mixed with 25 kg of inferior quality sugar. The price of superior quality and inferior quality sugar is Rs. 18 and Rs. 12 respectively. The average price per kg of the mixture is :*

*(a) Rs. 13 (b) Rs. 15 (c) Rs. 18 (d) Rs. 21*

**SOLUTION**

$$\begin{array}{ccc} 12 & & 18 \\ & x & \\ 25 & & 5 \end{array}$$

$$\frac{(x-12)}{(18-x)}=\frac{5}{25}$$

$$\Rightarrow \quad x=13$$

**SHORTCUT** The corresponding ratio is 25 : 5 = 5 : 1

Now reverse the ratio, which is 1 : 5

Now divide the differences of 12 and 18 in the ratio of 1 : 5 *i. e.*, divide 6 into two parts in the ratio of 1 : 5, then the average price of mixture is 12 + 1 = 13

or 18 − 5 = 13

**EXAMPLE 7** *16 litres of kerosene is mixed with 5 litres of petrol. The price of kerosene is Rs. 12 per litre and the price of petrol is Rs. 33 per litre. The average price of the mixture per litre is :*

*(a) Rs. 15 (b) Rs. 17 (c) Rs. 23 (d) Rs. 27*

**SOLUTION**

$$\begin{array}{ccc} 12 & & 33 \\ & x & \\ 16 & & 5 \end{array}$$

Now divide the difference of 12 and 33 in the ratio of 5 : 16 (not in the ratio of 16 : 5)

Here, the difference of 33 and 12 = 21

Again on dividing 21 in the ratio of 5 : 16, we get the first part = 5 and second part = 16

So, the average price = 12 + 5 = 17

or = 33 − 16 = 17

**NOTE** This cross among the numbers written above shows that the difference between $x$ and 12 is 5 and the difference between 33 and $x$ is 16.

**EXAMPLE 8** *Amit travels 30 minutes at the speed of 25 km/hr. Further he travels 20 minutes at the speed of 40 km/hr. Find his average speed.*

*(a) 25 km/hr (b) 30 km/hr*
*(c) 31 km/hr (d) none of these*

**SOLUTION**

$$\begin{array}{ccc} 25 & & 40 \\ & x & \\ 30 & & 20 \end{array}$$

Since the actual ratio is 3 : 2, so reverse it, *i.e.*, the required ratio is 2 : 3.

Now divide the difference of both the speeds *i.e.*, 25 and 40 in the ratio of 2 : 3.

*i.e.*, $(40-25)\times\frac{2}{5}=6$ and $(40-25)\times\frac{3}{5}=9$

So the average speed is 25 + 6 = 31

or 40 − 9 = 31

Compiled By Jasjeet

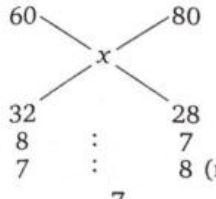
yoursmahboob.wordpress.com



**EXAMPLE 9** *A milkman has two types of milk. In the first container the percentage of milk is 80% and in the second container the percentage of milk is 60%. If he mixes 28 litres of milk of the first container to the 32 litres of milk of the second container, then the percentage of milk in the mixture is :*

(a) 63.99 (b) 69.33 (c) 72.5 (d) 75.2

**SOLUTION**



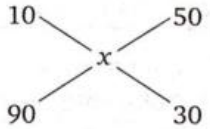

So $(80-60)\times\frac{7}{7+8}=20\times\frac{7}{15}=9.33$

Thus the required percentage = 60 + 9.33 = 69.33

**EXAMPLE 10** *Modern electronic shop sold the 30% hardware at the profit of 50% and 90% software at the profit of 10%. The average profit percent of the Modern electronic shop is, if it sells only these two kinds of things :*

(a) 15 (b) 20 (c) 25 (d) 45

**SOLUTION**




The actual ratio is 3 : 1.

So the reversed ratio is 1 : 3.

Now divide the difference of 10 and 50 in the ratio of 1 : 3 then add the first part to the 10 or subtract the second part from the 50.

*i.e.,* Required average $=10+(50-10)\times\frac{1}{4}$

$=10+10=20$

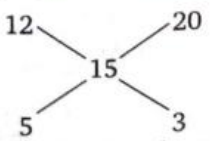
or $50-(50-10)\times\frac{3}{4}=20$

**NOTE** All the problems discussed above can be solved in any way, *i.e.,* either by using the formula of weighted average or Alligation Equation. But we have emphasised on the graphical (cross proportion) method. Since this technique is quite handy, *i.e.,* some times you need not to calculate on paper.

**EXAMPLE 11** *Avinash covered 150 km distance in 10 hours. The first part of his journey he covered by car, then he hired a rickshaw. The speed of car and rickshaw is 20 km/hr and 12 km/hr respectively. The ratio of distances covered by car and the rickshaw respectively are :*

(a) 2 : 3 (b) 4 : 5
(c) 1 : 1 (d) *none of these*

**SOLUTION** The average speed of Avinash $=\frac{150}{10}=15$ km/hr




It means the rickshaw took 5/8 and car took 3/8 of the total time i.e., the ratio of time taken by rickshaw to car is 5 : 3

So the ratio of distances covered by rickshaw to car is

$5\times12:3\times20 \Rightarrow 1:1$

**NOTE**

1. In this calculation (*i.e.,* in alligation method) distance never involves directly. Only time and speeds are involved.
2. Since we have to find generally the average speed (not the average time) so speeds are written on the top and corresponding time taken is written below.

**EXAMPLE 12** *A mixture of rice is sold at Rs. 3.00 per kg. This mixture is formed by mixing the rice of Rs. 2.10 and Rs. 2.52 per kg. What is the ratio of price of cheaper to the costlier quality in the mixture if the profit of 25% is being earned.*

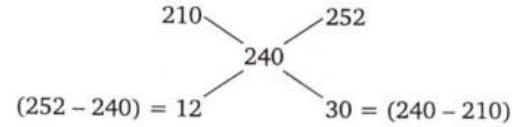
(a) 5 : 2 (b) 2 : 7 (c) 2 : 5 (d) 15 : 8

**SOLUTION** Let the cost price of the mixture be Rs. $x$ per kg, then selling price $=x+\frac{25\times x}{100}=3$

$\Rightarrow 1.25x=3$

$\Rightarrow x=2.4$

Now the average cost price of mixture = Rs. 2.4




Therefore, the ratio of cheaper to costlier rice is 12 : 30, *i.e.,* 2 : 5.

**NOTE** Re 1 = 100 paise. There is no change in the ratio when we change the rupees into paise, just for our convenience in calculation.

**EXAMPLE 13** *A milkman has 20 litres of milk. If he mixes 5 litres of water, which is freely available, in 20 litres of pure milk. If the cost of pure milk is Rs. 18 per litre, then the profit of the milkman, when he sells all the mixture at cost price, is :*

(a) 20% (b) 25% (c) 33.33% (d) 18%

**SOLUTION** When the water is freely available and all the water is sold at the price of the milk, then the water gives the profit on the cost of 20 litres of milk.

Therefore, profit percentage $=\frac{5}{20}\times100=25\%$

Since, the profit % $=\frac{\text{profit}}{\text{cost price}}\times100$

**NOTE** Here the milkman cheats his customer by false practise of creating illusion that instead of 20 litres milk, there is 25 litres of milk. So this extra 5 litres of milk (actually water) is the part of profit.

**EXAMPLE 14** *In what ratio should water and wine be mixed so that after selling the mixture at the cost price a profit of 33.33% is made?*

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

**SOLUTION** 33.33% profit means there is one part water and 3 part is pure wine. So the required ratio of water and wine in the mixture is 1 : 3.

**NOTE** The above problem (No. 14) and the previous problem are basically related to the topics of ratio and profit-loss.

**EXAMPLE 15** *In what ratio should freely available water be mixed with the wine worth Rs. 60 per litre so that after selling the mixture at Rs. 50 per litre, the profit will be 25%?*

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

Compiled By Jasjeet

yoursmahboob.wordpress.com



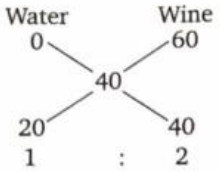
**SOLUTION** Selling price = Rs. 50

Therefore, the cost price

= Rs. 40, which is the average price.

It means the wine, worth Rs. 60 becomes worth Rs. 40 when the water was mixed in it. So we can conclude that in the mixture of Rs. 60, there is wine worth Rs. 40 and the rest is water. Therefore, the ratio of water and wine is 20 : 40 *i.e.*, 1 : 2 :

**Alternatively :**

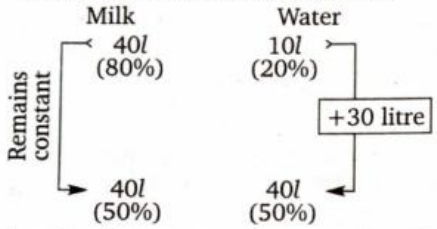



⇒ 1 : 2

**EXAMPLE 16** *A mixture of water and milk contains 80% milk. In 50 litres of such a mixture, how many litres of water is required to increase the percentage of water to, 50%?*

*(a) 20* *(b) 15*
*(c) 30* *(d) none of these*

**SOLUTION** Total amount of mixture is 50 litre



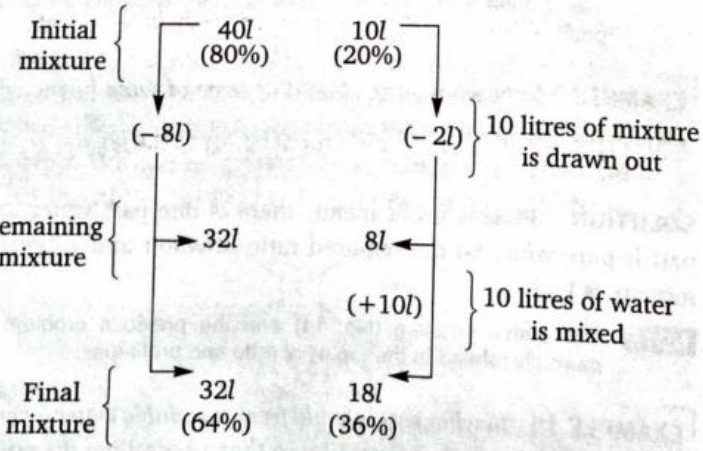

Note that, in this process the quantity of milk remains constant but its percentage decreases as the quantity (and percentage) of water increases.

Initially we have 40 litre milk and 10 litre water. Now we are required to have 50% water and remaining 50% milk in the new mixture. So we have to have 40 litre water, equal to the amount of pure milk (which is constant) available in the mixture. Thus we have to add up 30 litre (= 40 – 10) water in the original mixture.

**EXAMPLE 17** *In a 50 litre mixture of water and milk, water is only 20%. The milkman gives 10 litres `of this' mixture to a customer and then he adds up 10 litres of pure water in the remaining mixture. The percentage of water in the final mixture is :*

*(a) 84%* *(b) 74%* *(c) 26%* *(d) 36%*

**SOLUTION** Total quantity of mixture = 50 litre




See the chart for the solution.

Initially there is 40 litres (80%) milk in the 50 litres mixture. When 10 litres of mixture is drawn out, it means 8 litres of milk is drawn out. Now when 10 litres of water is added, it means in the 50 litres of mixture, there is only 32 litres of milk, *i.e.*, 64%. Hence the percentage of water is 36%.

**EXAMPLE 18** *There are three types of milk, Parag, Amul and Nestle. The ratio of fat to the non-fat contents in milk is 4 : 5, 5 : 6, 6 : 7 respectively. If all these three types of milk is mixed in equal quantity, the ratio of fat to the non-fat contents in the mixture will be :*

*(a) 1751 : 2110* *(b) 175 : 543*
*(c) 3 : 5* *(d) 10 : 18*

**SOLUTION** In this type of questions, we consider only one item (*viz.*, either fat or non-fat) as the fraction of the total quantity. Again we equate the denominators.

Let us consider fraction of 'fat'.

| | Parag | Amul | Nestle |
|---|---|---|---|
| Fraction of fat → | $\frac{4}{9}$ | $\frac{5}{11}$ | $\frac{6}{13}$ |
| | $\frac{4\times11\times13}{9\times11\times13}$ | $\frac{5\times9\times13}{11\times9\times13}$ | $\frac{6\times9\times11}{13\times9\times11}$ |
| | $\frac{572}{1287}$ | $\frac{585}{1287}$ | $\frac{594}{1287}$ |

So the total fat in the total mixture

$$= \frac{572 + 585 + 594}{1287 + 1287 + 1287} = \frac{1751}{3861}$$

Hence, the ratio of fat to the non-fat contents in the mixture

$= 1751 : 2110 \quad \because (3861 - 1751 = 2110)$

**EXAMPLE 19** *Sharabi Chand purchased two different kinds of alcohol. In the first mixture the ratio of alcohol to water is 3 : 4 and in the second mixture it is 5 : 6. If he mixes the two given mixtures and makes a third mixture of 18 litres in which the ratio of alcohol to water is 4 : 5, the quantity of first mixture (whose ratio is 3 : 4) is required to make the 18 litres of the third kind of mixture is :*

*(a) 6* *(b) 7* *(c) 8* *(d) 9*

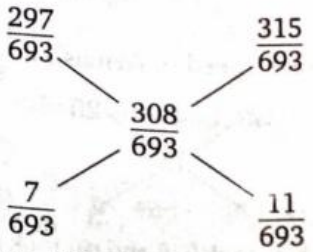
**SOLUTION** The fraction of alcohol in the different mixtures is as follows :

First mixture $\frac{3}{7} = \frac{297}{693}$

Second mixture $\frac{5}{11} = \frac{315}{693}$

Final mixture $\frac{4}{9} = \frac{308}{693}$

Therefore




Hence the ratio of first mixture is to second mixture is 7 : 11. Thus he has to mix 7 litres of first type of alcohol to make 18 litres of required mixture.

Compiled By Jasjeet

yoursmahboob.wordpress.com



**EXAMPLE 20** *Some amount out of Rs. 6000 was lent out at 10% per annum and the rest amount @ at 20% per annum and thus in 4 years the total interest from both the amounts collected was Rs. 3400. What is the amount which was lent out @ 10% per annum?*

*(a) Rs. 2500* *(b) Rs. 2800*
*(c) Rs. 3200* *(d) Rs. 3500*

**SOLUTION** The total interest of one year

$$= \text{Rs. } 850 = \left(\frac{3400}{4}\right)$$

Therefore, the average rate of interest $= 14\frac{1}{6}\% = \frac{85}{6}\%$

Thus,

$$\left(\frac{10\times 6}{6}\right) \qquad \left(\frac{20\times 6}{6}\right)$$

$$\left(\frac{85}{6}\right)$$

$$\left(\frac{35}{6}\right) \qquad \left(\frac{25}{6}\right)$$

Hence the ratio of amount which is lent @ 10% per annum to the amount lent @ 20% per annum is 35 : 25, *i.e.*, 7 : 5.

Therefore, the amount which is lent out @ 10% per annum is Rs. 3500.

**EXAMPLE 21** *From the 50 litres of milk, 5 litres of milk is taken out and after it 5 litres of water is added to the rest amount of milk. Again 5 litres of mixture of milk and water is drawn out and it was replaced by 5 litres of water. If this process is continued similarly for the third time, the amount of milk left after the third replacement :*

*(a) 45 L* *(b) 36.45 L* *(c) 40.5 L* *(d) 42.5 L*

**SOLUTION**

| Milk | Water | |
|---|---|---|
| 50 L | 0 L | 50 litre (initially) |
| − 5 L | − 0 L | withdrawn amount |
| 45 L | 0 L | 50 litre (after first replacement) |
| + 0 L | + 5 L | |
| − 4.5 L | − 0.5 L | withdrawn amount |
| 40.5 L | 4.5 L | 50 litre (after second replacement) |
| + 0 L | + 5 L | |
| − 4.05 L | − 0.95 L | withdrawn amount |
| 36.45 L | 8.55 L | 50 litre (after third replacement) |
| | + 5 L | |

**SHORTCUT** $50\times\left(1-\frac{5}{50}\right)\times\left(1-\frac{5}{50}\right)\times\left(1-\frac{5}{50}\right)$

$$= 50\times\frac{45}{50}\times\frac{45}{50}\times\frac{45}{50} = 50\times\left(\frac{45}{50}\right)^3 = 50\times\left(\frac{9}{10}\right)^3$$

$$= 36.45 \text{ L}$$

**GENERAL FORMULA**

Final or reduced concentration

= Initial concentration

$$\left(1-\frac{\text{amount being replaced in each operation}}{\text{total amount}}\right)^n$$

where $n$ is the number of times the same operation is being repeated. The "amount being replaced" could be pure or mixture as per the case. Similarly, "total amount" could also be either pure or mixture. Here amount being replaced denotes the quantity which is to be withdrawn in each time.

**EXAMPLE 22** *From a tank of petrol, which contains 200 litres of petrol, the seller replaces each time with kerosene when he sells 40 litres of petrol (or its mixture). Everytime he sells out only 40 litres of petrol (pure or impure). After replacing the petrol with kerosene 4th time, the total amount of kerosene in the mixture is :*

*(a) 81.92 l* *(b) 96 l*
*(c) 118.08 l* *(d) none of these*

**SOLUTION** The amount of petrol left after 4 operations

$$= 200\times\left(1-\frac{40}{200}\right)^4 = 200\times\left(\frac{4}{5}\right)^4$$

$$= 200\times\frac{256}{625} = 81.92 \text{ litres}$$

Hence the amount of kerosene = 200 − 81.92 = 118.08 litres

**EXAMPLE 23** *From a container of wine, a thief has stolen 15 litres of wine and replaced it with same quantity of water. He again repeated the same process. Thus in three attempts the ratio of wine and water became 343 : 169. The initial amount of wine in the container was :*

*(a) 75 litres* *(b) 100 litres*
*(c) 150 litres* *(d) 120 litres*

**SOLUTION** $\frac{\text{wine (left)}}{\text{water (added)}} = \frac{343}{169}$

It means $\frac{\text{wine (left)}}{\text{wine (initial amount)}} = \frac{343}{512}$ $(\because 343 + 169 = 512)$

Thus, $343x = 512x\left(1-\frac{15}{K}\right)^3$

$\Rightarrow$ $\frac{343}{512} = \left(\frac{7}{8}\right)^3 = \left(1-\frac{15}{K}\right)^3$

$\Rightarrow$ $\left(1-\frac{15}{K}\right) = \frac{7}{8} = \left(1-\frac{1}{8}\right)$

$\Rightarrow$ $K = 120$

Thus the initial amount of wine was 120 litres.

**EXAMPLE 24** *A jar was full with honey. A person used to draw out 20% of the honey from the jar and replaced it with sugar solution. He has repeated the same process 4 times and thus there was only 512 gm of honey left in the jar, the rest part of the jar was filled with the sugar solution. The initial amount of honey in the jar was :*

*(a) 1.25 kg* *(b) 1 kg*
*(c) 1.5 kg* *(d) none of these*

**SOLUTION** Let the initial amount of honey in the jar was $K$, then

$$512 = K\left(1-\frac{1}{5}\right)^4 \qquad \left(\because 20\% = \frac{20}{100} = \frac{1}{5}\right)$$

or $512 = K\left(\frac{4}{5}\right)^4$

$\Rightarrow$ $K = \frac{512\times 625}{256}$

$\therefore$ $K = 1250$

Hence initially the honey in the jar = 1.25 kg.

Compiled By Jasjeet

yoursmahboob.wordpress.com

# EXERCISE

1. How much Pepsi at Rs. 6 a litre is added to 15 litre of 'dew' at Rs. 10 a litre so that the price of the mixture be Rs. 9 a litre?
(a) 5 (b) 8
(c) 10 (d) none of these

2. In a municipal parking there are some two wheelers and rest are 4 wheelers. If wheels are counted, there are total 520 wheels but the incharge of the parking told me that there are only 175 vehicles. If no vehicle has a stepney, then the no. of two wheelers is :
(a) 75 (b) 100
(c) 90 (d) 85

3. In my pocket there are Rs. 25 consisting of only the denominations of 20 paise and 50 paise. Thus there are total 80 coins in my pocket. The no. of coins of the denomination of 50 paise is :
(a) 30 (b) 70
(c) 50 (d) 25

4. There are some shepherds and their sheep in a grazing field. The no. of total heads are 60 and total legs are 168 including both men and sheep. The no. of sheep is :
(a) 18 (b) 26
(c) 24 (d) 36

5. In the 75 litres of mixture of milk and water, the ratio of milk and water is 4 ; 1. The quantity of water required to make the ratio of milk and water 3 : 1 is :
(a) 1 litre (b) 3 litres
(c) 4 litres (d) 5 litres

6. In my office the average age of all the female employees is 21 years and that of male employees is 32 years, where the average age of all the (male and female) employees is 28 years. The total no. of employees in my office could be :
(a) 35 (b) 78
(c) 231 (d) 90

7. A car agency has 108 cars. He sold some cars at 9% profit and rest at 36% profit. Thus he gains 17% on the sale of all his cars. The no. of cars sold at 36% profit is :
(a) 25 (b) 32
(c) 35 (d) 75

8. Rs. 69 were divided among 115 students so that each girl gets 50 paise less than a boy. Thus each boy received twice the paise as each girl received. The no. of girls in the class is :
(a) 92 (b) 42
(c) 33 (d) 23

9. In what proportion water be mixed with spirit to gain 12.5% by selling it at cost price?
(a) 3 : 5 (b) 1 : 8
(c) 2 : 7 (d) 1 : 9

10. A butler stole wine from a butt of sherry containing 50% of spirit, then he replenished it by different wine containing 20% spirit. Thus there was only 30% strength (spirit) in the new mixture. How much of the original wine did he steal?
(a) 1/3 (b) 2/3
(c) 1/2 (d) 1/4

11. Mr. Mittal purchased two steel factories, one in India and other one in Malaysia for total Rs. 72 crores. Later on he sold the Indian factory at 16% profit and Malasian factory at 24% profit. Thus he gained a total profit of 19%. The selling price of Indian factory is :
(a) 45 crore (b) 52.2 crore
(c) 8.55 crore (d) can not be determined

12. In a 25 litre mixture of milk and water, the water is only 20%. How many litres of water is required to increase the percentage of water to 90%?
(a) 45 litre (b) 70 litre
(c) 115 litre (d) 175 litre

13. A milkman sells the milk at the cost price but he mixes the water (freely available) in it and thus he gains 9.09%. The quantity of water in the mixture of 1 litre is :
(a) 83.33 mL (b) 90.90 mL
(c) 99.09 mL (d) can't be determined

14. The price of petrol is Rs. 60 per litre and the price of spirit is Rs. 40 per litre. In what ratio the petrol and spirit be mixed such that the profit after selling the mixture at Rs. 75 per litre be 25%?
(a) 1 : 1
(b) 3 : 2
(c) 5 : 1
(d) such a mixture is not possible

15. A trader sells total 315 TV sets. He sells black and white TV sets at a loss of 6% and colour TV sets at a profit of 15%. Thus he gains 9% on the whole. The no. of B/W TV sets, which he has sold, is :
(a) 126 (b) 216
(c) 135 (d) 90

16. In a class of 30 students, the average weight of boys is 20 kg and the average weight of the girls is 25 kg. The fraction of boys out of the total students of the class is :
(a) $\frac{4}{5}$ (b) $\frac{5}{6}$
(c) $\frac{3}{4}$ (d) data insufficient

17. Baniya sells two types of tea *viz.* Desi Chai and Videshi Chai. He sells Desi Chai at Rs. 18 per kg and incurs a loss of 10% whereas on selling the Videshi Chai at Rs. 30 per kg, he gains

Compiled By Jasjeet

yoursmahboob.wordpress.com


20%. In what proportion should the Desi Chai and Videshi Chai be mixed such that he can gain a profit of 25% by selling the mixture at Rs. 27.5 per kg?

(a) 3 : 2 (b) 2 : 3
(c) 2 : 5 (d) 3 : 5

**18.** The average age of boys in class is 16.66, while the average age of girls is 18.75. Thus the average age of all the 40 students of the class is 17.5. If the difference between the no. of boys and girls is 8, then the no. of girls in the class is :

(a) 12 (b) 16
(c) 18 (d) data insufficient

**19.** The ratio of water and alcohol in two different containers is 2 : 3 and 4 : 5. In what ratio we are required to mix the mixtures of two containers in order to get the new mixture in which the ratio of alcohol and water be 7 : 5?

(a) 7 : 3 (b) 5 : 3
(c) 8 : 5 (d) 2 : 7

**20.** The average marks of the students in four sections *A, B, C* and *D* together is 60%. The average marks of the students of *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 number of students in sections *A* and *D*?

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

**21.** The diluted wine contains only 8 litres of wine and the rest is water. A new mixture whose concentration is 30%, is to be formed by replacing wine. How many litres of mixture shall be replaced with pure wine if there was initially 32 litres of water in the mixture ?

(a) 4 (b) 5
(c) 8 (d) none of these

**22.** The average weight of boys in a class is 30 kg and the average weight of girls in the same class is 20 kg. If the average weight of the whole class is 23.25 kg, what could be the possible strength of boys and girls respectively in the same class ?

(a) 14 and 26 (b) 13 and 27
(c) 17 and 27 (d) none of these

**23.** The shopkeeper mixed 40 kg refined oil with vegetable oil worth Rs. 60 per kg. Thus he gains Rs. 10 after selling the mixture of the two oils. The price of the first oil is :

(a) 20 (b) 25
(c) 45 (d) can't be determined

**24.** In a mixture of milk and water, there is only 26% water. After replacing the mixture with 7 litres of pure milk, the percentage of milk in the mixture become 76%. The quantity of mixture is :

(a) 65 litre (b) 91 litre
(c) 38 litre (d) none of these

**25.** The ratio of expenditure and savings is 3 : 2. If the income increases by 15% and the savings increases by 6%, then by how much per cent should his expenditure increases?

(a) 25 (b) 21
(c) 12 (d) 24

**26.** 4 kg of a metal contains $\frac{1}{5}$ copper and rest is zinc. Another 5 kg of metal contains $\frac{1}{6}$ copper and rest is zinc. The ratio of copper and zinc into the mixture of these two metals :

(a) 49 : 221 (b) 39 : 231
(c) 94 : 181 (d) none of these

**27.** 450 litres of a mixture of milk and water contain the milk and water in the ratio 9 : 1. How much water should be added to get a new mixture containing milk and water in the ratio 3 : 1?

(a) 54 (b) 90
(c) 45 (d) 63

**28.** The ratio of petrol and kerosene in the container is 3 : 2 when 10 litres of the mixture is taken out and is replaced by the kerosene, the ratio becomes 2 : 3. The total quantity of the mixture in the container is :

(a) 25 (b) 30
(c) 45 (d) cannot be determined

**29.** From a container, 6 litres milk was drawn out and was replaced by water. Again 6 litres of mixture was drawn out & was replaced by the water. Thus the quantity of milk and water in the container after these two operations is 9 : 16. The quantity of mixture is :

(a) 15 (b) 16
(c) 25 (d) 31

# Answers

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

Compiled By Jasjeet

yoursmahboob.wordpress.com



# Hints & Solutions

**1.** Let $x$ litre pepsi is required.

$$\begin{array}{ccc} 6 & & 10 \\ & 9 & \\ x & & 15 \\ (10-9)=1 & : & 3=(9-6) \end{array}$$

Therefore $\frac{x}{15}=\frac{1}{3}$

$\Rightarrow$ $x = 5$ litre

**Alternatively :** Go through options.

**2.** Go through options :

$$90 \times 2 + 85 \times 4 = 520$$

If 2 wheelers be 90 then the four wheelers will be

$$85 = (175 - 90)$$

**Alternatively :** The average number of wheels per vehicle $= \frac{520}{175}$

$$\begin{array}{ccc} 2\times\frac{175}{175} & & 4\times\frac{175}{175} \\ & \frac{520}{175} & \\ \frac{180}{175} & & \frac{170}{175} \end{array}$$

$\Rightarrow$ 180 : 170

$\Rightarrow$ 90 : 85

$\Rightarrow$ 18 : 17

Therefore the ratio of two wheelers to four wheelers is 18 : 17. Hence there are 90 "two wheelers".

**3.** Go through options :

$$30 \times 50 + 50 \times 20 = 2500 \text{ paise}$$

**Alternatively :** Since the average price of a coin

$$= \frac{2500}{80} = 31.25 \text{ paise}$$

$$\begin{array}{ccc} 20 & & 50 \\ & 31.25 & \\ 18.75 & & 11.25 \end{array}$$

So the ratio of no. of 20 paise coins to the no. of 50 paise coins

$= 18.75 : 11.25$

$= 75 : 45 = 5 : 3$

Therefore, the no. of coins of the denominations of 50 paise is 30.

**4.** Go through option :

$$24 \times 4 + 36 \times 2 = 168$$

**Alternatively :**

$$\begin{array}{ccc} 2 & & 4 \\ & 2.8 & \\ 1.2 & & 0.8 \end{array}$$

$\Rightarrow$ 3 : 2

Therefore, the ratio of men and sheep is 3 : 2

**Alternatively :** Suppose there are only men, then the no. of legs $= 60 \times 2 = 120$.

Now since there are $48 = (168 - 120)$ legs extra, it means there are $24 = \left(\frac{48}{2}\right)$ sheep, since a sheep has 2 extra legs than a man has.

**5.** Total quantity of mixture = 75 litre

Therefore

| Milk | | Water |
|---|---|---|
| 4 | : | 1 |
| 60 L | | 15 L |
| | | +5L |
| 60 L | | 20 L |
| 3 | : | 1 |

**6.** Since the ratio of no. of female and male employees is 4 : 7, so the total no. of employees must be the multiples of 11. Hence the possible answer is 231.

$$\begin{array}{ccc} 21 & & 32 \\ & 28 & \\ 4 & & 7 \end{array}$$

**7.** Since the ratio of cars sold at profit of 9% to the 36% is 19 : 8, hence the no. of cars sold at 36% profit is 32.

$$\begin{array}{ccc} 9 & & 36 \\ & 17 & \\ 19 & & 8 \end{array}$$

**8.** Here each girl receives 50 paise and each boy receives 100 paise and the average receiving of each student

$$= \frac{6900}{115} = 60 \text{ paise}$$

$$\begin{array}{ccc} 50 & & 100 \\ & 60 & \\ 40 & & 10 \end{array}$$

$\Rightarrow$ (G) 4 : (B) 1

Thus the no. of girls = 92 [Number of boys = 23]

**9.** Profit $= 12.5\% = \frac{1}{8}$

Hence the ratio of water to spirit is 1 : 8

since profit % $= \frac{\text{profit}}{\text{cost}} \times 100$.

**10.**

$$\begin{array}{ccc} 20 & & 50 \\ & 30 & \\ 20 & & 10 \\ 2 & : & 1 \end{array}$$

Since the ratio of 20% wine to 50% wine is 2 : 1, it means there is $\frac{2}{3}$ wine which is replaced with wine in which the concentration of spirit is 20%.

Compiled By Jasjeet

yoursmahboob.wordpress.com



**11.**

| 16 | | 24 |
|---|---|---|
| | 19 | |
| 5 | | 3 |

Thus the cost price of Indian factory is Rs. 45 crore.
Therefore, the selling price of Indian factory is

$$= 45 + \frac{45 \times 16}{100} = 52.2 \text{ crore}$$

**12.**

| Milk | | Water |
|---|---|---|
| 80% | | 20% |
| 4 | : | 1 |
| 20 L | | 5 L |
| 20 L | | 180 L |
| 10% | | 90% |
| 1 | : | 9 |

(+ 175 L)

**13.** Profit (%) $= 9.09\% = \frac{1}{11}$

Since the ratio of water and milk is 1 : 11,
Therefore the ratio of water is to mixture = 1 : 12
Thus the quantity of water in mixture of 1 litre

$$= 1000 \times \frac{1}{12} = 83.33 \text{ mL}$$

**14.** The selling price of mixture = Rs. 75

∴ The cost price of mixture = Rs. 60

Now we know that if he mixes the spirit (worth Rs. 40) with petrol (worth Rs. 60), the cost price of mixture must be less than Rs. 60, which is impossible. Hence there is no spirit with the petrol.

**15.**

| −6 | | 15 |
|---|---|---|
| | 9 | |
| 6 | | 15 |

⇒ 2 : 5

Thus the ratio of B/W TV sets to the no. of colour TV sets

= 2 : 5

Therefore, no. of B/W TV sets = 90

**16.** Since we do not know either the average weight of the whole class or the ratio of no. of boys to girls.

**17.** The S.P. of Desi Chai = Rs. 18
The S.P. of Videshi Chai = Rs. 30
The C.P. of Desi Chai = Rs. 20
The C.P. of Videshi Chai = Rs. 25
The S.P. of mixture = Rs. 27.5
The C.P. of mixture = Rs. 22

| 20 | | 25 |
|---|---|---|
| | 22 | |
| 3 | : | 2 |

Therefore, the ratio of Desi Chai is to Videshi Chai is 3 : 2

**18.**

| 16.66 | | 18.75 |
|---|---|---|
| | 17.5 | |
| (Boys) $x$ | | $y$ (Girls) |

⇒

| $\frac{50}{3} \times \frac{4}{4}$ | | $\frac{75}{4} \times \frac{3}{3}$ |
|---|---|---|
| | $\frac{35}{2} \times \frac{6}{6}$ | |
| $x$ | | $y$ |

⇒

| $\frac{200}{12}$ | | $\frac{225}{12}$ |
|---|---|---|
| | $\frac{210}{12}$ | |
| $\frac{15}{12}$ | | $\frac{10}{12}$ |

⇒ 3 : 2

Thus the no. of girls = 16 and no. of boys = 24

**19.**

| $W_1 : A_1$ | $W_2 : A_2$ | $W_N : A_N$ |
|---|---|---|
| 2 : 3 | 4 : 5 | 5 : 7 |
| $\frac{W_1}{W_1 + A_1} = \frac{2}{5}$ | $\frac{W_2}{W_2 + A_2} = \frac{4}{9}$ | $\frac{W_N}{W_N + A_N} = \frac{5}{12}$ |
| $= \frac{72}{180}$ | $= \frac{80}{180}$ | $= \frac{75}{180}$ |

| $\frac{72}{180}$ | | $\frac{80}{180}$ |
|---|---|---|
| | $\frac{75}{180}$ | |
| $\frac{5}{180}$ | | $\frac{3}{180}$ |

⇒ 5 : 3

Therefore, the ratio is 5 : 3.

**20.** Since the average marks of sections $B$ and $C$ together are equal the average marks of all the four sections (*i.e.*, $A$, $B$, $C$ and $D$), therefore the average marks of the remaining two sections $A$ and $D$ together will also be equal *i.e.*, 60%.

| 45 | | 80 |
|---|---|---|
| | 60 | |
| 20 | | 15 |

⇒ 4 : 3

Hence, the required ratio is 4 : 3.

**21.**

| Wine | | Water | |
|---|---|---|---|
| 8 L | | 32 L | |
| 1 | : | 4 | |
| 20% | | 80% | (original ratio) |
| 30% | | 70% | (required ratio) |

In this case, the percentage of water being reduced when the mixture is being replaced with wine.

So the ratio of **left quantity** to the initial quantity is 7 : 8.

Therefore $\frac{7}{8} = \left[1 - \frac{K}{40}\right] \Rightarrow \frac{7}{8} = \left[\frac{40 - K}{40}\right]$

⇒ $K = 5$ litre

**Alternatively :** Go through options.

**22.** Therefore no. of boys : Number of girls

| 20 | | 30 |
|---|---|---|
| | 23.25 | |
| 6.75 | | 3.25 |
| 27 | : | 13 |

Compiled By Jasjeet

yoursmahboob.wordpress.com



**23.** Since there is insufficient data.

**24.**

| Milk | Water | |
|---|---|---|
| 74% | 26% | (initially) |
| 76% | 24% | (after replacement) |

$$\text{Left amount} = \text{Initial amount}\left(1 - \frac{\text{replaced amount}}{\text{total amount}}\right)$$

$$24 = 26\left(1 - \frac{7}{K}\right)$$

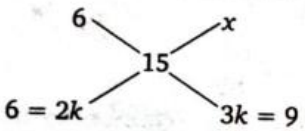
$$\Rightarrow \quad \frac{12}{13} = \left(1 - \frac{7}{K}\right)$$

$$\Rightarrow \quad \frac{1}{13} = \frac{7}{K}$$

$$\Rightarrow \quad K = 91 \text{ litre}$$

**NOTE** In case of replacement, the initial (pure) amount is equal to the amount of final mixture.

**25.**




Therefore $x = 21\%$

**26.** Copper in $4 \text{ kg} = \frac{4}{5} \text{ kg}$

and Zinc in $4 \text{ kg} = 4 \times \frac{4}{5} = \frac{16}{5} \text{ kg}$

Copper in $5 \text{ kg} = 5 \times \frac{1}{6} = \frac{5}{6} \text{ kg}$

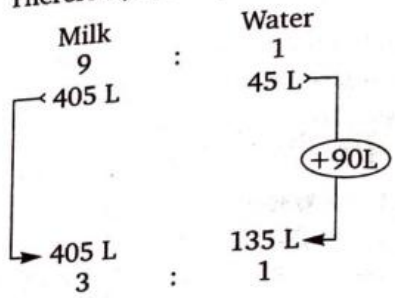
Zinc in $5 \text{ kg} = 5 \times \frac{5}{6} = \frac{25}{6} \text{ kg}$

Therefore, Copper in mixture $= \frac{4}{5} + \frac{5}{6} = \frac{49}{30} \text{ kg}$

and Zinc in the mixture $= \frac{16}{5} + \frac{25}{6} = \frac{221}{30} \text{ kg}$

Therefore, the required ratio = 49 : 221.

**27.**




**28.** Petrol : Kerosene

3 : 2 (initially)

2 : 3 (after replacement)

$$\frac{\text{Remaining (or left) quantity}}{\text{Initial quantity}} = \left(1 - \frac{\text{replaced quantity}}{\text{total quantity}}\right)$$

$$\text{(for petrol)} \quad \frac{2}{3} = \left(1 - \frac{10}{K}\right)$$

$$\Rightarrow \quad \frac{1}{3} = \frac{10}{K}$$

$$\Rightarrow \quad K = 30 \text{ litre}$$

Therefore, the total quantity of the mixture in the container is 30 litre.

**29.**

$$\frac{9}{25} = \left(1 - \frac{6}{K}\right)^2$$

$$\Rightarrow \quad \frac{3}{5} = \left(1 - \frac{6}{K}\right)$$

$$\Rightarrow \quad K = 15 \text{ litre}$$

Compiled By Jasjeet

yoursmahboob.wordpress.com

# 4 RATIO, PROPORTION & VARIATION

The basic applications of the concepts involved in this chapter are comparisons of two or more quantities and changes in their magnitudes, *e.g.*, comparison of the ages, weights income, savings, heights, volume, density, temperature etc.

So this chapter is very useful in solving the problems of Data interpretation. Also each and every year one or two problems from this chapter is/are asked in CAT, either directly or application based for QA section. Last but not the least, the concepts of ratio, proportion and variations are very useful in solving the maximum arithmetic problems. That's why these problems are usually asked in most of the competitive exams like FMS, IIFT, MAT, SYMBIOSIS etc.

## RATIO

The comparison between two quantities in terms of magnitude is called the ratio, *i.e.*, it tells us that the one quantity is how many times the other quantity.

For example, Amit has 5 pens and Sarita has 3 pens. It means the ratio of number of pens between Amit and Sarita is 5 is to 3. It can be expressed as '5 : 3'.

**NOTE** It should be noted that in a ratio, the order of the terms is very important. For example, in the above illustration the required ratio is 5 : 3 while 3 : 5 is wrong.

So the ratio of any two quantities is expressed as $\frac{a}{b}$ or $a : b$.

The numerator '$a$' is called the **antecedent** and denominator '$b$' is called as **consequent**.

### Rule of Ratio

The comparison of two quantities is meaningless if they are not of the same kind or in the same units (of length, volume or currency etc). We do not compare 8 boys and 6 cows or 15 litres and 5 toys or 5 metres and 25 centimetres. Therefore, to find the ratio of two quantities (of the same kind), it is necessary to express them in same units.

**NOTE**

1. We do not compare 8 boys and 6 cows, but we can compare the number (8) of boys and number (6) of cows. Similarly, we cannot compare the number (15) of litres and the number (5) of toys etc.
2. Ratio has no units.

## PROPERTIES OF RATIOS

1. The value of a ratio does not change when the numerator and denominator both are multiplied by same quantities *i.e.*,

$$\frac{a}{b} = \frac{ka}{kb} = \frac{la}{lb} = \frac{ma}{mb} \text{ etc.}$$

*e.g.*, $\frac{3}{4} = \frac{6}{8} = \frac{9}{12} \ldots$ etc. have the same ratio.

2. The value of a ratio does not alter (or change) when the numerator and denominator both are divided by same quantities *i.e.*,

$$\frac{a}{b} = \frac{a/k}{b/k} = \frac{a/l}{b/l} = \frac{a/m}{b/m} \text{ etc.}$$

*e.g.*, $\frac{3}{4} = \frac{3/2}{4/2} = \frac{3/3}{4/3} = \frac{3/4}{4/4} \ldots$ etc are same ratio.

3. The ratio of two fractions can be expressed in ratio of integers. *e.g.*,

$$\frac{3/4}{5/4} = \frac{3}{4} \times \frac{4}{5} = \frac{3}{5}$$

Since $\frac{a/b}{c/d} = \frac{a}{b} \times \frac{d}{c}$ (Refer to the **fractions** in Fundamentals)

4. When two or more than two ratios are multiplied with each other, then it is called as compounded ratio *e.g.*, $\frac{2}{3} \times \frac{4}{5} \times \frac{6}{7} = \frac{16}{35}$ is the compounded ratio of $\frac{2}{3}, \frac{4}{5}, \frac{6}{7}$

So, $\frac{a}{b} \times \frac{c}{d} \times \frac{e}{f} \ldots = \frac{k}{l}$ (compounded ratio)

5. When the ratio is compounded with itself, it is called as duplicate, triplicate ratios etc. *e.g.*,

$\frac{a}{b} \times \frac{a}{b} = \frac{a^2}{b^2} = \left(\frac{a}{b}\right)^2$ is called as duplicate ratio of $\frac{a}{b}$

and $\frac{a}{b} \times \frac{a}{b} \times \frac{a}{b} = \left(\frac{a}{b}\right)^3$ is called as triplicate ratio of $\frac{a}{b}$.

Compiled By Jasjeet

yoursmahboob.wordpress.com



Similarly, $\sqrt{\left(\frac{a}{b}\right)} = \left(\frac{a}{b}\right)^{1/2}$ is called as sub-duplicate ratio and $\sqrt[3]{\left(\frac{a}{b}\right)} = \left(\frac{a}{b}\right)^{1/3}$ is called as sub-triplicate ratio of $\frac{a}{b}$.

6. $\frac{a}{b} = \frac{c+am}{d+bm}$ if and only if $\frac{c}{d} = \frac{a}{b}$

*i.e.*, $\frac{30}{40} = \frac{30+3m}{40+4m} = \frac{33}{44} = \frac{36}{48} \ldots$ etc at $m = 1, 2, \ldots$

This property is very useful when we compare two fractions

*e.g.*, to compare between $\frac{10}{20}$ and $\frac{12}{22}$

We see that $\frac{10}{20} = \frac{1}{2}$

Now if $\frac{10}{20}$ and $\frac{12}{22}$ are equal then $\frac{12}{22} = \frac{10+m}{22+2m}$

Now putting $m = 2$, we don't get the required fraction.

So $\frac{12}{22} \neq \frac{10}{20}$ for any value of $m$, $\frac{12}{22} \neq \frac{10}{20}$ (in terms of ratio)

7. $\frac{a+k}{b+k} < \frac{a}{b}$ if for every positive $k$, $\frac{a}{b} > 1$

and $\frac{a-k}{b-k} > \frac{a}{b}$

8. $\frac{a+k}{b+k} > \frac{a}{b}$ if for every positive $k$, $\frac{a}{b} < 1$ and $\frac{a-k}{b-k} >$

9. $\frac{a+c}{b+d} > \frac{a}{b}$ if $\frac{c}{d} > \frac{a}{b}$

10. $\frac{a+c}{b+d} < \frac{a}{b}$ if $\frac{c}{d} < \frac{a}{b}$

11. If $\frac{a}{b} = \frac{c}{d} = \frac{e}{f} = \frac{g}{h} = \ldots = k$

then $\frac{a+c+e+g+\ldots}{b+d+f+h+\ldots} = k$

12. Let $\frac{a}{b}, \frac{c}{d}, \frac{e}{f}, \frac{g}{h} \ldots$ be some different ratios, then the value of $\left(\frac{a+c+e+g+\ldots}{b+d+f+h+\ldots}\right)$ must lies between the lowest and highest ratios.

13. If $a:b$ and $b:c$ are given, then

$$a:b:c = \begin{matrix} a & & b \\ \downarrow & \swarrow & \downarrow \\ b & & c \end{matrix} = (a \cdot b):(b \cdot b):(b \cdot c)$$

14. If the ratios between $a:b$, $b:c$, $c:d$, $d:e$ are given individually, then the combined ratio of $a:b:c:d:e$

$$\begin{matrix} a : b \\ b : c \\ c : d \\ d : e \end{matrix} \quad \begin{matrix} a \\ b \\ c \\ d \end{matrix} \Big| : \begin{matrix} b \\ b \\ c \\ d \end{matrix} \Big| : \begin{matrix} b \\ c \\ c \\ d \end{matrix} \Big| : \begin{matrix} b \\ c \\ d \\ d \end{matrix} \Big| : \begin{matrix} b \\ c \\ d \\ e \end{matrix}$$

*i.e.*, $a:b:c:d:e = (a.b.c.d):(b.b.c.d)$
$:(b.c.c.d):(b.c.d.d):(b.c.d.e)$

**EXAMPLE 1** *Find the ratio of 25 to 40.*

**SOLUTION** $\frac{25}{40} = \frac{5 \times 5}{5 \times 8} = \frac{5}{8}$

**NOTE** To get the ratio, we rationalize the fractions by cancelling out the common factors of numerator and denominator.

**EXAMPLE 2** *Find the ratio of 90 cm to 1.5 m.*

**SOLUTION** 1.5 m = 150 cm (units must be same)

So, the required ratio $= \frac{90}{150} = \frac{3}{5}$

**EXAMPLE 3** *The number of boys and girls in a school are 576 and 480 respectively. Express the ratio of the number of boys to that of girls in the simplest form.*

**SOLUTION** Required ratio $= \frac{576}{480} = \frac{6}{5}$ $\left(\because \frac{576}{480} = \frac{96 \times 6}{96 \times 5}\right)$

**EXAMPLE 4** *Shukla earns Rs. 14,000 per month and Mishra earns Rs. 18,000 per month. Find the ratio of Shukla's salary to Mishra's salary.*

**SOLUTION** Required ratio $= \frac{14,000}{18,000} = \frac{7}{9}$

**EXAMPLE 5** *Out of 144 persons working in an office, 56 are men and the remaining are women. Find the ratio of number of women to number of men.*

**SOLUTION** Ratio $= \frac{88}{56} = \frac{11}{7}$ ($\because$ number of women = 144 - 56)

**EXAMPLE 6** *In a club having 100 members, 20 play carrom, 24 play table-tennis and 16 play cricket and the remaining members do not play any game. No member plays more than one game. Find the ratio of the number of members who play.*

*(a) Carrom to the number of those who play table-tennis.*
*(b) Cricket to the number of those who play carrom.*
*(c) Cricket to the number of those who do not play any game.*
*(d) Table-tennis to the number of those who do not play any game.*
*(e) Some game to the number of those who do not play any game.*

**SOLUTION** Total members = 100
Carrom = 20
Table-tennis = 24
Cricket = 16
No any game = 40

Compiled By Jasjeet

yoursmahboob.wordpress.com


(a) $\frac{20}{24}=\frac{5}{6}$ (b) $\frac{16}{20}=\frac{4}{5}$

(c) $\frac{16}{40}=\frac{2}{5}$ (d) $\frac{24}{40}=\frac{3}{5}$

(e) $\frac{60}{40}=\frac{3}{2}$

**EXAMPLE 7** *A person earns Rs. 1200 per day and spends Rs. 800. Find the ratio of his savings to expenditure.*

**SOLUTION** $\frac{400}{800}=\frac{1}{2}$ (Savings = Income – Expenditure)

$=1:2$

**EXAMPLE 8** *Simplify the following ratios :*

(a) $\frac{1}{6}:\frac{1}{8}$ (b) $2\frac{1}{3}:3\frac{1}{2}$ (c) $\frac{5}{6}:\frac{3}{8}:3\frac{3}{4}$

**SOLUTION** (a) $\frac{1}{6}:\frac{1}{8}=\frac{1/6}{1/8}=\frac{1}{6}\times\frac{8}{1}=\frac{4}{3}$ or $4:3$

**Alternatively:** $\frac{1}{6}:\frac{1}{8}=\frac{48}{6}:\frac{48}{8}$ $\left(\text{or } \frac{24}{6}:\frac{24}{8}\right)$

$=8:6=4:3$

**NOTE** In case of fractions, convert them to whole numbers by multiplying each term by the L.C.M. of their denominators.

(b) $2\frac{1}{3}:3\frac{1}{2}=\frac{7}{3}:\frac{7}{2}=\frac{7/3}{7/2}=\frac{2}{3}$ or $2:3$

**NOTE** In case of two fractions if numerators are same, then the required ratio is the inverse ratio of the fractions.

(c) $\frac{5}{6}:\frac{3}{8}:3\frac{3}{4}=\frac{5}{6}:\frac{3}{8}:\frac{15}{4}=\frac{5}{6}\times24:\frac{3}{8}\times24:\frac{15}{4}\times24$

$=20:9:90$ {∵ LCM of 6, 8 and 4 is 24}

**EXAMPLE 9** *Divide 14 toffees among Ankita and Anshul in the ratio 5 : 2*

**SOLUTION** According to the question, if there are 7 toffees then Ankita will have 5 and Anshul will have 2 toffees but since there are 14 toffees, which is twice of 7. So Ankita will have 10 toffees and Anshul will have 4 toffees.

**SHORTCUT**

| Ankita | | Anshul |
|---|---|---|
| 5 | : | 2 |
| $14\times\frac{5}{(5+2)}$ | : | $14\times\frac{2}{(5+2)}$ |
| 10 | : | 4 |

**EXAMPLE 10** *Three boys are aged 2 years, 4 years and 8 years. They want to divide seventy rupees in the ratio of their ages. How much money would each get?*

**SOLUTION** The ratio of their ages $=A:B:C=2:4:8=1:2:4$

| A | : | B | : | C |
|---|---|---|---|---|
| 1 | : | 2 | : | 4 |
| $70\times\frac{1}{1+2+4}$ | : | $70\times\frac{2}{1+2+4}$ | : | $70\times\frac{4}{1+2+4}$ |
| 10 | : | 20 | : | 40 |

So $A$ gets Rs. 10, $B$ gets Rs. 20 and $C$ gets Rs. 40 if the ratio of their ages is $2:4:8$.

**EXAMPLE 11** *An amount of Rs. 100 is being divided among two persons in the ratio $\frac{1}{10}:\frac{1}{15}$. How much money does each get?*

**SOLUTION** $\frac{1}{10}:\frac{1}{15}=\frac{1}{10}\times30:\frac{1}{15}\times30=3:2$ (here 30 is the LCM of 10 and 15)

So, the ratio of amount of money $=\frac{3}{5}\times100:\frac{2}{5}\times100$

$=60$ and $40$

**EXAMPLE 12** *The lengths of sides of a triangle are in the ratio $2:3:4$. If the perimeter of the triangle is 63 cm, find the lengths of the sides of the triangle.*

**SOLUTION** Let the sides of triangle be $2x$, $3x$ and $4x$, then $2x+3x+4x=63$

$\Rightarrow$ $9x=63 \Rightarrow x=7$

∴ The sides of triangle $=2x, 3x, 4x=14, 21, 28$

**Alternatively:**

$63\times\frac{2}{(2+3+4)}$ and $63\times\frac{3}{(2+3+4)}$ and $63\times\frac{4}{(2+3+4)}$

$=14, 21$ and $28$.

**EXAMPLE 13** *Divide 1224 into three parts such that first part be double that of second part and second part be $\frac{1}{3}$ of the third part.*

**SOLUTION** Let $A, B, C$ be three parts respectively, then

$A:B=2:1$

and $B:C=1:3$

∴ $A:B:C=2:1:3$

∴ $A=1224\times\frac{2}{6}=408$

$B=1224\times\frac{1}{6}=204$

$C=1224\times\frac{3}{6}=612$

**EXAMPLE 14** *If $A:B=3:4$, $B:C=5:2$ then find the value of $A:B:C$.*

**SOLUTION** $A:B=3:4$

and $B:C=5:2$

$A:B:C=(3\times5):(4\times5):(4\times2)$

or $A:B:C=15:20:8$

$\begin{bmatrix}3 & : & 4\\ \downarrow & & \downarrow\\ 5 & : & 2\end{bmatrix}$

**EXAMPLE 15** *The ratio of $A:B=1:3$, $B:C=2:5$, $C:D=2:3$. Find the value of $A:B:C:D$.*

**SOLUTION** $A:B=1:3$

$B:C=2:5$

$C:D=2:3$

$A:B:C:D=(1\times2\times2):(3\times2\times2):(3\times5\times2):(3\times5\times3)$

$A:B:C:D=4:12:30:45$

Compiled By Jasjeet

yoursmahboob.wordpress.com



**EXAMPLE 16** *There are two types of mixtures of milk and water. In the first mixture, out of 12 litres of mixture, 5 litre is milk only and in the second mixture, 6 litre is milk and 12 litre is water. Which one mixture is better in terms of milk's strength?*

**SOLUTION** First Mixture Second Mixture

$\frac{5}{12}$ $\frac{6}{18}$ $(6 + 12 = 18)$

$\frac{5}{12} \times 36$ $\frac{6}{18} \times 36$ (milk + water = mixture)

15 12

So the first mixture has more milk in comparison to water.

**EXAMPLE 17** *The ratio of salary of $A : B = 1 : 2$, $B : C = 3 : 4$, $C : D = 5 : 6$ and $D : E = 7 : 8$. What is the ratio of salary of A and E?*

**SOLUTION**

$A : B$ $1 : 2$

$B : C$ $3 : 4$

$C : D$ $5 : 6$

$D : E$ $7 : 8$

$A : B : C : D : E = (1 \times 3 \times 5 \times 7) : (2 \times 3 \times 5 \times 7)$
$: (2 \times 4 \times 5 \times 7) : (2 \times 4 \times 6 \times 7) : (2 \times 4 \times 6 \times 8)$

or $A : B : C : D : E = 105 : 210 : 280 : 336 : 384$

So the ratio of salary of $A : E = 105 : 384 = 35 : 128$

**NOTE** In every next step, we leave the left term and adopt right term.

**EXAMPLE 18** *If $\frac{a}{b} = \frac{3}{4}$, then find the value of $7a - 4b : 3a + b$.*

(a) 7 : 1 (b) 5 : 13
(c) 12 : 1 (d) none of these

**SOLUTION** Simply substitute the value of $a$ and $b$ as 3 and 4 in the given algebraic ratio

as $(7 \times 3 - 4 \times 4) : (3 \times 3 + 4) = 5 : 13$

**EXAMPLE 19** *If $a : b = 3 : 2$ and $b : c = 6 : 5$ then $a : b : c$ is equal to*

(a) 9 : 6 : 5 (b) 9 : 6 : 10
(c) 3 : 3 : 5 (d) 3 : 6 : 5

**SOLUTION**

$a : b = 3 : 2$
$b : c = 6 : 5$

$a : b : c = (3 \times 6) : (2 \times 6) : (2 \times 5)$
$= 18 : 12 : 10 = 9 : 6 : 5$

**EXAMPLE 20** *The sum of two natural numbers is 64. Which of the following can not be the ratio of these two numbers?*

(a) 3 : 5 (b) 1 : 3 (c) 7 : 9 (d) 3 : 4

**SOLUTION** Let the numbers be $3x$ and $5x$, then

$3x + 5x = 64 \Rightarrow 8x = 64$

$\Rightarrow$ $x = 8$, which is possible

The numbers are 24, 40.

Take another option:

$x + 3x = 64 \Rightarrow x = 16$

The numbers are 16 and 48.

Check for option (c)

$7x + 9x = 64 \Rightarrow 16x = 64$

$\Rightarrow$ $x = 4$

The numbers are 28 and 36.

Check for option (d)

$3x + 4x = 64 \Rightarrow 7x = 64$

$x = \frac{64}{7}$

Numbers are $\frac{3 \times 64}{7}$ and $\frac{4 \times 64}{7}$ or $\frac{192}{7}$ and $\frac{256}{7}$

which are not the natural numbers.

Hence option (d) is the required answer.

**EXAMPLE 21** *Monthly incomes of A and B are in the ratio of 4 : 3 and their savings are in the ratio of 3 : 2. If the expenditure of each will be Rs. 600, then the monthly incomes of each are :*

(a) 1800, 2400 (b) 2400, 1600
(c) 2400, 1800 (d) 1600, 1200

**SOLUTION** Income = Exp. + Savings

$A \rightarrow 4x = 3y + 600$

$B \rightarrow 3x = 2y + 600$

Therefore, $4x - 3y = 600$ and $3x - 2y = 600$

$\Rightarrow$ $4x - 3y = 3x - 2y \Rightarrow x = y$

$\therefore$ $4x - 3x = 600 \Rightarrow x = 600$

Then, the income of $A = 4 \times 600 = 2400$

and income of $B = 3 \times 600 = 1800$

**Alternatively:** Check the options. Consider (c)

| | | | | |
|---|---|---|---|---|
| Income | A | | B | |
| | 2400 | | 1800 | |
| | (4) | : | (3) | $\Rightarrow$ correct |
| Again, | 2400 | | 1800 | |
| | − 600 | | − 600 | |
| Savings | 1800 | | 1200 | |
| | (3) | : | (2) | $\Rightarrow$ correct |

Hence, option (c) is correct. If you check other options, the ratio will not match.

**EXAMPLE 22** *A, B and C have 40, x and y balls with them respectively. If B gives 20 balls to A, he is left with half as many balls as C. If together they had 60 more balls, each of them would have had 100 balls on an average. What is value of $x : y$?*

(a) 3 : 2 (b) 4 : 6 (c) 2 : 1 (d) 3 : 4

**SOLUTION** From the last statement

$$\frac{100 + x + y}{3} = 100$$

$\Rightarrow$ $x + y = 200$ ...(1)

Again from first statement, $\frac{x - 20}{y} = \frac{1}{2}$

$\Rightarrow$ $2x - y = 40$ ...(2)

Solving equations (1) and (2), we get

$x = 80$ and $y = 120$

Therefore, required ratio of $x : y = 2 : 3$

Hence, option (b) is correct.

**Alternatively:** After forming the equation (1), we can go through the options. Let us assume option (b).

$x + y = 200$

$x : y = 4 : 6$

Compiled By Jasjeet

yoursmahboob.wordpress.com


$\Rightarrow \quad x = 80$ and $y = 120$

Now from the first statement, $\frac{x-20}{y} = \frac{1}{2}$

So $\quad \frac{80-20}{120} = \frac{1}{2}$ (verified)

hence option (b) is correct.

**EXAMPLE 23** *The incomes of A, B, C are in the ratio of 12 : 9 : 7 and their spendings are in the ratio 15 : 9 : 8. If A saves 25% of his income. What is the ratio of the savings of A, B and C?*

**SOLUTION** Income = Expenditure + Saving

$A \rightarrow \quad 12x = 15y + 3x \quad (3x = 25\% \text{ of } 12x)$

$B \rightarrow \quad 9x = 9y + (9x - 9y)$

$C \rightarrow \quad 7x = 8y + (7x - 8y)$

Therefore, $\quad 12x - 3x = 15y$

$\Rightarrow \quad \frac{x}{y} = \frac{5}{3}$

$\Rightarrow \quad y = \frac{3x}{5}$

Therefore, savings = (income – expenditure)

$$A = 12x - 9x = 3x$$

$$B = 9x - \frac{27}{5}x = \frac{18}{5}x$$

$$C = 7x - \frac{24}{5}x = \frac{11}{5}x$$

*i.e.*, the ratio of savings of $A : B : C = 3x : \frac{18}{5}x : \frac{11}{5}x$

$$= 15x : 18x : 11x$$

$$= 15 : 18 : 11$$

**EXAMPLE 24** *There are total 100 coins consisting of 20 paise, 50 paise and Re 1 in the ratio of 7 : 8 : 5. What is the no. of coins of 50 paise if the difference between the amount yielded by 20 paise and Re. 1 coin is 18?*

(a) 32 (b) 40 (c) 26 (d) 56

**SOLUTION** $(20 \times 7x) \sim (100 \times 5x) = 1800$ (Rs. 18 = 1800 paise)

$(140x) \sim (500x) = 1800$

$\Rightarrow \quad 360x = 1800$

$\Rightarrow \quad x = 5$

Therefore, number of coins of 50 paise = 8 × 5 = 40

**Alternatively:** Let there be 40 coins of 50 paise denomination, then

The no. of coins of $A, B, C = 7x : 8x : 5x = 35 : 40 : 25$

Therefore, the amount from 20 paise coins = 35 × 20 = Rs. 7

and amount from Re 1 coins = 1 × 25 = Rs. 25

Hence difference = Rs. 18 (25 – 7)

Thus the presumed option is correct.

**EXAMPLE 25** *There are 43800 students in 4 schools of a city. If half of the first, two-third of the second, three-fourth of the third and four-fifth of the fourth are the same number of students, then find the ratio of number of students of A and D if A, B, C and D be the first, second, third and fourth schools respectively.*

**SOLUTION** $\quad \frac{A}{2} = \frac{2B}{3} = \frac{3C}{4} = \frac{4D}{5}$

Therefore, $\frac{A}{B} = \frac{4}{3}$ and $\frac{B}{C} = \frac{9}{8}$ and $\frac{C}{D} = \frac{16}{15}$

$\therefore \quad A : B = 4 : 3$

$B : C = 9 : 8$

$C : D = 16 : 15$

$\therefore \quad A : B : C : D = (4 \times 9 \times 16) : (3 \times 9 \times 16) : (3 \times 8 \times 16) : (3 \times 8 \times 15)$

$$A : B : C : D = 576 : 432 : 384 : 360$$

Therefore, the ratio of number of students of $A$ and $D = 576 : 360 = 8 : 5$

**Alternatively:** $\frac{A}{2} = \frac{2}{3}B = \frac{3}{4}C = \frac{4}{5}D = k$

then $\quad A : B : C : D = 2k : \frac{3}{2}k : \frac{4}{3}k : \frac{5}{4}k$

$$= 24k : 18k : 16k : 15k$$

$\therefore \quad A : B : C : D = 24 : 18 : 16 : 15$

$\therefore \quad A : D = 24 : 15 = 8 : 5$

## PROPORTION

An equality of two ratios is called a proportion and we say that the four numbers are in proportion.

*i.e.*, if $\frac{a}{b} = \frac{c}{d}$, or $a : b = c : d$, then we say that $a$, $b$, $c$ and $d$ are in proportions and written as $a : b :: c : d$, where the symbol '::' indicates proportion and it is read as '$a$ is to $b$ as $c$ is to $d$'.

Here $a$ and $d$ are called **"extremes"** (or extreme terms) and $b$ and $c$ are called as **"means"** (or middle terms). Thus four numbers are said to be in proportion, if the ratio of the first to the second number is equal to the ratio of the third to the fourth number. *e.g.*, 2 : 3 :: 4 : 6. Some important results are derived from the discussion of proportion, which are very important for clear understanding.

### Properties of Proportion

1. If four numbers (quantities) are in proportion then product of the extremes is equal to the product of the means and if these are not in proportion, then product of extremes is not equal to the product of the means.

   *i.e.*, if $\quad a : b :: c : d$,

   then $\quad a \times d = b \times c$

   Thus it is clear that if three out of four terms of a proportion are given, then we can find the fourth term by dividing the product of means (or extremes) by the remaining term.

2. If $a$, $b$ and $c$ are three numbers such that $a : b = b : c$ then these numbers $a$, $b$, $c$ are said to be in **continued proportion** or simply in proportion.

Compiled By Jasjeet

yoursmahboob.wordpress.com



*i.e.,* $a : b = b : c \Rightarrow b^2 = ac$

Here $b$ is said to be the **mean proportional** between $a$ and $c$, and $c$ is said to be the **third proportional** to $a$ and $b$. *e.g.,* $3 : 9 :: 9 : 27$

Here $9 \times 9 = 3 \times 27$ which are in continued proportion.

**NOTE** Sometimes the above idea is also expressed by saying that the three numbers are in the ratio 3 : 9 : 27. Thus if three quantities are proportionals, the first is to the third as the duplicate ratio of the first to the second.

*i.e.,* if $a : b :: b : c$

then $a : c = a^2 : b^2$

$$\left[\because \frac{a}{b} = \frac{b}{c} \Rightarrow \frac{a^2}{b^2} = \frac{ab}{bc} \Rightarrow \frac{a^2}{b^2} = \frac{a}{c} \Rightarrow a : c = a^2 : b^2\right]$$

### Some Facts about Proportion

**(a) Invertendo:** If $\frac{a}{b} = \frac{c}{d} \Rightarrow \frac{b}{a} = \frac{d}{c}$

**(b) Alternando:** If $\frac{a}{b} = \frac{c}{d} \Rightarrow \frac{a}{c} = \frac{b}{d}$

**NOTE** Each of the two results (a) and (b) can be obtained by cross product.

**(c) Componendo:** If $\frac{a}{b} = \frac{c}{d} \Rightarrow \left(\frac{a+b}{b}\right) = \left(\frac{c+d}{d}\right)$

**(d) Dividendo:** If $\frac{a}{b} = \frac{c}{d} \Rightarrow \left(\frac{a-b}{b}\right) = \left(\frac{c-d}{d}\right)$

**(e) Componendo and Dividendo:** If $\frac{a}{b} = \frac{c}{d}$

$$\Rightarrow \left(\frac{a+b}{a-b}\right) = \left(\frac{c+d}{c-d}\right)$$

**NOTE** The result (e) can be obtained by dividing result (c) by result (d).

---

**EXAMPLE 1** *The first, second and fourth terms of a proportion are 5, 15 and 90 respectively. Find the third term.*

**SOLUTION** Let the third term be $x$, then 5, 15, $x$, 90 are in proportion *i. e.*, $5 : 15 :: x : 90$

$\Rightarrow$ $5 \times 90 = 15 \times x$ (by the I$^{st}$ property)

$\Rightarrow$ $x = 30$

**EXAMPLE 2** *The ratio of length to width of a rectangular sheet of paper is 5 : 3. If the width of the sheet is 18 cm, find its length.*

**SOLUTION** Let the length of sheet of paper be $x$ cm. Then the ratio of length to width = $x : 18$

Thus $x : 18 = 5 : 3$

$\Rightarrow$ $x \times 3 = 18 \times 5$

$\Rightarrow$ $x = 30$

Hence the length of paper = 30 cm.

**EXAMPLE 3** *If 81, x, x, 256 are in proportion, find x.*

**SOLUTION** $81 : x :: x : 256$

$\Rightarrow$ $81 \times 256 = x \times x \Rightarrow x = 144$

**EXAMPLE 4** *The ratio between the number of men and women in an office is 5 : 7. If the number of women working in the office is 56, find the number of men working in the office.*

**SOLUTION** $5 : 7 = x : 56$ (suppose number of men = $x$)

$\Rightarrow$ $x = 40$ (by the first property)

Therefore, number of men in the office = 40

**EXAMPLE 5** *The age of Chandi and Radhika are in the ratio 5 : 3. If Chandi's age is 20 years, find the age of Radhika.*

**SOLUTION** $5 : 3 = 20 : x$

$\Rightarrow$ $x = \frac{3 \times 20}{5}$ (by the first property)

$\Rightarrow$ $x = 12$

Hence the age of Radhika is 12 years.

**EXAMPLE 6** *The ratio of the number of boys to that of girls in a school is 9 : 11. If the number of girls in the school is 2035, find :*

*(a) number of boys in school*

*(b) number of students in school.*

**SOLUTION** (a) $9 : 11 = x : 2035$

$\Rightarrow$ $x = \frac{9 \times 2035}{11}$

$x = 1665$ (number of boys)

(b) number of students

= number of boys + number of girls = 3700

**EXAMPLE 7** *What is the least possible number which must be subtracted from 16, 19 and 23 so that the resulting numbers are in continued proportion?*

*(a) 2* *(b) 4* *(c) 6* *(d) 7*

**SOLUTION** Going through options, we find option (d) is correct.

**Alternatively:**

$(16 - x) : (19 - x) :: (19 - x) : (23 - x)$

$\Rightarrow$ $(19 - x)^2 = (16 - x)(23 - x)$

By solving the above equation, we get $x = 7$

**EXAMPLE 8** *If $(a + b) : (a - b) = 15 : 1$, then the value of $a^2 - b^2$ is:*

*(a) 56* *(b) 15* *(c) 112* *(d) 8*

**SOLUTION** $\frac{(a+b)}{(a-b)} = \frac{15}{1}$

$\Rightarrow$ $\frac{a}{b} = \frac{8}{7}$ (by componendo and dividendo)

therefore $a^2 - b^2 = 64 - 49 = 15$

**EXAMPLE 9** *The mean proportional between 8 and 98 is :*

*(a) 16* *(b) 53* *(c) 112* *(d) 28*

**SOLUTION** $8 : x :: x : 98$

$\Rightarrow$ $x^2 = 8 \times 98$

$x = 28$

Hence (d) is correct.

Compiled By Jasjeet

yoursmahboob.wordpress.com


**EXAMPLE 10** *The students in three classes are in the ratio of 2 : 3 : 4. If 40 students are added in each class, the ratio becomes 4 : 5 : 6. Find the total number of students in all the three classes is :*
*(a) 270 (b) 180 (c) 126 (d) 135*

**SOLUTION**

$$2x + 40 = 4y \quad \ldots(i)$$
$$3x + 40 = 5y \quad \ldots(ii)$$
$$4x + 40 = 6y \quad \ldots(iii)$$

Therefore $2x = 40$

$\Rightarrow$ $x = 20$

Hence, total number of students $= 2x + 3x + 4x = 9x$
$= 9 \times 20 = 180$

**Alternatively:** It can be solved through options also.

**EXAMPLE 11** *The dimensions of a photograph are 4 and 1.8 cms. If the breadth of the enlarged photo is 4.5 cm and it was enlarged proportionally then what is the new length of new photograph?*
*(a) 6 (b) 5.4 (c) 10 (d) 9*

**SOLUTION** $4 : 1.8 = x : 4.5$

$\Rightarrow$ $x = 10$

Thus, the length of new photograph is 10 cm.

**EXAMPLE 12** *Two equal containers are filled with the mixture of milk and water. The concentration of milk in each of the containers is 20% and 25% respectively. What is the ratio of water in both the containers respectively?*
*(a) 15 : 16 (b) 16 : 15 (c) 4 : 5 (d) 5 : 4*

**SOLUTION**

| | | |
|---|---|---|
| **Milk** | 20% | 25% |
| **Water** | 80% | 75% |

Thereofre, required ratio $= \frac{80}{75} = \frac{16}{15}$ or 16 : 15

**EXAMPLE 13** *A cat takes 7 steps for every 5 steps of a dog, but 5 steps of a dog are equal to 6 steps of cat. What is the ratio of speed of cat to that of dog?*
*(a) 24 : 25 (b) 42 : 25 (c) 24 : 19 (d) 25 : 42*

**SOLUTION**

| | CAT | DOG |
|---|---|---|
| Given speed | 7 steps | 5 steps |

but the length of 5 steps of dog = length of 6 steps of cat

it means the ratio of length covered by dog is to cat $= \frac{6}{5}$

Therefore, in each step a dog will cover $\frac{6}{5}$ times distance than that of a cat.

Thus the ratio of actual speed of cat is to dog

$$= 7 : 5 \times \frac{6}{5} = 7 : 6$$

**SHORTCUT** Actual speed of $A : B$

$$= \frac{\text{Given speed of } A}{\text{no. of steps of } A \text{ in terms of length}} : \frac{\text{Given speed of } B}{\text{no. of steps of } B \text{ in terms of length}}$$

$= \text{CAT} : \text{DOG}$

$= \frac{7}{6} : \frac{5}{5} = 7 : 6$

**EXAMPLE 14** *A camel pursue an elephant and takes 5 leaps for every 7 leaps of the elephant, but 5 leaps of elephant are equal to 3 leaps of camel. What is the ratio of speeds of camel and elephant?*

**SOLUTION** Ratio of speed of camel and elephant

$$= \frac{5}{3} : \frac{7}{5} = \frac{5}{3} \times 15 : \frac{7}{5} \times 15$$
$$= 25 : 21$$

## UNITARY METHOD

A method in which the value of a quantity is first obtained to find the value of any required quantity is called unitary method.

In solving problems based on unitary method.

### Direct Proportion

Two quantities are said to be directly proportional if the increase (or decrease) in one quantity causes the increase (or decrease) in the other quantity by same proportion. *e.g.,*

(i) The cost of articles varies directly to the number of articles. More articles more cost, less articles less cost.

(ii) The work done varies directly to the number of men (work force) at work. More men at work, more work done in same time. Less men, less work done in same time.

### Inverse Proportion

Two quantities are said to vary inversely if the increase (or decrease) in one quantity causes the decrease (or increase) in the other quantity by same proportion *e.g.,* The time taken to finish a work varies inversely to the number of men at work.

More men at work, less time taken to finish the same work. Less men at work, more time taken to finish the same work.

**EXAMPLE 1** *If 6 note books cost Rs. 45, how much would 8 notebooks cost?*

**SOLUTION** More note books more cost; less note books, less cost

| Note books | Cost |
|---|---|
| 6 | 45 |
| 1 | 45/6 |
| 8 | $\frac{8 \times 45}{6} = 60$ |

Hence 8 note books cost Rs. 60.

**EXAMPLE 2** *If 45 students can consume a stock of food in 2 months, find for how many days the same stock of food will last for 27 students?*

**SOLUTION** More students, less days; less students, more days

| Students | Days |
|---|---|
| 45 | 60 |
| 1 | $60 \times 45$ |
| 27 | $\frac{60 \times 45}{27} = 100$ days |

Compiled By Jasjeet

yoursmahboob.wordpress.com



**EXAMPLE 3** *A man working 8 hours a day takes 5 days to complete a project. How many hours a day must he work to complete it in 4 days?*

**SOLUTION** 'More days, less hours; less days, more hours'

| Days | Hours |
|---|---|
| 5 | 8 |
| 1 | $5 \times 8$ |
| 4 | $\frac{5 \times 8}{4} = 10$ hours a day |

## VARIATION

When two or more quantities are dependent upon each other and then if any one of them is changed, the other (dependent) quantity is also changed.

For example :

(i) When the salary of a person increases, then its savings/expenditure increases.

(ii) When the number of guests in a hotel/number of students in a hostel/number of employees changes, their respective expenses increases.

Basically, as it happens in direct proportion and inverse proportion, there are two types of variation :

(i) Direct variation (ii) Inverse variation

### Direct Variation

A quantity $A$ is said to vary directly if the increase (or decrease) in $B$ yields increase (or decrease) in $A$ but not in proportion. It is expressed as

$$A \propto B \Rightarrow A = KB,$$

where $K$ is called proportionality constant

$$\Rightarrow \quad K = \frac{A}{B}$$

### Inverse Variation

A quantity $A$ is said to vary inversely if the increase (or decrease) in $B$ yields decrease (or increase) in $A$ but not in same proportion. It is expressed as

$$A \propto \frac{1}{B} \Rightarrow A = \frac{K}{B}$$

or $K = AB$, $K$ is called as proportionality constant.

**NOTE**

1. If it is not mentioned that a particular quantity is inversely variable, then it means the given quantity is directly variable.
2. A quantity sometimes vary jointly *i.e.*, directly on any quantity and inversely on another quantity.

*e.g.*, $A \propto B$ and $A \propto \frac{1}{C}$

It means $A \propto \frac{B}{C} \Rightarrow A = \frac{KB}{C}$

Here $A$ varies directly as $B$ but inversely as $C$.

Also it can vary as only directly or inversely as more than one quantities

*e.g.*, $A \propto BC \Rightarrow A = KBC$

and $A \propto \frac{1}{BC} \Rightarrow A = \frac{K}{BC}$

**EXAMPLE 1** *A varies directly as B and inversely as C. A is 12 when B is 6 and C is 2. What is the value of A when B is 12 and C is 3?*

**SOLUTION** $A \propto B$ and $A \propto \frac{1}{C}$

$$\Rightarrow \quad A \propto \frac{B}{C} \Rightarrow A = K\frac{B}{C}$$

when $A = 12, B = 6, C = 2$, then

$$12 = K\frac{6}{2} \Rightarrow K = 4$$

Again $A = K\frac{B}{C} = 4 \times \frac{12}{3} = 16$

$$\Rightarrow \quad A = 16$$

**EXAMPLE 2** *The value of a coin varies directly to the square of its radius, when its thickness is constant. The radius of a coin is 1.5 cm and its value is Rs. 2. What will be the radius of a coin if its value is Rs. 5?*

**SOLUTION** $V \propto r^2$

$$\Rightarrow \quad V = Kr^2$$

$$2 = K \times (1.5)^2$$

$$\Rightarrow \quad K = \frac{2}{2.25}$$

$$K = \frac{8}{9}$$

Again $5 = \frac{8}{9} \times r^2$

$$\Rightarrow \quad r^2 = \frac{5 \times 9}{8}$$

$$\therefore \quad r = \frac{3}{2} \times \sqrt{\frac{5}{2}}$$

$$= 1.5 \times \sqrt{2.5} = 1.5 \times 1.6$$

$$r \approx 2.4 \text{ cm}$$

Hence, required radius = 2.4 cm

## PROBLEMS BASED ON AGES

This article is very suitable as an appendix of Ratio-proportion, since most of the questions based on ages involve the concept of ratio-proportion. *e.g.*, the age of Ravi is 16 years and the age of her mother is twice etc. or the ratio of the ages of the father and son at present is 3 : 1. 4 years, earlier the ratio was 4 : 1. What is the present ages of the father and son etc.

Compiled By Jasjeet

yoursmahboob.wordpress.com



**EXAMPLE 1** *The ratio of ages of Krishna and Balram is 3 : 4. Four years earlier the ratio was 5 : 7. Find the present ages of Krishna and Balram :*

*(a) 15 years, 20 years* *(b) 24 years, 32 years*
*(c) 16 years, 20 years* *(d) 32 years, 24 years*

**SOLUTION** Let the present age of Krishna and Balram be $3x$ and $4x$, then

four years ago their ages be $(3x-4)$ and $(4x-4)$

So $$\frac{(3x-4)}{(4x-4)} = \frac{5}{7}$$

$\Rightarrow$ $$7(3x-4) = 5(4x-4)$$

$\Rightarrow$ $$21x - 28 = 20x - 20$$

$\Rightarrow$ $$x = 8$$

$\therefore$ Present age of Krishna $= 3x = 24$ years

and age of Balram $= 4x = 32$ years

**EXAMPLE 2** *The ratio of age of Aman and her mother is 3 : 11. The difference of their ages is 24 years. What will be the ratio of their ages after 3 years?*

**SOLUTION** Let the present age of Aman and her mother be $3x$ and $11x$ then 3 years later their ages will be $(3x+3)$ and $(11x+3)$ respectively.

Again $$11x - 3x = 24$$

$\Rightarrow$ $$8x = 24 \Rightarrow x = 3$$

Therefore the ratio of their ages 3 years after

$$= \frac{3x+3}{11x+3} = \frac{12}{36} = \frac{1}{3}$$

**EXAMPLE 3** *The age of Sachin is 4 times that of his son. Five years ago Sachin was nine times as old as his son was at that time. The present age of the Sachin is :*

*(a) 25 years* *(b) 36 years*
*(c) 32 years* *(d) 48 years*

**SOLUTION** Let the age of son is $x$ years, then the age of Sachin will be $4x$ years.

$\therefore$ $$(4x-5) = 9(x-5) \Leftrightarrow x = 8$$

$\therefore$ Age of Sachin is 32 years.

**EXAMPLE 4** *The ratio of Varun's age and his mother's age is 5 : 11. The difference of their ages is 18 years. The ratio of their ages after 5 years will be :*

*(a)* 19 : 59 *(b)* 2 : 3 *(c)* 37 : 75 *(d)* 10 : 19

**SOLUTION** Let their ages be $5x$ and $11x$.

$$11x - 5x = 18 \Leftrightarrow x = 3$$

So their present ages are 15 and 33 years. Therefore, ratio of their ages after 5 years = 20 : 38 = 10 : 19.

## PARTNERSHIP

When two or more than two people run a business jointly by investing their money/resources, then it is called a joint venture or the business in partnership.

All these people, who have invested their resources, are called as Partners.

### Partners are basically of two types

(i) **Working partner:** A partner who is directly involved with day-to-day activities of business is called as working partner.

(ii) **Sleeping partner:** A partner who just invests his or her money is called as sleeping partner.

### General rules of partnership :

(i) If the partners invest different amounts for the same period of time, then the profits of all the partners are shared in the ratio of their investments.

(ii) If the partners invest same amount for the different time periods, then the profits of all the partners are shared in the ratio of time periods for which their amounts were invested.

(iii) If the partners invest different amounts for different time periods, then their profits are shared in the ratio of products of respective investments with the time period for each partner, individually.

Thus gain or loss is divided in the ratio of 'money-time' capitals.

**NOTE** Sometimes different problems are solved on the basis of partnership to find the expenses.

**EXAMPLE 1** *Bhanu and Shafeeq started a business by investing Rs. 36,000 and Rs. 63,000. Find the share of each, out of an annual profit of Rs. 5,500.*

**SOLUTION** Ratio of shares of Bhanu and Shafeeq

$$= 36000 : 63{,}000 = 4 : 7$$

$\therefore$ Share of Bhanu $= 5500 \times \frac{4}{11} =$ Rs. 2000

and Share of Shafeeq $= 5500 \times \frac{7}{11} = 3500$

**EXAMPLE 2** *A starts some business with Rs. 50,000. After 3 months B joins him with Rs. 70,000. At the end of the year, in what ratio should they share the profits?*

**SOLUTION** Ratio of amount of $A$ and $B$ = 50,000 : 70,000

Ratio of time periods for $A$ and $B$ = 12 : 9

$\therefore$ Ratio of their money-time capital

Investments $= 50000 \times 12 : 70000 \times 9 = 20 : 21$

**EXAMPLE 3** *Harsh Vardhan started a business by investing Rs. 36,000. After 4 months Gyan Vardhan joined him with some investment. At the end of the year, the total profit was divided between them in the ratio of 9 : 7. How much capital was invested by Gyan Vardhan in the business?*

**SOLUTION** $$\frac{36{,}000 \times 12}{x \times 8} = \frac{9}{7}$$

$\Rightarrow$ $$x = 42{,}000$$

$\therefore$ Gyan Vardhan invested Rs. 42,000 for 8 months only.

Compiled By Jasjeet

yoursmahboob.wordpress.com



**EXAMPLE 4** *A started some business with Rs. 26,000. After 3 months B joined him with Rs. 16,000. After some more time C joined them with Rs. 25,000. At the end of the year, out of a total profit of Rs. 15,453, C gets Rs. 3825 as his share. How many months after B joined the business did C join?*

**SOLUTION** Ratio (of share) of profits

$$= 26{,}000 \times 12 : 16000 \times 9 : 25000 \times C$$

$$= 312 : 144 : 25C$$

Now $C$'s share $= \dfrac{25C}{456 + 25C} = \dfrac{3825}{15453}$

$\Rightarrow \quad C = 6$

Therefore $C$ joined 3 months later than $B$ joined.

**EXAMPLE 5** *A, B and C started a business with their investments in the ratio 1 : 2 : 4. After 6 months A invested the half amount more as before and B invested twice the amount as before while C withdrew $\frac{1}{4}$th of the their investments. Find the ratio of their profits at the end of the year.*

**SOLUTION** Let us assume their initial investments were $x$, $2x$ and $4x$ respectively.

Therefore, ratio of their investments during the whole year

$$= (x \times 6 + \frac{3x}{2} \times 6) : (2x \times 6 + 4x \times 6) : (4x \times 6 + 3x \times 6)$$

$$= 15x : 36x : 42x$$

$$= 5x : 12x : 14x$$

$$= 5 : 12 : 14$$

$\therefore$ Ratio of their profits $= 5 : 12 : 14$

**EXAMPLE 6** *A started a business with Rs. 52,000 and after months B joined him with Rs. 39,000. At the end of the year, out of the total profits B received total Rs. 20,000 including 25% of profits as commission for managing the business. What amount does A receive?*

**SOLUTION** Profit's share of $A$ and $B$

$$= 52{,}000 \times 12 : 39{,}000 \times 8 = 2 : 1$$

Let the profit be Rs. $x$, then $B$ receives 25% as commission managing business, the remaining 75% of the total profit shared between $A$ and $B$ in the ratio 2 : 1. Hence $B$ will get $\frac{1}{3}$rd of this in addition to his commission. Hence his total earning

$$= 0.25x + \frac{1}{3} \times 0.75x$$

$$= 0.5x = 20{,}000$$

$\Rightarrow \quad x = 40{,}000$

So, the remaining profit goes to $A$, hence the profit of A is Rs. 20,000.

**EXAMPLE 7** *A working partner gets 20% as his commission of the profit after his commission is paid. If the working partner's commission is Rs. 8000, then what is the total profit in the business?*

**SOLUTION** Let the total profit be Rs. $x$. The remaining profit after paying 20% working partner's commission $= (x - 8000)$. Again since 20% of this is working partner's commission,

therefore $\quad \dfrac{20}{100} \times (x - 8000) = 8000$

$\Rightarrow \quad x = 48{,}000$

$\therefore$ The total profit in the business is Rs. 48,000.

## UNITARY METHOD

### INTRODUCTORY EXERCISE-4.1

1. If 40 articles cost Rs. 180, the cost of 18 articles is :
   (a) Rs. 18 (b) Rs. 36
   (c) Rs. 81 (d) Rs. 40.5
2. If 20 persons can do a piece of work in 7 days, then the number of persons required to complete the work in 28 days :
   (a) 4 (b) 5
   (c) 14 (d) 10
3. If 20 men can reap a field in 38 days, in how many days will 19 men reap the field?
   (a) 21 days (b) 19 days
   (c) 76 days (d) 40 days
4. A rope makes 260 rounds of a cylinder with base radius 20 cm. How many times can it go round a cylinder with base radius 26 cm?
   (a) 130 (b) 300
   (c) 200 (d) 150
5. A garrison of 750 men has provision for 20 weeks. If at the end of 4 weeks they are reinforced by 450 men, how long will the remaining provision last?
   (a) 10 weeks (b) 11 weeks
   (c) 15 weeks (d) 16 weeks
6. 40 men can build a wall 20 m high in 15 days. The number of men required to build a similar wall 25 m high in 6 days will be :
   (a) 100 (b) 125
   (c) 150 (d) 200
7. Cost of erecting a fence round a square field of 625 hectares at 15 paise per metre is :
   (a) Rs. 500 (b) Rs. 750
   (c) Rs. 100 (d) Rs. 1500
8. 56 workers can reap a field in 8 days. If the work is to be completed in 7 days, the extra workers needed are :
   (a) 7 (b) 8
   (c) 14 (d) 16
9. If 5 persons weave 180 shawls in 12 days, how many shawls will 6 persons weave in 15 days?
   (a) 260 (b) 370
   (c) 270 (d) 360

Compiled By Jasjeet

yoursmahboob.wordpress.com



10. 15 men take 42 days of 4 hours each to do a piece of work. How many days of 6 hours each would 21 women take if 3 women do as much work as 2 men?
(a) 15 (b) 22
(c) 25 (d) 30

11. 10 engines consume 80 litres diesel when each is running 9 hours a day., How much diesel will be required for 10 engines, each running 15 hours a day, whereas 6 engines of the former type consume as much as 5 engines of latter type?
(a) 160 litre (b) 75 litre
(c) 80 litre (d) $111\frac{1}{9}$ litre

12. If $\frac{3}{5}$th of a cistern is filled in 30 minutes, how much more time will be required to fill the rest of it?
(a) 50 minutes (b) 20 minutes
(c) 15 minutes (d) 45 minutes

## AGE RELATED PROBLEMS

### INTRODUCTORY EXERCISE-4.2

1. Amit is as much younger to Barkha as he is older to Chaman. If the sum of the ages of Barkha and Chaman is 48 years, what is the present age of Amit?
(a) 18 years (b) 36 years
(c) 24 years (d) 28 years

2. Bipin is 6 times old as Alok. Bipin's age will be twice of Chandan's age after 10 years. If Chandan's 7th birthday was celebrated 3 years ago, what is Alok's present age?
(a) 15 years (b) 12 years
(c) 5 years (d) none of these

3. Renuka got married 8 years ago. Today her age is $1\frac{1}{3}$ times her age at the time of marriage. Her daughter's age is 1/8 times her age. Her daughter's age is :
(a) 3 years (b) 4 years
(c) 6 years (d) 8 years

4. Ten years ago *B* was twice of *A* in age. If the ratio of their present ages is 4 : 3, what is the sum of their present ages?
(a) 25 years (b) 30 years
(c) 40 years (d) 35 years

5. The sum of the ages of Aryabhatta and Shridhar is 45 years. Five years ago the product of their ages was 4 times the Aryabhatta's age at that time. The present ages of Aryabhatta and Shridhar respectively are :
(a) 25 and 20 (b) 35 and 10
(c) 36 and 9 (d) 40 and 5

## PARTNERSHIP

### INTRODUCTORY EXERCISE-4.3

1. A company make a profit of Rs. 9,00,000, 20% of which is paid as taxes. If the rest is divided among the partners *P*, *Q* and *R* in the ratio of $1 : 1\frac{1}{2} : 2$, then the shares of *P*, *Q* and *R* are respectively :
(a) 2,40,000; 3,20,000; 1,60,000
(b) 3,20,000; 2,40,000; 1,60,000
(c) 1,60,000; 3,20,000; 2,40,000
(d) 1,60,000; 2,40,000; 3,20,000

2. We have to divide a sum of Rs. 13,950 among three persons *A*, *B* and *C*. *B* must get the double of *A*'s share and *C* must get Rs. 50 less than the double of *B*'s share. The share of *A* will be :
(a) Rs. 1950 (b) Rs. 1981.25
(c) Rs. 2000 (d) Rs. 2007.75

3. *A* started business with Rs. 45,000 and *B* joined afterward with Rs. 30,000. If the profits at the end of one year were divided in the ratio 2 : 1 respectively, then *B* would have joined *A* for business after :
(a) 1 month (b) 2 months
(c) 3 months (d) 4 months

4. *A* and *B* are partners in a business. They invest in the ratio 5 : 6, at the end of 8 months *A* withdraws. If they receive profits in the ratio of 5 : 9, find how long *B*'s investment was used?
(a) 12 months (b) 10 months
(c) 15 months (d) 14 months

5. Four milkmen rented a pasture. A put to graze 16 cows for 3 months, *B* 20 cows for 4 months, *C* 18 cows for 6 months and *D* 42 cows for 2 months. If *A*'s share of rent be Rs. 2400, the rent paid by *C* is :
(a) Rs. 3200 (b) Rs. 4200
(c) Rs. 4000 (d) Rs. 5400

6. *A*, *B* and *C* subscribe Rs. 47000 for a business. If *a* subscribes Rs. 7000 more than *B* and *B* Rs. 5000 more than *C*, then out of total profit of Rs. 4700, *C* receives :
(a) Rs. 1200 (b) Rs. 4500
(c) Rs. 1000 (d) none of these

Compiled By Jasjeet

yoursmahboob.wordpress.com

## INTRODUCTORY EXERCISE-4.4

1. If $A : B = 4 : 5$, $B : C = 3 : 4$, $C : D = 7 : 11$, then $A : D$ is :
   (a) 3 : 4 (b) 21 : 55
   (c) 21 : 44 (d) 7 : 5
2. Mean proportional between 17 and 68 is :
   (a) 51 (b) 24
   (c) 4 (d) 34
3. Third proportional between 16 and 36 is :
   (a) 64 (b) 144
   (c) 81 (d) 49
4. If $a : b = 2 : 3$, then $(5a + b) : (3a + 2b)$ is :
   (a) 13 : 12 (b) 15 : 17
   (c) 12 : 13 (d) 13 : 11
5. $a = 2b = 3c = 4d$, then $a : b : c : d$ is :
   (a) 12 : 3 : 6 : 4 (b) 3 : 4 : 6 : 12
   (c) 6 : 12 : 4 : 3 (d) 12 : 6 : 4 : 3
6. The fourth proportional to 4, 7 and 20 is :
   (a) 28 (b) 21
   (c) 18 (d) 35
7. If $\sqrt{2} : (1 + \sqrt{3}) :: \sqrt{6} : x$, then $x$ is equal to :
   (a) $1 + \sqrt{3}$ (b) $\sqrt{3} - 1$
   (c) $\sqrt{3} + 3$ (d) $2\sqrt{3}$
8. If $\frac{a}{3} = \frac{b}{4} = \frac{c}{5}$ then $\frac{a + b + c}{b} = ?$
   (a) 2 (b) 3
   (c) 4 (d) 5
9. If $\frac{a}{b} = \frac{c}{d}$, then :
   (a) $\frac{a + b}{a - b} = \frac{c + d}{c - d}$ (b) $\frac{a + b}{a^2} = \frac{c + d}{d^2}$
   (c) $\frac{a + b}{a^2} = \frac{c + d}{c^2}$ (d) $ac = bd$
10. If $a : b = b : c = c : d$ then $\frac{a}{b}, \frac{b}{c}, \frac{c}{d}$ are :
    (a) in AP
    (b) in continued proportion
    (c) in GP
    (d) both (b) and (c)
11. If $(a + b) : (a - b) = 3 : 2$, the $(a^2 - b^2) : (a^2 + b^2)$ equals :
    (a) 5 : 13 (b) 12 : 13
    (c) 9 : 4 (d) none of these
12. Two whole numbers, whose sum is 64, can not be in the ratio :
    (a) 1 : 7 (b) 3 : 5
    (c) 5 : 11 (d) 1 : 2
13. Two numbers are in the ratio 3 : 4. The difference between their squares is 28. Find the greater number :
    (a) 12 (b) 8
    (c) 24 (d) 16
14. If $a, b, c, d, e, f, g$ are in continued proportion, then the value of $a.b.c.e.f.g$ is :
    (a) $d^3$ (b) $d^7$
    (c) $d^6$ (d) none of these
15. If $A$ and $B$ shared Rs. 1300 in the ratio 1 : 12, how much did $A$ get?
    (a) 120 (b) 1200
    (c) 100 (d) 1000
16. Rs. 3960 are divided among $A$, $B$ and $C$ so that half of $A$'s part, one-third of $B$'s part and one-sixth of $C$'s part are equal. Then $C$'s part is :
    (a) 720 (b) 2160
    (c) 1080 (d) 810
17. A sum of Rs. 21000 is divided among $A$, $B$, $C$ such that shares of $A$ and $B$ are in the ratio of 2 : 3 and those of $B$ and $C$ are in the ratio 4 : 5. The amount received by $A$ is :
    (a) Rs. 6000 (b) Rs. 4500
    (c) Rs. 4800 (d) Rs. 8400
18. A certain amount was divided between $A$ and $B$ in the ratio 7 : 9. If $B$'s share was Rs. 7200, the total amount was :
    (a) Rs. 1280 (b) Rs. 6300
    (c) Rs. 5600 (d) Rs. 12800
19. Rs. 11250 are divided among $A$, $B$ and $C$ so that $A$ may receive one-half as much as $B$ and $C$ together receive and $B$ receives one-fourth of what $A$ and $C$ together receive. The share of $A$ is more than that of $B$ by :
    (a) Rs. 2500 (b) Rs. 1500
    (c) Rs. 1800 (d) Rs. 650
20. A girl 1.2 metre tall casts a shadow 1.1 m at the time when a building casts a shadow 6.6 m long. The height of the building is :
    (a) 2.7 m (b) 7.2 m
    (c) 6.0 m (d) 5.5 m
21. The prices of Bajaj Scooter and Bajaj Pulser are in the ratio of 4 : 9. If the Bajaj Pulser costs Rs. 30,000 more than a Bajaj Scooter, the price of Bajaj Pulser is :
    (a) Rs. 63,000 (b) Rs. 45,000
    (c) Rs. 54,000 (d) Rs. 60,000
22. What is the ratio whose terms differ by 40 and the measure of which is 2/7?
    (a) 16 : 56 (b) 14 : 49
    (c) 15 : 36 (d) 16 : 72
23. Two numbers are in the ratio 3 : 5. If 9 be subtracted from each, then they are in the ratio of 12 : 23. The second number is :
    (a) 53 (b) 54
    (c) 55 (d) 52
24. Consider the following statements :
    (1) If both the terms of a ratio are multiplied or divided by the same natural number, then the ratio remains unaltered.

Compiled By Jasjeet

yoursmahboob.wordpress.com



(2) A statement which states that two ratios are equivalent is called proportion.

(3) If 4 quantities are in proportion, the product of extremes is not equal to the means.

(4) The mean proportion between any two numbers is equal to the square root of their product. The wrong one statements is/are :

(a) 1 (b) 3
(c) 3 and 4 (d) 1 and 4

25. In a mixture of 120 litres, the ratio of milk and water is 2 : 1. If the ratio of milk and water is 1 : 2, then the amount of water (in litres) is required to be added is :

(a) 20 (b) 40
(c) 80 (d) 120

26. A quantity $x$ varies inversely as the square of $y$. Given that $x = 4$, when $y = 3$, the value of $x$ when $y = 6$ is :

(a) 1 (b) 2
(c) 3 (d) 4

27. Suppose $y$ varies as the sum of two quantities of which one varies directly as $x$ and the other inversely as $x$. If $y = 6$ when $x = 4$ and $y = 3\frac{1}{3}$ when $x = 3$, then the relation between $x$ and $y$ is :

(a) $x = y + 4$ (b) $y = 2x + \frac{8}{x}$
(c) $y = 2x - \frac{8}{x}$ (d) $y = 2x - \frac{4}{x}$

28. The time period of a pendulum is proportional to the square root of the length of the pendulum. Consider the following statements :

(1) If the length of the pendulum is doubled, then the time period is also doubled.

(2) If the length is halved, then time period becomes one-fourth of the original time period.

The correct assertions are :

(a) 1 (b) 2
(c) neither 1 nor 2 (d) both 1 and 2

Compiled By Jasjeet

yoursmahboob.wordpress.com

# EXERCISE

## LEVEL 1

**1.** Four numbers are in proportion. The sum of the squares of the four numbers is 50 and the sum of the means is 5. The ratio of first two terms is 1 : 3. What is the average of the four numbers?
(a) 2 (b) 3
(c) 5 (d) 6

**2.** A naughty student breaks the pencil in such a way that the ratio of two broken parts is same as that of the original length of the pencil to one of the larger part of the pencil. The ratio of the other part to the original length of pencil is :
(a) $1 : 2\sqrt{5}$ (b) $2 : (3 + \sqrt{5})$
(c) $2 : \sqrt{5}$ (d) can't be determined

**3.** If $\frac{x+y}{x-y} = \frac{5}{3}$ and $\frac{x}{(y+2)} = 2$, the value of $(x, y)$ is :
(a) (4, 1) (b) (2, 8)
(c) (1, 4) (d) (8, 2)

**4.** If $a^3 + b^3 : a^3 - b^3 = 133 : 117$; find $a : b$ :
(a) 2 : 3 (b) 5 : 4
(c) 5 : 2 (d) none of these

**5.** A student obtained equal marks in History and Sociology. The ratio of marks in Sociology and Geography is 2 : 3 and the ratio of marks in History and Philosophy is 1 : 2. If he has scored an aggregate of 55% marks. The maximum marks in each subject is same. In how many subjects did he score equal to or greater than 60% marks?
(a) 1 (b) 2
(c) 3 (d) none of these

**6.** The ratio of income of Anil and Mukesh is 2 : 3. The sum of their expenditure is Rs. 8000 and the amount of savings of Anil is equal to the amount of expenditure of Mukesh. What is the sum of their savings?
(a) 22,000 (b) 4,000
(c) 16,000 (d) 12,000

**7.** Hutch and Essar entered into a partnership just 5 months ago. The ratio of profit claimed by Hutch and Essar is 6 : 17. If Essar had just started his business 12 months ago with Rs. 1275, what is the amount contributed by Hutch?
(a) Rs. 980 (b) Rs. 1080
(c) Rs. 1200 (d) Rs. 998

**8.** A child has three different kinds of chocolates costing Rs. 2, Rs. 5 and Rs. 10. He spends total Rs. 120 on the chocolates. What is the minimum possible number of chocolates, he can buy, if there must be atleast one chocolate of each kind?
(a) 22 (b) 19
(c) 17 (d) 15

**9.** In the previous problem (no. 8) what is the maximum possible no. of chocolates?
(a) 52 (b) 53
(c) 55 (d) 60

**10.** Mr. Teremere and Mr. Meretere have 5 chocolates and 3 chocolates with them respectively. Meanwhile Mr. Khabbu Singh joined them and all 8 chocolates were distributed equally among all these three people. In turn Khabbu Singh gave Rs. 16 to Mr. Teremere and Mr. Meretere, since Khabbu Singh did not has any chocolate. What is the difference of amounts received by Teremere and Meretere? Given that the amount was shared in proportion of chocolates received by Khabbu Singh.
(a) Rs. 8 (b) Rs. 12
(c) Rs. 14 (d) Rs. 15

**11.** Rs. 4536 is divided among 4 men, 5 women and 2 boys. The ratio of share of a man, a woman and a boy is 7 : 4 : 3. What is the share of a woman?
(a) Rs. 336 (b) Rs. 498
(c) Rs. 166 (d) Rs. 256

**12.** The concentration of petrol in three different mixtures (petrol and kerosene) is $\frac{1}{2}$, $\frac{3}{5}$ and $\frac{4}{5}$ respectively. If 2 litres, 3 litres and 1 litre are taken from these three different vessels and mixed. What is the ratio of petrol and Kerosene in the new mixture?
(a) 4 : 5 (b) 3 : 2
(c) 3 : 5 (d) 2 : 3

**13.** Time period ($T$) of pendulum is directly proportional to the square root of length of string by which bob is attached to a fixed point and inversely proportional to the square root of gravitational constant '$g$'. Time period of a bob is 3 seconds when the gravitational constant $g$ is 4 m/sec$^2$ and length of string is 9 metre, what is the time period of a bob having a string of length 64 metre and gravitational constant 16 m/sec$^2$?
(a) 4 seconds (b) 12 seconds
(c) 16 seconds (d) 10 seconds

**14.** In a milk shoppe there are three varieties of milk, 'Pure', 'Cure' and 'Lure'. The 'Pure' milk has 100% concentration of milk. The ratio of milk is to water in the 'Cure' is 2 : 5 and in the Lure it is 3 : 8 respectively. Sonali purchased 14 litres of Cure and 22 litres of Lure milk and mixed them. If she wanted to make the concentration of milk in the mixture of purchased milk to 50%. How many litres of 'Pure' milk she is needed?
(a) 6 litres (b) 8 litres
(c) 16 litres (d) 18 litres

Compiled By Jasjeet

yoursmahboob.wordpress.com


15. In the squadron of Indian Air Force the ratio of Sukhoi is to Mig and Jaguar together is 5 : 7 and the ratio of Jaguar is to Sukhoi and Mig together is 1 : 2. Find the ratio of Sukhoi and Mig :
(a) 2 : 7 (b) 3 : 5
(c) 3 : 1 (d) 5 : 3

16. During our campaign against child labour we have found that in three glass making factories $A$, $B$ and $C$ there were total 33 children aged below 18 were involved. The ratio of male to female in $A$, $B$ and $C$ was 4 : 3, 3 : 2 and 5 : 4 respectively. If the no. of female children working in the factories $B$ and $C$ be equal then find the no. of female children working in factory $A$ :
(a) 5 (b) 2
(c) 8 (d) 6

17. The value of a diamond is directly proportional to the square of its weight. A diamond unfortunately breaks into three pieces with weights in the ratio of 3 : 4 : 5 thus a loss of Rs. 9.4 lakh is incurred. What is the actual value of diamond :
(a) 28.8 lakh (b) 13.5 lakh
(c) 14.4 lakh (d) 18.8 lakh

18. In the Ruchika's wallet there are only Rs. 16, consisting of 10 paise, 20 paise and Re. 1 coins. The ratio of no. of coins of 10 paise and 20 paise is 6 : 1. The minimum no. of Re 1 coin is :
(a) 5 (b) 12
(c) 4 (d) 8

19. There are two vessels containing the mixture of milk and water. In the first vessel the water is 2/3 of the milk and in the second vessel water is just 40% of the milk. In what ratio these are required to mix to make 24 litres mixture in which the ratio of water is to milk is 1 : 2 ?
(a) 4 : 3 (b) 5 : 7
(c) 5 : 2 (d) 7 : 5

20. Nehru Ji had '$n$' chocolates. He distributed them among 4 children in the ratio of $\frac{1}{2} : \frac{1}{3} : \frac{1}{5} : \frac{1}{8}$. If he gave them each one a complete chocolate, the minimum no. of chocolates that he had :
(a) 139 (b) 240
(c) 278 (d) none of these

21. The ratio of working efficiency of $A$ and $B$ is 5 : 3 and the ratio of efficiency of $B$ and $C$ is 5 : 8. Who is the most efficient ?
(a) $A$ (b) $B$
(c) $C$ (d) can't be determined

22. If $4A = 5B$ and $3A = 2C$, the ratio of $B : C$ is :
(a) 4 : 3 (b) 5 : 8
(c) 8 : 15 (d) 10 : 15

23. Equal quantities of three mixtures of milk and water are mixed in the ratio of 1 : 2, 2 : 3 and 3 : 4. The ratio of water and milk in the mixture is :
(a) 193 : 122 (b) 122 : 193
(c) 61 : 97 (d) 137 : 178

24. The ratio of age of $A$ and $B$ is 8 : 9 and the age of $B$ is 2/3 of $C$'s age and age of $C$ is $\frac{9}{13}$ times the age of $D$. If the age of $B$ is 18 years then the age of $C$ is :
(a) 36 years (b) 39 years
(c) 27 years (d) 54 years

25. A milk man has a mixture of milk in which ratio of milk and water is 5 : 3. He sells 40 litres of milk *i. e.*, mixture then he adds up 15 litres of pure water. Now the ratio of milk and water is 5 : 4. What is the new quantity of mixture?
(a) 72 litres (b) 270 litres
(c) 135 litres (d) data insufficient

26. $A$ and $B$ are two alloys of copper and tin prepared by mixing the respective metals in the ratio of 5 : 3 and 5 : 11 respectively. If the alloys $A$ and $B$ are mixed to form a third alloy $C$ with an equal proportion of copper and tin, what is the ratio of alloys $A$ and $B$ in the new alloy $C$?
(a) 3 : 5 (b) 4 : 5
(c) 3 : 2 (d) 2 : 3

27. A hotel incurs two types of expenses, one which is fixed and others depend upon no. of guests. When there are 10 guests, total expenses of hotel are Rs. 6000. Also when there are 25 guests average expenses per guests are Rs. 360? What is the total expenses of hotel when there are 40 guests?
(a) Rs. 8,000 (b) Rs. 12,000
(c) Rs. 15,500 (d) none of these

28. The ratio of third proportional to 21 and 42 and mean proportional to 16 and 49 is :
(a) 3 : 1 (b) 2 : 3
(c) 4 : 3 (d) 1 : 3

29. The period of the pendulum is directly proportional to the square root of the length of the string. The period of such a pendulum with string of length 16 cm is 52 seconds. Find the length of the string if the period is 65 seconds :
(a) 4.5 cm (b) 5 cm
(c) 6 cm (d) none of these

30. For any two numbers $m$, $n$; $(m + n) : (m - n) : mn = 7 : 1 : 60$ Find the value of $\frac{1}{m} : \frac{1}{n}$
(a) 4 : 3 (b) 8 : 6
(c) 3 : 4 (d) 7 : 8

31. Rs. 960 were distributed among $A$, $B$, $C$ and $D$ in such a way that $C$ and $D$ together gets half of what $A$ and $B$ together gets and $C$ gets one-third amount of $B$. Also $D$ gets $\frac{5}{3}$ times as much as $C$. What is the amount of $A$?
(a) Rs. 240 (b) Rs. 280
(c) Rs. 320 (d) data insufficient

32. Find the value of $\frac{p^2 + q^2}{r^2 + s^2}$, if $p : q :: r : s$.
(a) $\frac{1}{4}$ (b) $\frac{1}{9}$
(c) $\frac{ps}{rq}$ (d) $\left(\frac{p-q}{r-s}\right)^2$

33. Find the value of $\frac{p^2 + q^2}{r^2 + s^2}$, if $p : q :: r : s$.
(a) $\frac{1}{4}$ (b) $\frac{pq}{rs}$
(c) $\left(\frac{p+q}{r+s}\right)^2$ (d) both (b) and (c)

34. The speeds of rickshaw, car and scooter are in the ratio of 3 : 5 : 6. What is the ratio of time taken by each one of them for the same distance?
(a) 6 : 5 : 3 (b) 10 : 6 : 5
(c) 12 : 4 : 1 (d) data insufficient

Compiled By Jasjeet

yoursmahboob.wordpress.com



**35.** Divide Rs. 6940 in such a way that $A$ gets $\frac{2}{3}$rd of what $B$ gets and $B$ gets $\frac{3}{5}$th of what $C$ gets? What is the share of $A$ and $B$ together?
(a) Rs. 1982 (b) Rs. 1388
(c) Rs. 3470 (d) none of these

**36.** The ratio of age of $A$ and $B$ is $x : y$. If $A$'s age is increased by 3 years and $B$'s age is increased by 2 years then new ratio of their ages becomes 24 : 25. Given that the sum of their actual ages is 93 years. Find the actual ratio of their ages.
(a) 21 : 22 (b) 42 : 45
(c) 45 : 48 (d) can't be determined

**37.** $a : b = 4 : 9$ if 4 is added to both of the numbers then the new ratio becomes 21 : 46. What is the difference between $a$ and $b$?
(a) 80 (b) 100
(c) 125 (d) 130

**38.** The ratio of ages of Rahul and Deepesh is 3 : 5. 10 years later this ratio becomes 5 : 7. What is the present age of Deepesh?
(a) 20 years (b) 50 years
(c) 25 years (d) 40 years

**39.** When 5 is added to the numerator and denominator both of a (positive) fraction, then the new ratio of numerator to denominator becomes 11 : 15. What is the original ratio?
(a) 17 : 25 (b) 3 : 5
(c) 28 : 40 (d) none of these

**40.** Five numbers $a$, $b$, $c$, $d$ and $e$ are in the ratio of 2 : 3 : 5 : 8 : 9 and their sum is 162. Find the average of all these numbers :
(a) 27 (b) 30
(c) 32.4 (d) can't be determined

**41.** 6 pumps of Kirlosker can fill a tank in 7 days and 2 similar pumps of USHA can fill the same tank in 18 days. What is the ratio of the efficiency of a Kirlosker pump and a USHA pump?
(a) 6 : 7 (b) 7 : 6
(c) 7 : 54 (d) can't be determined

**42.** 16 persons can reap $\frac{1}{5}$th field in 6 days. How many persons (with same efficiency) are required to reap rest of the field in 8 days?
(a) 27 (b) 54
(c) 48 (d) 64

**43.** The LCM of two numbers is 210 and their ratio is 2 : 3. The sum of these numbers is :
(a) 210 (b) 175
(c) 315 (d) can't be determined

**44.** What number must be subtracted from each of the numbers 53, 21, 41, 17 so that the remainders are in proportion?
(a) 1 (b) 3
(c) 5 (d) none of these

**45.** The angles of a triangle are in the ratio of 2 : 3 : 4. Find the measurement of greatest angle :
(a) 30° (b) 60°
(c) 100° (d) 80°

**46.** In a wallet the ratio of 25 paise, 50 paise and Re 1 coins are in the ratio of 12 : 4 : 3, which amounts to Rs. 600. Find the no. of coins of 25 paise :
(a) 200 (b) 225
(c) 275 (d) none of these

**47.** $(x-a) : (x-b) : (x-c) = 11 : 9 : 5$, where $x = \frac{a+b+c}{2}$. What is the ratio of $a$, $b$, $c$?
(a) 10 : 8 : 7 (b) 3 : 5 : 9
(c) 7 : 8 : 10 (d) 6 : 5 : 3

**48.** Petrol is 7 times heavy than Kerosene and Castrol mobil is 18 times as heavy as Kerosene. What should be the ratio of petrol and mobil in the new mixture to get the mixture which must be 11 times as heavy as kerosene?
(a) 3 : 4 (b) 7 : 4
(c) 9 : 19 (d) 9 : 10

**49.** A girl buys 2 pigeons for Rs. 182. She sells one at a loss of 5% and another at a profit if 8%. But she neither gains nor loses on the whole. Find the price of pigeon which has sold at a profit :
(a) Rs. 112 (b) Rs. 85
(c) Rs. 70 (d) can't be determined

**50.** The ratio of prices of Cello and Rotomac pens in 2000 were in the ratio of 3 : 5. In 2005 the price of Cello pen trebles itself and the price of Rotomac pen is increased by Rs. 100, then the new ratio of prices of the same pens becomes 4 : 5. What was the original price of the Rotomac pen in 2000?
(a) Rs. 60 (b) Rs. 80
(c) Rs. 100 (d) Rs. 120

**51.** A goldsmith has 361 rings of gold. He sells some of them at a loss of 4% and rest at a profit of 15% making overall profit of 8%. Find the no. of rings sold at a profit of 15% :
(a) 171 (b) 133
(c) 218 (d) 228

**52.** Michel travelled from New York to New Jersey covering total distance of 250 miles in 8 hr. partly by car at 30 miles/hr. and rest by train at 35 miles/hr. The distance travelled by car is :
(a) 150 miles (b) 80 miles
(c) 220 miles (d) 180 miles

**53.** A rabit takes 22 leaps for every 17 leaps of cat and 22 leaps of a rabit are equal to 17 leaps of the cat. What is the ratio of the speeds of rabit and cat?
(a) 1 : 1 (b) 484 : 289
(c) 17 : 22 (d) none of these

**54.** Rs. 171 are divided among four friends in the ratio of $\frac{1}{3} : \frac{1}{4} : \frac{1}{5} : \frac{1}{6}$. What is the amount of the person who got the greatest share?
(a) 14 (b) 40
(c) 36 (d) 60

**55.** 10 years ago the age of Karishma was $\frac{1}{3}$rd of the age of Babita. 14 years hence the ratio of ages of Karishma and Babita will be 5 : 9. Find the ratio of their present ages :
(a) 13 : 29 (b) 11 : 27
(c) 29 : 17 (d) 13 : 25

Compiled By Jasjeet

yoursmahboob.wordpress.com


56. The ratio of numerator to a denominator of a fraction is $\frac{1}{5}$ when $x$ and $5x$ are added to the numerator and denominator respectively to the given fraction then the ratio of the new fraction will be :
(a) 1 : 1 (b) 1 : 25
(c) 1 : 5 (d) 2 : 7

57. $x$ varies directly as $y$ and $x$ varies inversely as the square of $z$. When $y = 75$ and $x = 6$, then $z = 5$. Find the value of $x$ when $y = 24$ and $z = 4$ :
(a) 1 (b) 2
(c) 3 (d) 4

58. $x$ varies directly as $(y^2 + z^2)$. At $y = 1$ and $z = 2$, the value of $x$ is 15. Find the value of $z$, when $x = 39$ and $y = 2$ :
(a) 2 (b) 3
(c) 4 (d) 6

59. Weight of a sumo is jointly varies as his height and his age. When height is 1.2 m and age is 20 years his weight is 48 kg. Find the weight of the sumo when his height is 1.5 metre and age is 30 years :
(a) 60 kg (b) 72 kg
(c) 90 kg (d) 58 kg

60. If $(a + b) : (b + c) : (c + a) = 5 : 6 : 9$ and $a + b + c = 10$. What is the value of $c$ :
(a) 2 (b) 3
(c) 5 (d) 7

61. $A$, $B$, and $C$ have amounts in the ratio of 3 : 4 : 5. First $B$ gives $\frac{1}{4}$th to $A$ and $\frac{1}{4}$th to $C$ then $C$ gives $\frac{1}{6}$th to $A$. Find the final ratio of amount of $A$, $B$ and $C$, respectively :
(a) 4 : 3 : 5 (b) 5 : 4 : 3
(c) 6 : 4 : 2 (d) 5 : 2 : 5

## LEVEL 2

1. A tin contains a mixture of Dew and Sprite in the ratio of 7 : 3 and another tin contains the Dew and Sprite in the ratio of 5 : 4. In what proportion should the solution of two tins be mixed to achieve a perfect proportion of 2 : 1 (in which Dew is 2 times that of sprite).
(a) 10 : 3 (b) 4 : 1
(c) 3 : 10 (d) 3 : 1

2. There are two containers $A$ and $B$ filled with mentha oil with different prices and their volumes are 140 litres and 60 litres respectively. Equal quantities are drawn from both $A$ and $B$ in such a manner that the oil drawn from $A$ is poured into $B$ and the oil drawn from $B$ is poured into $A$. The price per litre becomes equal in both $A$ and $B$. How much oil is drawn from each of $A$ and $B$ :
(a) 40 litre (b) 21 litre
(c) 42 litre (d) can't be determined

3. A three digit number is such that this number itself is divisible by the sum of its digits. The sum of hundreds and unit digit is 6 while the sum of the tens and unit digit is 5. What is the ratio of unit and tens digit :
(a) 1 : 2 (b) 2 : 3
(c) 3 : 4 (d) 2 : 7

4. Sachin bought 1.5 kg fresh grapes. The ratio of water is to pulp was 4 : 1. When his naughty child crushed these grapes, then some water get wasted. Now the ratio of water is to pulp is 3 : 2. What is the total amount of the crushed grapes?
(a) 0.5 kg (b) 1 kg
(c) 0.75 kg (d) none of these

5. A man bought 9 mangoes for a rupee and sold them at 6 mangoes for a rupee. What is the ratio of profit to the cost price?
(a) $\frac{3}{10}$ (b) $\frac{3}{2}$
(c) 1/2 (d) none of these

6. Half of the volume of Petrol and kerosene mixture of ratio 7 : 5 is converted into a mixture of ratio 3 : 1 by the substitution (or replacement) method. While the mixture of ratio 7 : 5 was formed from the mixture of 7 : 3 by adding the Kerosene in it. If 240 litres petrol is required in the replacement method, what is the total amount of Kerosene was added to prepare the mixture of 7 : 5?
(a) 100 litres (b) 400 litres
(c) 50 litres (d) 200 litres

7. Sometimes ago in a Cinema hall a blockbuster movie was being shown. Due to excessive demand of the show, manager of the Cinema hall increased the prices of tickets in all the three categories. 25% in first class, 12.5% in special class and 40% in balcony. If the collection of one show was Rs. 218925, then find the collection from the balcony only given that the ratio of price of ticket (increased price) for first class, special class and balcony is 5 : 9 : 14 :
(a) 109462.5 (b) 58800
(c) 14400 (d) data insufficient

8. In a mixture of petrol and Kerosene petrol is only 99 litres. if this same quantity of petrol would be presented in another mixture of petrol and Kerosene where total volume would be 198 litres less than the actual mixture then the concentration of petrol in the actual mixture would have been 13.33% point less than that of the new mixture. What is the concentration of petrol in actual mixture?
(a) 20% (b) 16.66%
(c) 26.66% (d) 8.33%

9. A drum of 20 litres is filled with milk. A milkman has only two measuring vessels of 3 litres and 5 litres without any calibration. He has to measure four litres of milk for a customer without using anyother vessel. Minimum how many operations are required for this work, where an operation is counted if the milk is transferred from one vessel to another vessel?
(a) 5 (b) 6
(c) 8 (d) 11

10. The ages of Vinay, Varsha, Veera and Vikram are in arithmetic progression, but not in order. The ratio of ages of Vinay and Varsha is 6 : 5 and Veera is to Vikram is 7 : 8. Two years later

Compiled By Jasjeet

yoursmahboob.wordpress.com



the age of Varsha and Vikram will be 2 : 3. Find the ratio of ages of Vinay and Veera :

(a) 7 : 6 (b) 5 : 8
(c) 6 : 7 (d) 8 : 9

**11.** A container is filled with the mixture of milk and water. The ratio of milk and water is same. Bobby and Sunny increases the concentration to 60%. Bobby makes it by adding the milk and Sunny makes it by replacing the mixture with milk. What is the percentage of milk added by Bobby to that of milk replaced by Sunny :

(a) 100% (b) 120%
(c) 133.33% (d) none of these

**12.** There are two vessels $A$ and $B$ containing 25 litres each of pure milk and pure water respectively. 5 litres of milk from $A$ is taken and poured into $B$, then 6 litres of mixture from $B$ is taken and poured in $A$. What is the ratio of water in $A$ and $B$ respectively :

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

**13.** The ratio of age between $A$ and $B$ is 6 : 5 and the age of each $C$ and $D$ is $\frac{9}{10}$ times that of $B$. Age of $F$ is less than $A$ but greater than $B$. The ratio of ages between $B$ and $E$ is 2 : 3 also age of $A$ is 3 years less than $E$. What is the ratio of ages of $A$ and $F$ if all the ages are in integers?

(a) 12 : 11 (b) 9 : 7
(c) 24 : 19 (d) 12 : 13

**14.** The ratio of students in a coaching preparing for B.Tech and MBA is 4 : 5. the ratio of fees collected from each of B. Tech and MBA student is 25 : 16. If the total amount collected from all the students is 1.62 lakh, what is the total amount collected from only MBA aspirants?

(a) Rs. 62,000 (b) Rs. 72,000
(c) Rs. 80,000 (d) none of these

**15.** The cost of the marble varies directly with square of its weight. Marble is broken into 3 parts whose weights are in the ratio 3 : 4 : 5. If marble had been broken into three equal parts by weight then there would have been a further loss of Rs. 1800. What is the actual cost of the original (or unbroken) marble?

(a) Rs. 3600 (b) Rs. 10,800
(c) Rs. 2160 (d) none of these

***Directions for 16 and 17:*** *Four friends $A, B, C$ and $D$ have some money among them one day they decided to equate the money, so first $A$ gave $B$ what $B$ had initially, then $B$ gave $C$ what $C$ had initially. Again $C$ gave $D$ what $D$ had initaily and finally $D$ had doubled the money of $A$. Thus each of them had equal sum of Rs. 48.*

**16.** What was the initial amount of $B$?

(a) Rs. 36 (b) Rs. 54
(c) Rs. 45 (d) Rs. 42

**17.** What was the amount with $C$ after second transaction?

(a) Rs. 45 (b) Rs. 69
(c) Rs. 72 (d) Rs. 84

**18.** Hari and Murli have 24 cows and 30 cows respectively. Both of them together hired a grazing field for the whole month of November. Initially Hari's cows used for grazing then for the remaining days of the month Murli's cows grazed it. If Hari has paid Rs. 3500 and Murli has paid Rs. 5000 for grazing then for how many days Hari used the grazing field :

(a) 14 (b) 16
(c) 21 (d) 20

**19.** The speeds of scooter, car and train are in the ratio of 1 : 4 : 16. If all of them covers equal distance then the ratio of time taken/velocity for the each of the vehicle is :

(a) 256 : 16 : 1 (b) 1 : 4 : 16
(c) 16 : 4 : 1 (d) 16 : 1 : 4

**20.** Radhika purchased one dozen bangles. One day she slipped on the floor fell down. What can not be the ratio of broken to unbroken bangles :

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

**21.** If $\frac{a}{b} = \frac{c}{d} = \frac{e}{f}$, then the value of $\left(\frac{a^n p + c^n q + e^n r}{b^n p + d^n q + f^n r}\right)^{1/n}$ :

(a) $\frac{ad}{bc}$ (b) $\frac{af}{be}$
(c) $\frac{ck}{dk}$ (d) none of these

**22.** At a casino in Mumbai, there are 3 tables $A$, $B$ and $C$. The pay-offs at $A$ is 10 : 1, at $B$ is 20 : 1 and at $C$ is 30 : 1. If a man bets Rs. 200 at each table and win at two of the tables, what is the maximum and minimum difference between his earnings can be?

(a) Rs. 2500 (b) Rs. 2000
(c) Rs. 4000 (d) none of these

**23.** If $m = \frac{4pq}{p+q}$, then the value of $\frac{m+2p}{m-2p} + \frac{m+2q}{m-2q}$ :

(a) 2 (b) 4
(c) $\frac{2mpq}{(p+q)}$ (d) none of these

**24.** The ratio of volumes of two cubes is 8 : 27. What is the ratio of surface area of these cubes respectively?

(a) 2 : 3 (b) 4 : 9
(c) 8 : 19 (d) 9 : 4

**25.** Dudheri Lal has two jars. Jar $A$ is completely filled with milk and another jar $B$ is totally empty. Before selling the milk in a town he transferred some milk in to the empty jar $B$ then he fill the jar $A$ with water. Once again he transferred the mixture of milk from $A$ to $B$ so that $B$ is completely filled. Which one of the following is correct?

(a) Concentration of milk in $B$ cannot be less than 75%
(b) Concentration of milk in $B$ cannot be greater than 75%
(c) Concentration of milk is always 75%
(d) none of the above

**26.** In $ABC$ corporation there are some management trainees. These trainees are divided into 3 groups $A$, $B$ and $C$ for 3 different projects in the ratio of 3 : 4 : 5 respectively, where $P$, $Q$, $R$ are the projects-in-charge of $A$, $B$, $C$ respectively. The difference between the no. of trainees in $A$ and $C$ is not greater than 3. Also $P$, $Q$, $R$ belongs to the group of trainees. The no. of assistant of $Q$ is less than the no. of assistance of $R$ by :

Compiled By Jasjeet

yoursmahboob.wordpress.com


(a) 33.33% (b) 20%
(c) 25% (d) 16.66%

27. If $\frac{a}{b}=\frac{b}{c}=\frac{c}{d}=\frac{d}{e}=\frac{e}{f}=\frac{1}{3}$, find the value of $\left(\frac{a+b+c+d+e}{b+c+d+e+f}\right)$:
(a) $\frac{1}{81}$ (b) $\frac{1}{27}$
(c) $\frac{1}{3}$ (d) 1

28. An engine can move at the speed of $\frac{20}{3}$ m/s without any wagon attached. Reduction in the speed of the train is directly proportional to the square root of the no. of wagons attached to the engine. When there are only four wagons attached its speed is $\left(\frac{50}{9}\right)$ m/s. The greatest no. of wagons with which the engine can move is :
(a) 144 (b) 143
(c) 12 (d) none of these

29. Mrs. Annapurna per day sells exactly four quintal sugar at Rs. 2000 per quintal getting the profit of Rs. 25%. Since she mixes two varities of sugar, one costs Rs. 14 per kg and another costs Rs. 22 per kg. One day due to huge demand in market she had only 3 quintal of the required mixture so she purchased the sugar costs Rs. 17 per kg at Rs. 18 per kg from the wholeseller on that day and then she mixed 300 kg mixture with 100 kg sugar costing Rs. 18 per kg to fullfill the demand of the market selling at the same price. How much percent less does she gain that she would have gained, if she had sufficient quantity of usual mixture of sugar?
(a) 12.5% (b) 18.18%
(c) 62.5% (d) can't be determined

30. Two vessels $P$ and $Q$ contain '$a$' litres of petrol and '$b$' litres of Kerosene respectively. '$c$' litres of petrol and same quantity of Kerosene is taken out and then transferred to $Q$ and $P$ respectively. This process is repeated several times. If after the first operation the quantity of petrol or Kerosene in either of $P$ and $Q$ does not change. What is the value of '$c$'?
(a) $\frac{ab}{(a-b)}$ (b) $\frac{2ab}{(a+b)}$
(c) $\frac{ab}{(a+b)}$ (d) $\left(\frac{a}{b}\right)^2$

31. Arvind Singh purchased a 40 seater bus. He started his services on route no. 2 (from Terhipuliya to Charbagh with route length of 50 km). His profit (P) from the bus depends upon the no. of passangers over a certain minimum number of passangers '$n$' and upon the distance travelled by bus. His profit is Rs. 3600 with 29 passangers in the bus for a journey of 36 km and Rs. 6300 when there are 36 passengers. travelled for 42 km. What is the minimum no. of passangers are required so that he will not suffer any loss?
(a) 12 (b) 20
(c) 18 (d) 15

32. Three cats are roaming in a zoo in such a way that when cat $A$ takes 5 steps, $B$ takes 6 steps and cat $C$ takes 7 steps. But the 6 steps of $A$ are equal to the 7 steps of $B$ and 8 steps of $C$. What is the ratio of their speeds :
(a) 140 : 144 : 147 (b) 40 : 44 : 47
(c) 15 : 21 : 28 (d) 252 : 245 : 240

33. In a family there were $n$ people. The expenditure of rice per month in this family is directly proportional to the 5 times the square of no. of people in the family. If the elder son left the family to study in USA there was decrease in consumption of 95 kg rice per month. What is the value of $n$?
(a) 5 (b) 12
(c) 9 (d) 10

34. One day in summer I wanted to chill me out, I went to a cool corner. I gave him a note of Rs. 10 and asked for a coke costing Rs. 5 per jar and he did so, but he returned me Rs. 5, in the denomination of Re. 1, 50 paise and 25 paise. What could be the ratio of no. of coins of Re. 1, 50 paise and 25 paise respectively :
(a) 2 : 3 : 1 (b) 1 : 7 : 2
(c) 6 : 1 : 3 (d) 2 : 1 : 2

35. If $\frac{a}{b+c}=\frac{b}{c+a}=\frac{c}{a+b}$ and $a+b+c\neq 0$ then the value of $\frac{b}{a+b+c}$ is :
(a) $\frac{1}{2}$ (b) $\frac{1}{3}$
(c) $\frac{1}{4}$ (d) 1

36. The ratio of the density of 3 kinds of petrol $P_1$, $P_2$ and $P_3$ is 9 : 7 : 5. The density of $P_1$ is 18 gm/cc and $P_1$, $P_2$, $P_3$ are mixed in the ratio of 6 : 5 : 4 by weight. If a litre of $P_3$ cost Rs. 40, then find the cost of $P_3$ in 450 kg of mixture of $P_1$, $P_2$ and $P_3$ :
(a) Rs. 380 (b) Rs. 480
(c) Rs. 355 (d) Rs. 448

37. Three persons Amar, Akbar and Anthony agree to pay their hotel bills in the ratio of 3 : 4 : 5. Amar pays the first day's bill which amounts to Rs. 26.65, Akbar pays the second days bill which amounts to Rs. 42.75 and $C$ pays the third day's bill which amounts to Rs. 53.00. When they settle their accounts, which of the following happens?
(a) Amar gives Rs. 3 to $C$
(b) Akbar gives Rs. 2 to Amar
(c) Amar gives Akbar Rs. 1.95 and Rs. 2 to Anthony
(d) none of the above

38. Find the value of $x$ if $(14x-4):(8x-1)=(3x+8):(9x+5)$:
(a) 1 (b) 1/2
(c) 3/4 (d) none of these

39. Pooja, Shipra and Monika are three sisters. Pooja and Shipra are twins. The ratio of sum of the ages of Pooja and Shipra is same as that of Monika alone. Three years earlier the ratio of age of Pooja and Monika was 2 : 7. What will be the age of Shipra 3 years hence?
(a) 21 years (b) 16 years
(c) 8 years (d) 12 years

40. A couple got married 9 years ago when the age of wife was 20% less than her husband. 6 years from now the age of wife will be only 12.5% less than her husband. Now they have six

Compiled By Jasjeet

yoursmahboob.wordpress.com



children including single, twins and triplets and the ratio of their ages is 2 : 3 : 4 respectively. What can be the maximum possible value for the present age of this family?

(a) 110 years (b) 103 years
(c) 105 years (d) 83 years

**41.** The price of a necklace varies directly as the no. of pearls in it. Also, it varies directly as the square root of radius of a pearl. The price of a necklace was Rs. 150. When it had 75 pearls each of radius 1 cm. Find the radius of the pearl of a necklace having 100 pearls whose cost is Rs. 600.

(a) 2 (b) 9
(c) 3 (d) 4

**42.** The price of a book varies directly as the no. of pages in it and inversely as the time periods in years that have elapsed since the date of purchasing. Two books cost the same, however, the no. of pages in the first book is triple of the second book. if the first book is sold on 18 years ago, how long ago was the second book sold?

(a) 54 years (b) 9 years
(c) 6 years (d) 3 years

**43.** Akbar and Birbal who purchased the shares for the cost of their basic salaries which are in the ratio of 5 : 6. later on company gave them 40 additional shares to each, due to which the ratio changed to 7 : 8. If the worth of each share is Rs. 75, what is the basic salary of the person who got less shares?

(a) Rs. 10500 (b) Rs. 7500
(c) Rs. 8800 (d) Rs. 9000

**44.** Distance covered by a train is directly proportional to the time taken and also it varies directly as the square root of fuel used and varies inversely as the no. of wagons attached to it. A train coveres 192 km journey in 20 hours when there are 10 wagons attached to it and total fuel consumption was 256 litre of diesel. Find the consumption of fuel per km when a train goes 200 km in 25 hours with 15 wagons attached to it :

(a) 1.5 $l$/km (b) 2 $l$/km
(c) 2.8 $l$/km (d) 20 $l$/km

**45.** At Sahara shopping centre, a person can purchase as much articles at a time as his or her age that is a person of $n$ years age can purchase only $n$ similar articles at a time. Amisha is younger to her elder brother who has just entered into his twenties. One day Amisha went to the Sahara shopping centre, she purchased same toffees at a particular rate on the ground floor. But when she reached on third floor she found that she could purchase double the no. of toffees with the same amount as she had spent on the ground floor. Also to purchase the same no. of toffees on the third floor she had to spend Rs. 2 less than that of on the first floor. How many toffees did she buy?

(a) 6 (b) 12
(c) 18 (d) 15

**46.** A contractor deployed some men to plant 1800 trees in a certain no. of days. But in $\frac{1}{3}$rd of the planned time 120 plants could be less planted so to ful fill the target for the rest of the days every day 20 more plants were planted. Thus it saved one day out of the initially planned no. of days. How many plants he planned to plant each day initially?

(a) 180 (b) 100
(c) 120 (d) 160

**47.** $A$ and $B$ have to write 810 and 900 pages respectively in the same time period. But $A$ completes his work 3 days ahead of time and $B$ completes 6 days ahead of time. How many pages did $A$ write per hour if $B$ wrote 21 pages more in each hour?

(a) 45 (b) 72
(c) 54 (d) 100

**48.** Three friends $A$, $B$ and $C$ decided to share the soda water with $D$, who had no soda water. A contributed 2 tumbler more than that of $B$ and $B$ contributed 1 tumbler more than that of $C$ and then all of them had equal amount of soda water. In turn $D$ paid money, which was divided among $A$, $B$ and $C$ in the ratio of their contribution to $D$. Thus $A$ had gotten thrice as much money as $B$ had gotten. The price of each tumbler of soda water was Rs. 15 and each transaction was integral in numbers either the sharing of money or contribution of soda water. What was the sum of money that $B$ had gotten?

(a) Rs. 15 (b) Rs. 18
(c) Rs. 22.5 (d) none of these

**49.** In Maa Yatri Temple every devotee offers fruits to the orphans. Thus every orphan receives bananas, oranges and grapes in the ratio of 3 : 2 : 7 in terms of dozen. But the weight of a grape is 24 gm and weight of a banana and an orange are in the ratio of 4 : 5, while the weight of an orange is 150 gm. Find the ratio of all the three fruits in terms of weight, that an orphan gets :

(a) 90 : 75 : 42 (b) 180 : 150 : 82
(c) 75 : 42 : 90 (d) none of these

## Final Round

**1.** In two alloys the ratio of Iron and copper is 4 : 3 and 6 : 1 respectively. If 14 kg of the first alloy and 42 kg of the second alloy are mixed together to form a new alloy, then what will be the ratio of copper to iron in the new alloy :

(a) 11 : 3 (b) 11 : 8
(c) 8 : 11 (d) none of these

**2.** In a zoo, there are rabbits and pigeons. If heads are counted, there are 340 heads and if legs are counted there are 1060 legs. How many pigeons are there?

(a) 120 (b) 150
(c) 180 (d) 170

**3.** 6 litre is taken out from a vessel full of Kerosene and substituted by pure petrol. This process is repeated two more times. Finally the ratio of petrol and Kerosene in the mixture becomes 1701 : 27. Find the volume of the original solution.

(a) 14 litre (b) 16 litre
(c) 8 litre (d) 42 litre

Compiled By JasJeet

yoursmahboob.wordpress.com


4. In three vessels, each of 25 litres capacity, mixture of milk and water is filled. The ratio of milk and water are 3 : 1, 2 : 3, 4 : 3 in the respective vessels. If all the three vessels are emptied into a single large vessel, then what will be the ratio of water to milk in the resultant mixture?
(a) 179 : 241 (b) 197 : 214
(c) 219 : 117 (d) 179 : 234

5. Two liquids are mixed in the ratio 4 : 3 and the mixture is sold at Rs. 20 with a profit of $33\frac{1}{3}$%. If the first liquid is costlier than the second by Rs. 7. Find the sum of costs of both the liquids :
(a) Rs. 11 (b) Rs. 29
(c) Rs. 35 (d) Rs. 70

6. Two alloys made up of copper and tin. The ratio of copper and tin in the first alloy is 1 : 3 and in the second alloy it is 2 : 5. In what ratio the two alloys should be mixed to obtain a new alloy in which the ratio of tin and copper be 8 : 3?
(a) 3 : 5 (b) 4 : 7
(c) 3 : 8 (d) 5 : 11

7. Three vessels having volumes in the ratio of 2 : 3 : 5 are full of a mixture of water and milk. In the first vessel ratio of water and milk is 1 : 3, in second 2 : 3 and in third vessel, 2 : 5. If all the three vessels were poured out in a large container, what is the resulting ratio of milk and water?
(a) 43 : 96 (b) 438 : 962
(c) 348 : 962 (d) 962 : 438

8. The number of oranges in three baskets are in the ratio of 3 : 4 : 5. In which ratio the no. of oranges in first two baskets must be increased so that the new ratio becomes 5 : 4 : 3?
(a) 1 : 3 (b) 2 : 1
(c) 3 : 4 (d) 2 : 3

9. A vessel of capacity 2 litre has 25% alcohol and another vessel of capacity 6 litre had 40% alcohol. The total liquid of 8 litre was poured out in a vessel of capacity 10 litre and thus the rest part of the vessel was filled with the water. What is the new concentration of mixture?
(a) 31% (b) 71%
(c) 49% (d) 29%

10. Alloy $A$ contains 40% gold and 60% silver. Alloy $B$ contains 35% gold and 40% silver and 25% copper. Alloys $A$ and $B$ are mixed in the ratio of 1 : 4. What is the ratio of gold and silver in the newly formed alloy is?
(a) 20% and 30% (b) 36% and 44%
(c) 25% and 35% (d) 49% and 36%

11. Dia and Urea are two chemical fertilizers. Dia is consists of $N$, $P$ and $K$ and Urea conists of only $N$ and $P$. A mixture of Dia and Urea is prepared in which the ratio of $N$, $P$ and $K$ is 26%, 68% and 6% respectively. The ratio of $N$, $P$ and $K$ in Dia is 20%, 70% and 10% respectively. What is the ratio of $N$ and $P$ in the Urea?
(a) 27% and 63% (b) 33% and 67%
(c) 35% and 65% (d) 70% and 30%

12. The ratio of copper and nickel by weight in the two alloys $X$ and $Y$ are 2 : 7 and 5 : 4. How many kilogram of the alloy $X$ and $Y$ are required to make 42 kg of new alloy $Z$ in which the ratio of copper and nickel is same?
(a) 6 kg and 36 kg (b) 10 kg and 32 kg
(c) 7 kg and 35 kg (d) none of these

13. There are two alloys made up of copper and aluminium. In the first alloy copper is half of the aluminium and in the second alloy copper is thrice as much as aluminium. How many times the second alloy must be mixed with first alloy to get the new alloy in which copper is twice as that of aluminium?
(a) 2 (b) 3
(c) 4 (d) 5

14. There are 90 litres castrol and 150 litres CRB mobil oils. The price of castrol is Rs. 80 per litre and price of CRB is Rs. 75 per litre. Equal amount of castrol and CRB is taken out and then CRB is poured out in the vessel of castrol and castrol is poured out in the vessel of CRB. Now the rate of both the mixtures is same. What is the amount of mobil oil taken out from each of the vessel?
(a) 45 litres (b) 56.25 litres
(c) 24.5 litres (d) 36 litres

15. There are two containers, the first contain, 1 litre pure water and the second contains 1 litre of pure milk. Now 5 cups of water from the first container is taken out is mixed well in the second container. Then, 5 cups of this mixture is taken out and is mixed in the first container. Let $A$ denote the proportion of milk in the first container and $B$ denote the proportion of water in the second container then :
(a) $A < B$ (b) $A = B$
(c) $A > B$ (d) can't be determined

16. Mitthu Bhai sells rasgulla (a favorite indian sweets) at Rs. 15 per kg. A rasgulla is madeup of flour and sugar in the ratio of 5 : 3. The ratio of price of sugar and flour is 7 : 3 (per kg). Thus he earns $66\frac{2}{3}$% profit. What is the cost price of sugar?
(a) Rs. 10/kg (b) Rs. 9/kg
(c) Rs. 18/kg (d) Rs. 14/kg

Compiled By Jasjeet

yoursmahboob.wordpress.com



# Answers

## INTRODUCTORY EXERCISE-4.1

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 (c) | 2. (b) | 3. (d) | 4. (c) | 5. (a) | 6. (b) | 7. (d) | 8. (b) | 9. (c) | 10. (d) |
| 11. (a) | 12. (b) | | | | | | | | |

## INTRODUCTORY EXERCISE-4.2

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 (c) | 2. (c) | 3. (b) | 4. (d) | 5. (c) | | | | | |

## INTRODUCTORY EXERCISE-4.3

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 (d) | 2. (c) | 3. (c) | 4. (a) | 5. (d) | 6. (c) | | | | |

## INTRODUCTORY EXERCISE-4.4

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

## LEVEL-1

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

## LEVEL-2

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 (a) | 2. (c) | 3. (b) | 4. (c) | 5. (c) | 6. (d) | 7. (d) | 8. (a) | 9. (c) | 10. (c) |
| 11. (d) | 12. (b) | 13. (a) | 14. (b) | 15. (d) | 16. (c) | 17. (d) | 18. (a) | 19. (a) | 20. (c) |
| 21. (c) | 22. (c) | 23. (a) | 24. (b) | 25. (a) | 26. (c) | 27. (c) | 28. (b) | 29. (a) | 30. (c) |
| 31. (d) | 32. (a) | 33. (d) | 34. (b) | 35. (b) | 36. (b) | 37. (c) | 38. (b) | 39. (c) | 40. (b) |
| 41. (b) | 42. (c) | 43. (b) | 44. (b) | 45. (b) | 46. (b) | 47. (c) | 48. (a) | 49. (a) | |

## FINAL ROUND

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 (d) | 2. (b) | 3. (c) | 4. (a) | 5. (b) | 6. (b) | 7. (d) | 8. (b) | 9. (d) | 10. (b) |
| 11. (c) | 12. (c) | 13. (c) | 14. (b) | 15. (b) | 16. (d) | | | | |

Compiled By Jasjeet

# Hints & Solutions

jasmahboob.wordpress.com

## LEVEL 1

1. $a : b :: c : d$

$a^2 + b^2 + c^2 + d^2 = 50$

$b + c = 5$

and $a : b = 1 : 3$

If consider $a : b = 1 : 3$ as it is, then

$c = 2$ $(5 - 3 = 2)$

and $d = 6$ $(\because a : b :: c : d)$

$a^2 + b^2 + c^2 + d^2 = 1^2 + 3^2 + 2^2 + 6^2 = 50$

Hence, the presumed values are correct.

Thus, the average of $a$, $b$, $c$ and $d = \dfrac{a + b + c + d}{4}$

$= \dfrac{1 + 3 + 2 + 6}{4} = 3$

Hence (b) is correct.

**Alternatively:** Assume option (b)

$\because \quad \dfrac{a + b + c + d}{4} = 3$

$\Rightarrow \quad a + b + c + d = 12$

Now $\because \quad b + c = 5$

$\Rightarrow \quad a + d = 7$

Again $\quad a : b = 1 : 3$

$\Rightarrow \quad c : d = 2 : 6$

Now verify that $a^2 + b^2 + c^2 + d^2 = 50$. Since it is correct. Hence option (b) is correct.

**NOTE** It can also be solved by forming quadratic equations.

2. $\dfrac{a}{b} = \dfrac{a + b}{a}$

$\Rightarrow \quad a^2 = ab + b^2$

$\Rightarrow \quad a^2 - b^2 - ab = 0$

Let $b = 1$, then $a : b = a : 1$ (by putting $b = 1$)

$\therefore \quad a^2 - a - 1 = 0$

$\Rightarrow \quad a = \dfrac{1 \pm \sqrt{5}}{2}$ (Solving quadratic equation by Sridharacharya's formula)

$\therefore a = \dfrac{1 + \sqrt{5}}{2}$ (negative value can't be considered)

$a : b = \dfrac{1 + \sqrt{5}}{2} : 1$

or $a : b = (1 + \sqrt{5}) : 2$

Therefore, $\dfrac{b}{a + b} = \dfrac{2}{1 + \sqrt{5} + 2} = \dfrac{2}{3 + \sqrt{5}}$

Hence option (b) is correct.

3. The best way is to go through options

$\dfrac{x + y}{x - y} = \dfrac{8 + 2}{8 - 2} = \dfrac{10}{6} = \dfrac{5}{3}$ (verified)

Again $\dfrac{x}{y + 2} = \dfrac{8}{2 + 2} = 2$ (verified)

Hence option (d) is correct.

4. Best way is to go through options

and $\dfrac{a^3 + b^3}{a^3 - b^3} = \dfrac{5^3 + 2^3}{5^3 - 2^3} = \dfrac{125 + 8}{125 - 8} = \dfrac{133}{117}$

Hence option (c) is correct.

5. $H : S = 1 : 1$

and $S : G = 2 : 3$

$H : P = 1 : 2$

$\therefore \quad H : S : G : P = 2 : 2 : 3 : 4$

$= 2x : 2x : 3x : 4x$

Therefore $\dfrac{2x + 2x + 3x + 4x}{4} = \dfrac{11x}{4} = 55$

$\Rightarrow \quad x = 20$

Marks in History = 40
Sociology = 40
Geography = 60
Philosophy = 80

Hence, only in two subjects he scored 60% or above.
Hence option (b) is correct.

6. Let the incomes of $A$ and $M$ is $2x$ and $3x$
Let the savings of $A$ be $K$, then the expenditure of $M$ be $K$
Also expenditure of $A = 2x - K$

Given $(2x - K) + K = 8000 \Rightarrow x = 4000$

$\therefore$ Total income of

$A$ and $B = 2x + 3x = 5x = 5 \times 4000 = 20000$

$\therefore$ Total savings of $A$ and $B = 20{,}000 - 8000 =$ Rs. 12,000

7. $\dfrac{\text{Profit of Hutch}}{\text{Profit of Essar}} = \dfrac{\text{time period} \times \text{amount of Hutch invested}}{\text{time period} \times \text{amount of Essar invested}}$

$\dfrac{6}{17} = \dfrac{5 \times K}{12 \times 1275}$

$\Rightarrow \quad K = \dfrac{6 \times 12 \times 1275}{17 \times 5} = 1080$

8. Minimum number of chocolates are possible when he purchases maximum number of costliest chocolates.

Thus $2 \times 5 + 5 \times 2 =$ Rs. 20

Now Rs. 100 must be spend on 10 chocolates as $100 = 10 \times 10$.

Thus minimum number of chocolates $= 5 + 2 + 10 = 17$

9. Maximum number of chocolates are possible only when he purchases minimum number of costlier chocolates and maximum number of cheaper chocolates

$\therefore \quad 2 \times 5 + 1 \times 10 =$ Rs. 20

Now Rs. 100 must be spend on 50 chocolates as $100 = 2 \times 50$.

Thus maximum number of possible chocolates

$= 2 + 1 + 50 = 53$

Compiled By Jasjeet

yoursmahboob.wordpress.com



**10.** Meretere → M, Teremere → T and Khabbu Singh → K

$\frac{5+3}{3} = 2.66$ (since all the 8 chocolates were shared by 3)

It means M has given $5 - 2.66 = 2.33$ chocolates to K and T has given $3 - 2.66 = 0.33$ chocolates to K

Thus M and T will receive the amount in the ratio of donations (*i.e.*, share of chocolates)

| M | : | T |
|---|---|---|
| 2.33 | : | 0.33 |
| $2\frac{1}{3}$ | : | $\frac{1}{3}$ |
| $\frac{7}{3}$ | : | $\frac{1}{3}$ |
| 7 | : | 1 |

So the M receives Rs. 14 and T receives Rs. 2

Thus the difference = Rs. 12

**11.** Share of a man, a woman and a boy = $7x$, $4x$ and $3x$

then the share of 4 men = $4 \times 7x = 28x$

then the share of 5 women = $5 \times 4x = 20x$

then the share of 2 boys = $2 \times 3x = 6x$

Now, the share of all women $= \frac{20x}{(28x + 20x + 6x)} \times 4536$

$= \frac{20}{54} \times 4536 =$ Rs. 1680

Hence, the share of one woman $= \frac{1680}{5} = 336$

**12.** Concentration of petrol in

| $A$ | $B$ | $C$ |
|---|---|---|
| $\frac{1}{2}$ | $\frac{3}{5}$ | $\frac{4}{5}$ |

Quantity of petrol taken from $A = 1$ litre out of 2 litre

Quantity of petrol taken from $B = 1.8$ litre out of 3 litre

Quantity of petrol taken from $C = 0.8$ litre out of 1 litre

Therefore total petrol taken out from

$A, B$ and $C = 1 + 1.8 + 0.8 = 3.6$ litre

So, the quantity of Kerosene $= (2 + 3 + 1) - (3.6) = 2.4$ litre

Thus, the ratio of petrol to Kerosene $= \frac{3.6}{2.4} = \frac{3}{2}$

**13.** $T \propto \frac{\sqrt{l}}{\sqrt{g}} \Rightarrow T = k\sqrt{\frac{l}{g}}$

Therefore, $3 = K\sqrt{\frac{9}{4}}$ or $3 = K\frac{3}{2} \Rightarrow K = 2$

Again $T = K\sqrt{\frac{l}{g}} = 2 \times \sqrt{\frac{64}{16}} = 4$

$T = 4$ seconds

**14.**

| Pure | Cure | Lure |
|---|---|---|
| 100% | 40% | 37.5% |
| $\frac{1}{1}$ | $\frac{2}{5}$ | $\frac{3}{8}$ |

| | Milk | Water | Mixture |
|---|---|---|---|
| Cure | $4l$ | $10l$ | $14l$ |
| Lure | $6l$ | $16l$ | $22l$ |
| New mixture | Milk | Water | |
| | $10l$ | $26l$ | |
| ⊕ | $16l$ | | |
| | $26l$ | $26l$ | |

Required mixture 1 : 1

Since in the required mixture the ratio of milk and water is 1 : 1 so she has to add up 16 litre of more milk (pure) to get it for the fixed quantity of water.

**15.** $S : (M + J) = 5 : 7 \Rightarrow 7S = 5M + 5J$ ...(1)

$J : (S + M) = 1 : 2 \Rightarrow 2J = S + M$ ...(2)

By solving equations (1) and (2), we get

$S : M : J = 5 : 3 : 4$

$S : M = 5 : 3$

so

**16.**

| | Male | | Female |
|---|---|---|---|
| $A$ | $4x$ | : | $3x$ |
| $B$ | $3y$ | : | $2y$ |
| $C$ | $5z$ | : | $4z$ |

$2y = 4z$

but

| | Male | | Female |
|---|---|---|---|
| $A$ | $4x$ | : | $3x$ |
| $B$ | $6z$ | : | $4z$ |
| $C$ | $5z$ | : | $4z$ |

∴ Therefore, $7x + 19z = 33$

but $z$ can assume only one value *i.e.*, $z = 1$

Hence, $7x + 19 = 33 \Rightarrow x = 2$

Thus the no. of female children in factory $A = 3x = 6$.

**17.** The ratio of broken parts (by weight) $= 3x : 4x : 5x$

Therefore value of broken parts of diamond

$= (3x)^2 + (4x)^2 + (5x)^2 = 50x^2$

The value of original diamond $= (3x + 4x + 5x)^2 = 144x^2$

Therefore, loss in value $= 144x^2 - 50x^2 = 9.4$ lakh

$\Rightarrow 94x^2 = 9.4$ lakh

$\Rightarrow 94x^2 = 940000$

$\Rightarrow x^2 = 10000$

Hence, the actual value of the diamond $= 144x^2$

$= 144 \times 10000$

$= 14.4$ lakh

**18.** $10x + 20y + 100z = 1600$

Again since $x : y = 6 : 1$

∴ $60y + 20y + 100z = 1600$

$\Rightarrow 80y + 100z = 1600$

$\Rightarrow 4y + 5z = 80$

Putting $z = 1, 2, 3, 4, 5 \ldots$, we get at $z = 4$, $y = 15$ (an integer)

Hence, min. 4 coins of Re. 1 will be there

**19.** Concentration of water in first vessel $= \frac{2}{5} = 40\%$

concentration of water in second vessel $= \frac{2}{7} = 28.57\%$

**By alligation**

$\frac{2}{7}$ $\quad$ $\frac{2}{5}$

$\frac{1}{3}$

$\left(\frac{2}{5} - \frac{1}{3}\right)$ $\quad$ $\left(\frac{1}{3} - \frac{2}{7}\right)$

$\frac{1}{15} : \frac{1}{21}$

$21 : 15$

$7 : 5$

Therefore, ratio of first mixture to the second mixture = 5 : 7

Compiled By Jasjeet

yoursmahboob.wordpress.com


20. LCM of 2, 3, 5, 8 = 120

Therefore,
$$\frac{1}{2}\times 120 = 60$$
$$\frac{1}{3}\times 120 = 40$$
$$\frac{1}{5}\times 120 = 24$$
$$\frac{1}{8}\times 120 = 15$$

Therefore, minimum number of chocolates
$$= 60 + 40 + 24 + 15 = 139$$

21.
$$A : B = 5 : 3$$
$$B : C = 5 : 8$$
$$A : B : C = 25 : 15 : 24$$
$\therefore$ So, $A$ is the most efficient.

22.
$$A : B = 5 : 4 \Rightarrow 10 : 8$$
$$A : C = 2 : 3 \Rightarrow 10 : 15$$
$$A : B : C = 10 : 8 : 15$$
$\therefore$
$$B : C = 8 : 15$$

23.

| | A | | B | | C |
|---|---|---|---|---|---|
| (Proportion of milk in mixture) | $\frac{1}{3}$ | : | $\frac{2}{5}$ | : | $\frac{3}{7}$ |
| or | $\frac{35}{105}$ | : | $\frac{42}{105}$ | : | $\frac{45}{105}$ |

quantity of milk in new mixture $= 35 + 42 + 45 = 122l$

quantity of water in new mixture $= (105 \times 3) - 122 = 193l$

Therefore, ratio of water is to milk $= 193 : 122$

24.
$$A : B = 8 : 9$$
$$B : C = 2 : 3$$
$$C : D = 9 : 13$$
$$A : B : C : D = 144x : 162x : 243x : 351x$$
But we need not to solve this, since we already know that
$$B : C = 2x : 3x$$
$\therefore$ $2x : 3x :: 18 : k \Rightarrow k = 27$ years

25.

| Milk | Water | |
|---|---|---|
| $5x$ | $3x$ | (initially) |
| $-25l$ | $-15l$ | |
| $5x - 25$ | $3x - 15$ | (after selling $40l$ mixture) |
| | $+15l$ | |
| $5x - 25$ | $3x$ | (after adding $15l$ water) |
| 5 : | 4 | |

$\therefore$
$$\frac{5x - 25}{3x} = \frac{5}{4} \Rightarrow x = 20$$
$\therefore$ New quantity of mixture $= (5x - 25) + 3x = 135$ litre

26.

| A | B |
|---|---|
| $C : T$ | $C : T$ |
| $5 : 3$ | $5 : 11$ |

Concentration of copper in $A = \frac{5}{8}$

Concentration of copper in $B = \frac{5}{16}$

By alligation

$$\begin{array}{ccc} (B)\ \frac{5}{16} & & \frac{5}{8}\ (A) \\ & \frac{1}{2} & \\ \left(\frac{5}{8} - \frac{1}{2}\right) & & \left(\frac{1}{2} - \frac{5}{16}\right) \\ \frac{2}{16} & : & \frac{3}{16} \\ 2 & : & 3 \end{array}$$

So, the required ratio of $A : B = 3 : 2$ (Since $B : A = 2 : 3$)

27.
$$k + 10x = 6000$$
$$k + 25x = 9000 \qquad (\because 25 \times 360 = 9000)$$
$$\Rightarrow \quad 15x = 3000$$
$$\Rightarrow \quad x = 200 \text{ and } k = 4000$$
$$\therefore \quad k + 40x = 4000 + 40 \times 200 = 12{,}000$$
where $k$ is the fixed expenditure.

28. Third proportional of 21 and 42 is 84 and mean proportional to 16 and 49 is 28.

Therefore required ratio $= \frac{84}{28} = \frac{3}{1}$ or $3 : 1$

29.
$$P \propto \sqrt{l} \Rightarrow P = k\sqrt{l}$$
$$\therefore \quad 52 = k\sqrt{16}$$
$$\Rightarrow \quad k = 13$$
Again,
$$P = k\sqrt{l}$$
$$65 = 13\sqrt{l}$$
$$\Rightarrow \quad l = 25 \text{ cm}$$

30.
$$\frac{m+n}{m-n} = \frac{7x}{x} \Rightarrow \frac{m}{n} = \frac{4x}{3x}$$
Again $\quad mn = 4x \times 3x = 12x^2$

and $\quad mn = 60x$

So $\quad 60x = 12x^2$

$\Rightarrow \quad x = 5$

$\therefore \quad m = 20$ and $n = 15$

Hence, $\quad \frac{1}{m} : \frac{1}{n} = \frac{1}{20} : \frac{1}{15} = 3 : 4$

**Alternatively:**
$$\frac{m}{n} = \frac{4x}{3x}$$
$$\frac{1}{m} : \frac{1}{n} = 3 : 4$$

31.
$$\underbrace{A + B}_{2} : \underbrace{C + D}_{1}$$
and $\quad \frac{B}{3} : \frac{C}{1}$ and $\frac{C}{3} : \frac{D}{5}$

$\Rightarrow \quad B : C : D$

$9 : 3 : 5$

Again $\quad A + B : C + D$
$$\underbrace{7 + 9}_{16} \quad \underbrace{3 + 5}_{8}$$
Thus $A + B = 16 \Rightarrow A = 7$ when $B = 9$

$\therefore$ Therefore share of $A = \frac{7}{24} \times 9600 =$ Rs. 280

Compiled By Jasjeet

yoursmahboob.wordpress.com



**32.** The best way is to consider some values in the proportion and verify the option, but care should be taken that in this type of question you are required to verify a possible correct option atleast with 2-3 times with different values.
Since, if you consider

$$p:q::r:s \Rightarrow 1:2::3:6$$

you will find answer (b) is also correct, but for only particular values. So it is not the general solution. Finally you will realize that option (d) is the most appropriate answer.

**33.** Solve by componendo and dividendo or as mentioned in the previous solution.

**34.** Since for the constant distance time is inversely proportional to the speed. So, the required ratio of time taken by each of the rickshaw, car and scooter is

$$\frac{1}{3}:\frac{1}{5}:\frac{1}{6} \Rightarrow 10:6:5$$

$$\left[\frac{1}{3}\times\frac{10}{10}:\frac{1}{5}\times\frac{6}{6}:\frac{1}{6}\times\frac{5}{5}=\frac{10}{30}:\frac{6}{30}:\frac{5}{30}=10:6:5\right]$$

**35.** $A:B=2:3$ and $B:C=3:5$

$\Rightarrow$ $A:B:C=2:3:5$

$\therefore$ $(A+B):C=5:5=1:1$

Hence, Share of $(A+B)=\frac{1}{2}\times 6940=3470$

**36.** $x+y=93$ ...(1)

and $\frac{x+3}{y+2}=\frac{24}{25}$

$\Rightarrow$ $25x-24y=(-27)$ ...(2)

From equations number (1) and (2)

$x=45$ and $y=48$

**Alternatively:** Go through options.

**37.** $\frac{a}{b}=\frac{4x}{9x}$ and $\frac{a+4}{b+4}=\frac{21}{46}$

$\Rightarrow$ $a=80$ and $b=180$

$\therefore$ $b-a=100$

**38.** $\frac{R}{D}=\frac{3x}{5x}$ and $\frac{R}{D}\Rightarrow\frac{3x+10}{5x+10}=\frac{5}{7}$

$\Rightarrow$ $x=5$

Hence, $\frac{R}{D}=\frac{15}{25}$

**Alternatively:** Go through options.

**39.** Let the fraction be $\frac{x}{y}$ then

$$\frac{x+5}{y+5}=\frac{11}{15} \Rightarrow 11y-15x=20$$

Since, we have only one equation in two variables, so we cannot find the solution.

**40.** $\frac{2x+3x+5x+8x+9x}{5}=\frac{162}{5}=32.4$

**41.** The number of days required by a single Kirlosker pump to fill the tank $=6\times7=42$ days and the number of days required by a single USHA pump to fill the same tanks $=2\times18=36$ days. Now, since efficiency is inversely proportional to the number of days. Hence,

$$\frac{\text{Efficiency of one K-pump}}{\text{Efficiency of U-pump}}=\frac{36}{42}=\frac{6}{7}$$

**42.** $\frac{1}{5}$th field can be reaped by 96 man days

$\therefore$ $\frac{4}{5}$th field can be reaped by $96\times4=384$ man days

Now, since there are only 8 days so reqired

number of men $=\frac{384}{8}=48$ men

**43.** $210=2\times3\times5\times7$

Therefore, $\frac{N_1}{N_2}=\frac{2k\times5\times7}{3k\times5\times7}$

since, $N_1:N_2=2:3$

Therefore, $N_1=70$ and $N_2=105$

$\therefore$ $N_1+N_2=70+105=175$

**44.** $\frac{(53-x)}{(21-x)}=\frac{(41-x)}{(17-x)} \Rightarrow x=5$

**Alternatively :** Go through options.

**45.** $2x+3x+4x=180$

$\Rightarrow$ $x=20$ $\therefore$ $4x=80$

**46.** $(25\times12x)+(50\times4x)+(100\times3x)=800x=60000$

$\Rightarrow$ $x=75$

$\therefore$ number of coins of 25 paise $=12x=12\times75=900$

**Alternatively :** Go through options, choices (a), (b) and (c) are eliminated since neither of 200, 225, 275 is divisible by 12. Hence choice (d) is correct.

**47.** Go through options.

**Alternatively :** $\frac{(x-a)}{11}=\frac{(x-b)}{9}=\frac{(x-c)}{5}=k$

$\Rightarrow$ $a=x-11k$

$b=x-9k$

$c=x-5k$

$\therefore$ $x=\frac{(x-11k)+(x-9k)+(x-5k)}{2}$

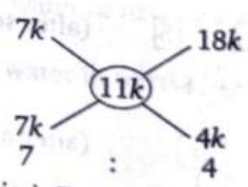
$2x=3x-25k \Rightarrow x=25k$

$a=14k \Rightarrow b=16k$ and $c=20k$

$\therefore$ $a:b:c=14:16:20=7:8:10.$

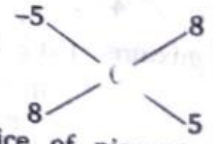
**48.** If the weight of kerosene be $k$ kg/unit volume, then
weight of petrol $=7k$/unit volume
weight of castrol $=18k$/unit volume
required weight of the mixture $=11k$/unit volume

**By Alligation**




The required ratio is 7 : 4.

**49.** **By Alligation**




The ratio of price of pigeons sold at loss and profit respectively are in the ratio of 8 : 5

$\therefore$ Cost-price of profitable pigeon $=\frac{5}{8+5}\times182=$ Rs. 70

Compiled By Jasjeet

yoursmahboob.wordpress.com

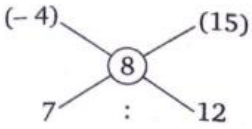

**50.** $\frac{C}{R} = \frac{3x}{5x}$

Again $\frac{C}{R} = \frac{(3x)\,3}{(5x+100)} = \frac{4}{5}$

$x = 16$

$\Rightarrow$ $\therefore$ Price of Rotomac pen in 2000 was Rs. 80.

**51. By Alligation**




Now, we get the ratio of no. of rings sold at a loss and profit is 7 : 12

$\therefore$ Number of rings sold at profit $= \frac{12}{19} \times 361 = 228$

**Alternatively :** Go through options.

**52.** Best way is to go through options.
consider option (d)

$$\frac{180}{30} + \frac{70}{35} = 6 + 2 = 8 \text{ hrs}$$

Hence, (d) is correct.

**Alternatively :** $\frac{x}{30} + \frac{250 - x}{35} = 8$

$\Rightarrow$ $x = 180$ miles

**Alternatively :** Since the Average Speed

$$= \frac{\text{Total Distance}}{\text{Total Time}} = \frac{250}{8} \text{ miles/hr}$$

$\therefore$ **By Alligation**

Therefore, the ratio of time taken @ 30 m/hr and @ 35 m/hr is in the ratio of 3 : 1. It means he has travelled @ 30 m/hr for 6 hr.

Therefore, the distance travelled by car is 180.
($\because$ Distance = Speed $\times$ Time).

**53.** $\frac{22}{22} : \frac{17}{17} = 1 : 1$

**54.** $\frac{1}{3} : \frac{1}{4} : \frac{1}{5} : \frac{1}{6}$

$\Rightarrow$ $\frac{20}{60} : \frac{15}{16} : \frac{12}{60} : \frac{10}{60}$ (by taking LCM)

$\Rightarrow$ $20 : 15 : 12 : 10$

$\therefore$ Largest share $= \frac{20}{(20 + 15 + 12 + 10)} \times 171$

$= \frac{20}{57} \times 171 = 60.$

**55.** Let the present age of Karishma and Babita be $x$ and $y$ then,

$$\frac{x - 10}{y - 10} = \frac{1}{3} \quad \ldots(1)$$

Again $$\frac{x + 14}{y + 14} = \frac{5}{9} \quad \ldots(2)$$

By solving (1) and (2) we get $x = 26$ and $y = 58$

**56.** Let the fraction be $\frac{k}{5k}$

then, $\frac{k + x}{5k + 5x} = \frac{(k + x)}{5(k + x)} = \frac{1}{5}$

**57.** $x \propto y$ and $x \propto \frac{1}{z^2}$

$x \propto \frac{y}{z^2} \Rightarrow x = k\frac{y}{z^2}$

$6 = k \times \frac{75}{(5)^2} \Rightarrow k = 2$

Again $x = 2 \times \frac{24}{(4)^2} \Rightarrow x = 3$

**58.** $x \propto (y^2 + z^2) \Rightarrow x = k(y^2 + z^2)$

$15 = k(1^2 + 2^2) \Rightarrow k = 3$

again $39 = 3 \times (2^2 + z^2)$

$\Rightarrow$ $13 = (4 + z^2) \Rightarrow z = 3$

**59.** $W \propto HA \Rightarrow W = K \times H \times A$

Now, $48 = K \times 1.2 \times 20 \Rightarrow K = 2$

Again $W = 2 \times 1.5 \times 30$

$\therefore$ $W = 90$

**60.** $(a + b) : (b + c) : (c + a) = 5x : 6x : 9x$

and $a + b + c = 10$

$\Rightarrow$ $(a + b) + (b + c) + (c + a) = 20x$

$\Rightarrow$ $a + b + c = 10x$

$\Rightarrow$ $a + b + c = 10$ ($\because x = 1$)

$\therefore$ $c = (a + b + c) - (a + b)$

or $c = 10 - 5 = 5$

**61.**

| A | B | C | |
|---|---|---|---|
| $3x$ | $4x$ | $5x$ | |
| $(3x + x)$ | $2x$ | $(5x + x)$ | ($B$ gives $\frac{1}{4}$ to $A$ and $\frac{1}{4}$ to $C$) |
| $= 4x$ | $2x$ | $6x$ | |
| $(4x + x)$ | $2x$ | $(5x)$ | ($C$ gives $\frac{1}{6}$ to $A$) |
| $5x$ | $2x$ | $5x$ | |
| 5 : | 2 : | 5 | |

yoursmahboob.wordpress.com



## LEVEL 2

**1.**

| $M_1$ | $M_2$ |
|---|---|
| $D : S$ | $D : S$ |
| $7 : 3$ | $5 : 4$ |

New Mixture

| $D$ | | $S$ |
|---|---|---|
| 2 | : | 1 |

proportion of Dew in $M_1 = \frac{7}{10}$

proportion of Dew in $M_2 = \frac{5}{9}$

proportion of new mixture $= \frac{2}{3}$ (required)

**By alligation rule**

$$\begin{array}{ccc} \frac{7}{10} & & \frac{5}{9} \\ & \frac{2}{3} & \\ \left(\frac{2}{3}-\frac{5}{9}\right) & & \left(\frac{7}{10}-\frac{2}{3}\right) \\ \frac{3}{27} & & \frac{1}{30} \end{array}$$

or $\frac{1}{9} : \frac{1}{30}$

or $10 : 3$

**2.** The ratio of quantities $= 140 : 60 = 7 : 3$

$\therefore$ The quantity to be exchanged $= \frac{(140 \times 3) + (60 \times 7)}{2(7+3)}$

$= 42$ litre

**NOTE** In this question individual prices are not required. You can solve it by forming equation.

**Alternatively :** Go through options by assuming some prices.

**3.** Let the number be $100x + 10y + z$, then

$x + z = 6$ and $y + z = 5$

Also, from the given options only option (b) is suitable

*i.e.,* $y + z = 5$

or $3 + 2 = 5$

**4.**

| Water | Pulp |
|---|---|
| $4x$ | $x$ |
| $3y$ | $2y$ |

but $x = 2y$ since pulp remains contant

| | Water | Pulp |
|---|---|---|
| $5y$ = loss in water → | $8y$ | $2y$ |
| | $3y$ | $2y$ |

but $10y\ (= 8y + 2y) = 1.5$ kg

$\therefore$ $5y\ (= 3y + 2y) = 0.75$ kg

**5.**

| Cost price | : | Selling price |
|---|---|---|
| $\frac{1}{9}$ | : | $\frac{1}{6}$ |
| 2 | : | 3 |

or

CP : SP = 2 : 3

since profit = SP − CP

$\therefore$ Profit = 3 − 2 = 1

$\therefore$ Profit : CP = 1 : 2

**6. Flow Chart :**

$P : K$

$7x : 3x$ → + Kerosene by addition

Step 1 → $7x : 5x$ ← by replacement

Step 2 → $3x : x$ ←

By the replacement formula from alligation chapter

$$\frac{1}{4} = \frac{5}{12}\left(1 - \frac{240}{12x}\right)$$

$$\Rightarrow \frac{3}{5} = \left(1 - \frac{240}{12x}\right)$$

$$\Rightarrow \frac{2}{5} = \frac{20}{x}$$

$$\Rightarrow x = 50$$

Therefore, half of the initial amount $= (350 + 150)$ litres then, the required amount of kerosene

$= 5x - 3x = 2x = 100$ litres

But for the whole amount required kerosene to be added $= 200$ litres

**7.** Data insufficient. Since we don't know that how many persons bought ticket of all the categories individually

*i.e.,* $5x + 9y + 14z = 213925$

but we don't know anything about $x$, $y$ and $z$

**8.**

| Petrol | Kerosene | Total Mixture |
|---|---|---|
| 99 | $x$ | $99 + x$ |
| 99 | $(x - 198)$ | $(x - 99)$ |

Again $\frac{99}{(x-99)} \times 100 - \frac{99}{(x+99)} \times 100 = 13.33$

or $9900\left(\frac{x + 99 - x + 99}{x^2 - 99^2}\right) = 13.33$

or $\frac{9900\,(198)}{x^2 - 99^2} = \frac{40}{3}$

$\Rightarrow x^2 - 99^2 = 99^2 \times 15$

$\Rightarrow x^2 = (99)^2 \times (16)$

$\Rightarrow x = 99 \times 4 = 396$ litres

Therefore the actual concentration of petrol

$= \frac{99}{(99 + 396)} = 20\%$

Compiled By Jasjeet

yoursmahboob.wordpress.com


Do it yourself.

Varsha : Vinay = 5 : 6 = 5x : 6x

Veera : Vikram = 7 : 8 = 7y : 8y

But their ages are in A.P.

Therefore, $6x - 5x = 8y - 7y$

$$x = y$$

$$\Rightarrow \quad \frac{5x+2}{8y+2} = \frac{2}{3}$$

Again,

$$\frac{5x+2}{8x+2} = \frac{2}{3}$$

$$\Rightarrow \quad x = 2$$

Therefore, the ages of Varsha, Vinay, Veera and Vikram are 10, 12, 14 and 16 years respectively.

Therefore, the ratio of ages of Vinay and Veera = 6 : 7

| Bobby | | | Sunny | | |
|---|---|---|---|---|---|
| Milk | | Water | Milk | | Water |
| 1 | : | 1 | 1 | : | 1 |
| 50% | | 50% | 50% | | 50% |
| ② | | ② | | | |
| 60% | | 40% | | | |
| ③ | : | ② | | | |

It means bobby will add up 1 litre of milk, in 4 litre of initial mixture, to prepare 5 litres mixture in the ratio of 3 : 2

By replacement method

$$\frac{2}{5} = \frac{2}{4}\left(1 - \frac{k}{4}\right)$$

$$\Rightarrow \quad \frac{4}{5} = \left(1 - \frac{k}{4}\right)$$

$$\Rightarrow \quad \frac{1}{5} = \frac{k}{4}$$

$$\Rightarrow \quad k = \frac{4}{5}$$

It means Sunny will replace $\frac{4}{5}$ litre of initial mixture by the same quantity of pure milk.

Hence, the percentage of milk added by Bobby to that of replaced by Sunny $= \frac{1}{4/5} \times 100 = 125\%$

| | A | | | B | |
|---|---|---|---|---|---|
| | Milk | Water | | Milk | Water |
| After first operation | 25l | 0 | | 0 | 25l |
| | 20l | 0 | → | 5l | 25l |
| | | | | 1 : 5 | |
| After second operation | 21l | 5l | ← | 4l | 20l |

Therefore, the ratio of water in $A$ and $B$ is 1 : 4

$$B = \frac{5}{6}A \quad \text{...(i)}$$

and

$$C = D = \frac{9}{10}B \quad \text{...(ii)}$$

also

$$B = \frac{2}{3}E \quad \text{...(iii)}$$

and

$$E - A = 3 \quad \text{...(iv)}$$

From (i) and (iii) $\frac{A}{E} = \frac{4}{5}$ or $E = \frac{5}{4}A$ ...(v)

$$\therefore \quad E - A = \frac{5A}{4} - A = 3 \text{ from (iv) and (v)}$$

$$\Rightarrow \quad A = 12 \text{ and } E = 15 \text{ and } B = 10$$

Also $C = D = 9$ and $F = 11$, since $B < F < A$ and $F$ is integer

$$\therefore \quad A : F = 12 : 11$$

**14.** The ratio of fees collected from B.Tech : MBA

$$= 4x \times 25y : 5x \times 16y$$
$$= 100xy : 80xy$$
$$= 5xy : 4xy = 5k : 4k$$

The amount collected only from MBA students

$$= \frac{4}{9} \times 1.62 \text{ lakh}$$
$$= \text{Rs. } 72{,}000$$

**15.**

$$C \propto (W)^2$$
$$W_1 : W_2 : W_3 = 3 : 4 : 5$$
$$\text{cost} = (3x)^2 + (4x)^2 + (5x)^2 = 50\,(x)^2$$

Again $W_1 : W_2 : W_3 = 4 : 4 : 4$ (when weights are equal)

$$\text{cost} = (4x)^2 + (4x)^2 + (4x)^2 = 48x^2$$
$$\text{loss} = 50x^2 - 48x^2 = 2x^2$$
$$1800 = 2x^2$$
$$x = 30$$

$\therefore$ Actual cost of unbroken marble $= (4x + 4x + 4x)^2$

$$= (12x)^2 = 144x^2$$
$$= 144 \times x^2$$
$$= 144 \times 900 = 129600$$

**Solutions for 16 and 17 :**

| | A | B | C | D |
|---|---|---|---|---|
| Initially | 69 | 45 | 42 | 36 |
| $A \to B$ | 24 | 90 | 42 | 36 |
| $B \to C$ | 24 | 48 | 84 | 36 |
| $C \to D$ | 24 | 48 | 48 | 72 |
| $D \to A$ | 48 | 48 | 48 | 48 |

Solve it in reverse order (*i.e.*, from the result side)

**18.** Ratio of price paid by Hari and Murli = 7 : 10

or $\quad (24 \times x) : 30 \times (30 - x) = 7 : 10$

$\Rightarrow \quad x = 14$

or go through options.

**19.** Since distance is constant. Therefore ratio of speeds of scooter, car and train = 1 : 4 : 16

and therefore, ratio of time taken = 16 : 4 : 1

Therefore, required ratio $= \frac{16}{1} : \frac{4}{4} : \frac{1}{16}$

$$= 16 : 1 : \frac{1}{16} = 256 : 16 : 1$$

**20.** Since there are 12 bangles, then the no. of broken to unbroken bangles can not be 2 : 3, since $5x = (2x + 3x)$ can not divide 12 for any integral value of $x$ *i.e.*, all the sum of ratios which are the factors of 12 can possibly be the ratio of broken to unbroken.

Compiled By Jasjeet

yoursmahboob.wordpress.com





**21.** $$\frac{a}{b}=\frac{c}{d}=\frac{e}{f}=k$$

$$\Rightarrow \quad \frac{a^n}{b^n}=\frac{c^n}{d^n}=\frac{e^n}{f^n}=k^n$$

$$\Rightarrow \quad \frac{a^np}{b^np}=\frac{c^nq}{d^nq}=\frac{e^nr}{f^nr}=k^n$$

$$\therefore \quad \frac{a^np+c^nq+e^nr}{b^np+d^nq+f^nr}=(k^n)$$

$$\therefore \quad \left(\frac{a^np+c^nq+e^nr}{b^np+c^nq+f^nr}\right)^{\frac{1}{n}}=(k^n)^{1/n}$$

$$\therefore \quad \left(\frac{a^np+c^nq+e^nr}{b^np+d^nq+f^nr}\right)^{1/n}=k=\frac{a}{b}=\frac{c}{d}=\frac{e}{f}$$

Hence (c) is the possible answer.

**22.** Maximum earning will be only when he will won on the maximum yielding table.

$$A \to 10:1$$
$$B \to 20:1$$
$$C \to 30:1$$

*i.e.,* he won on $B$ and $C$ but lost on $A$

$$20\times 200+30\times 200-1\times 200=9800$$

minimum earning will be when he won on table $A$ and $B$ and lose on that table 3.

$$\therefore \quad 10\times 200+20\times 200-1\times 200$$
$$6000-200=5800$$

Therefore, difference = 9800 − 5800 = 4000

Alternatively the difference

$$=[(30+20-1)-(10+20-1)]\times 200$$
$$=20\times 200=\text{Rs. } 4000.$$

**23.** $\frac{m+2p}{m-2p}+\frac{m+2q}{m-2q}$

$=\frac{m}{2p}+\frac{m}{2q}$ (by componendo and dividendo)

$=m\left(\frac{p+q}{2pq}\right)$

$=\left(\frac{4pq}{p+q}\right)\left(\frac{p+q}{2pq}\right)$ substituting the value of $m=\frac{4pq}{p+q}=2$

**24.** Volume of a cube = $(\text{side})^3=(a)^3$

surface area of a cube = $6(a)^2$ ($a \to$ side)

$$a_1^3 : a_2^3 = 8:27$$
$$\Rightarrow \quad a_1 : a_2 = 2:3$$
$$\Rightarrow \quad a_1^2 : a_2^2 = 4:9$$
$$\Rightarrow \quad 6a_1^2 : 6a_2^2 = 4:9$$

**25.** Clearly it can not be less than 75%. For clarification of concept consider some values and then verify it.

**26.** $$A:B:C=3x:4x:5x$$

but $$C-A=5x-3x\le 3$$

or $$C-A=2x\le 3 \Rightarrow x=1$$

$$\Rightarrow \quad C-A=2$$

$$\therefore \quad A:B:C=3:4:5$$

Therefore, number of assistant trainee (except project charge) of $Q=3$ and assistant trainee of $R=4$

Therefore, required percentage $=\frac{4-3}{4}\times 100$

$$=\frac{1}{4}\times 100=25\%$$

**27.** $b=3a$

$c=3b=9a$

$d=3c=9b=27a$

$e=3d=9c=27b=81a$ and $f=3e=243a$

put the values and simplify.

or we know that $\frac{a}{b}=\frac{c}{d}=\frac{e}{f}\ldots=\frac{a+c+e}{b+d+f}$

**28.** Let $w$ be the number of wagons and $s$ be the speed of engine without wagon $=\frac{20}{3}$ m/s = 24 km/hr.

then speed of the train $=s-k\sqrt{w}$

$$\therefore \quad 20=24-k\sqrt{4} \qquad [\because \frac{50}{9}\text{ m/s}=20\text{ km/h}]$$

$$\therefore \quad k=2$$

when train will stop its speed becomes zero

$$0=24-2\sqrt{w} \qquad (\because k=2)$$

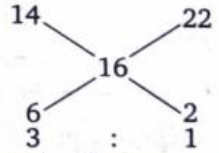
$$\Rightarrow \quad w=144$$

since at 144 wagons train will stop, so at 143 wagons train just can move with its least possible speed having maximum possible wagons.

**29.** Cost of 1 kg (mixture) of sugar = Rs. 16/kg

since selling price is Rs. 20/kg

Therefore, ratio of quantity of sugar costing Rs. 14 and Rs. 22 per kg = 3 : 1




So, the available stock of mixture costing Rs. 16 = 3 quintal and the required stock of sugar costing Rs. 18 = 1 quintal

Therefore, the new price of mixture costing 3 quintal of sugar @ Rs. 16/kg and 1 quintal of sugar @ Rs. 18 per kg

$\therefore \quad x=$ Rs. 16.5 per kg

New price = Rs. 16.5 per kg

Now, original profit = 20 − 16 = Rs. 4 per kg

New profit = 20 − 16.5 = Rs. 3.5 per kg

$\therefore$ Percentage reduction in profit $=\frac{4-3.5}{4}\times 100=12.5\%$

**30.**

| | P | Q |
|---|---|---|
| Initial amounts | $a$ (petrol) | $b$ (kerosene) |
| After one operation | $a-c$ (petrol)<br>$c$ (kerosene) | $b-c$ (kerosene)<br>$c$ (petrol) |

Compiled By Jasjeet

yoursmahboob.wordpress.com


Since there is no change in concentration in the second, third... etc operations.

**In the vessel P;**

The fraction of kerosene in $P$ is $\frac{c}{a}$

**In the vessel Q;**

The fraction of kerosene in $Q$ is $\left(\frac{b-c}{b}\right)$

$$\left(\frac{b-c}{b}\right) = \frac{c}{a}$$

$\therefore$ $$c(a+b) = ab$$

$\Rightarrow$ $$c = \frac{ab}{a+b},$$ Hence (c)

Since at this moment the concentration in both vessels is same.

31. The minimum number of passengers $n$, at which there is no loss and number of passengers travelling $= m$ and let the distance travelled is $d$, then

$$P \propto (m-n)d$$

or $$p = k(m-n)d;\ k \text{ is a constant.}$$

when $P = 3600$, $m = 29$ and $d = 36$, then

$$3600 = k(29-n) \times 36 \quad \ldots(1)$$

Again, when $p = 6300$, $m = 36$, $d = 42$ km

$$6300 = k(36-n) \times 42 \quad \ldots(2)$$

Dividing equation (2) by (1)

$$\frac{6300}{3600} = \frac{k}{k}\frac{(36-n)\times 42}{(29-n)\times 36}$$

$\Rightarrow$ $$\frac{(36-n)}{(29-n)} = \frac{9}{6}$$

$\Rightarrow$ $$3n = 45 \Rightarrow n = 15$$

Hence to avoid loss, minimum number of 15 passengers are required.

32. Frequency of step of $A : B : C = 5 : 6 : 7$

but it terms of size of step, $6A = 7B = 8C$

$\therefore$ Ratio of speeds of $A$, $B$ and $C = \frac{5}{6} : \frac{6}{7} : \frac{7}{8}$

$$= 280 : 288 : 294$$

$$= 140 : 144 : 147$$

33. Expenditure = 5 (no. of family members)$^2$

$\Rightarrow$ $$E_1 = 5(n)^2 \quad \ldots(1)$$

again $$E_2 = 5(n-1)^2 \quad \ldots(2)$$

but $$E_1 - E_2 = 95$$

$\therefore$ $$5[n^2 - (n-1)^2] = 95$$

$$5[n^2 - (n^2 + 1 - 2n)] = 95$$

$$n^2 - n^2 - 1 + 2n = 19$$

$\Rightarrow$ $$2n = 20 \Rightarrow n = 10$$

34. Finally I have Rs. 5

Consider option (a)

$$2 \times 100 + 3 \times 50 + 1 \times 25 = 375 \text{ paise}$$

Its integer multiple can not give the value equals to 500. So can not be true.

Consider option (b)

$1 \times 100 + 7 \times 50 + 2 \times 25 = 500$ paise, can be true

but we also check the option (c) and (d) now when you check the choices (c) and (d) you will find wrong as choice (a). So, only choice be could be the best answer.

35. By componendo and dividendo :

$$\frac{a}{b+c} = \frac{b}{c+a}$$

$$\frac{a+b+c}{a-b-c} = \frac{b+c+a}{b-c-a}$$

$\Rightarrow$ $$a - b - c = b - c - a$$

$\Rightarrow$ $$a = b$$

similarily $$a = b = c$$

$\therefore$ $$\frac{b}{a+b+c} = \frac{1}{3}$$

36. Density of $P_1$, $P_2$ and $P_3$ are 18, 14 and 10 gm/cc

again since volume $= \frac{\text{weight}}{\text{density}}$

now the weight of $P_3$ in 450 kg mixture $= \frac{450 \times 4}{15} = 120$ kg

now the volume of $P_3 = \frac{120}{10} = 12$ litre

$\therefore$ The cost of 12 litre $P_3$ petrol $= 12 \times 40 =$ Rs. 480

37. 26.65 + 42.75 + 53 = 122.40

Proportionate amount of Amar, Akbar and Anthony in the ratio of 3 : 4 : 5 is Rs. 30.60, Rs. 40.80 and Rs. 51 respectively.

| Now | Amar | Akbar | Anthony |
|---|---|---|---|
| | 30.60 | 40.80 | 51.00 |
| | 26.65 | 42.75 | 53.00 |

So, Amar pays Rs. 1.95 to Akbar and Rs. 2 to Anthony.

38. The best way is to go through options

**Alternatively:** Solve by cross product rule and componendo.

39. Since Pooja and Shipra are twins so their ages be same. Let their ages be $x$ and age of Monika be $y$, then,

$$x + x = y \quad \ldots(1)$$

and $$\frac{(x-3)}{(y-3)} = \frac{2}{7}$$

$\Rightarrow$ $$7x - 2y = 15$$

Now, from equation (1),

$$7x - 4x = 15 \Rightarrow x = 5$$

So the age of Shipra 3 years hence will be $5 + 3 = 8$ years.

40. $\frac{H-9}{W-9} = \frac{5}{4}$ and $\frac{H+6}{W+6} = \frac{8}{7}$

$\therefore$ Thus the present age of Husband is 34 [illegible] age of his wife is 29 years.

Now, the maximum age of any child must be less than 9 years. Hence their ages can be 2, 3 and 4 years or 4, 6 and 8 years. So the max. possible sum of age of this family

$$= 34 + 29 + (1 \times 4 + 2 \times 6 + 3 \times 8)$$

$$= 103 \text{ years}$$

Compiled By Jasjeet

yoursmahboob.wordpress.com





**41.** $P \propto n\sqrt{r} \Rightarrow P = kn\sqrt{r}$

where $P$ is the price of necklace, $n$ is number of pearls and $r$ is the radius of a pearl.

Now $150 = k \times 75 \times \sqrt{1}$

$\Rightarrow$ $k = 2$

again $600 = 2 \times 100 \times \sqrt{r}$

$\Rightarrow$ $\sqrt{r} = 3 \Rightarrow r = 9$ cm

**42.** $P \propto \frac{N}{T} \Rightarrow P = K\frac{N}{T}$

$P \to$ Price of a book, $N \to$ Number of Pages, $T \to$ Time period

$$P_1 = P_2$$

$$\therefore \quad K\frac{N_1}{T_1} = K\frac{N_2}{T_2}$$

$$\Rightarrow \quad \frac{3N}{18} = \frac{N}{T}$$

$$T = 6 \text{ years}$$

**43.** $\frac{5x+40}{6x+40} = \frac{7}{8} \Rightarrow \frac{\text{Akbar}}{\text{Birbal}}$

$\Rightarrow$ $x = 20$

$\therefore$ The actual number of shares of less salaried person

$= 100$ $\quad \because (5 \times 20 = 100)$

$\therefore$ The salary of Akbar $= 100 \times 75 = 7500$

**44.** $D \propto \frac{\sqrt{F} \times T}{W}$, $D \to$ Distance, $F \to$ Fuel, $T \to$ Time, $W \to$ No. of wagons

$$D = k\frac{\sqrt{F} \times T}{W}$$

$$192 = k\frac{\sqrt{256} \times 20}{10}$$

$\Rightarrow$ $k = 6$

again $200 = \frac{6 \times \sqrt{F} \times 25}{15}$

$\Rightarrow$ $\sqrt{F} = 20 \Rightarrow F = 400$ litre

$\therefore$ fuel used per km $= \frac{400}{200} = 2 l/\text{km}$

**45.** Just go through option and factorize the product into two factors such that the given conditions must satisfy.

*e.g.,* $6 = 1 \times 6$

$2 \times 3$

$3 \times 2$

$6 \times 1$

It is not true.

Again consider option (b)

$12 = 1 \times 12$

$2 \times 6$

$3 \times 4 \to 3 \times 4 = 12$

$4 \times 3$

$6 \times 2 \to 6 \times 2 = 12$

$12 \times 1$

Now you can see that the rate is being half from 4 to 2 so she can purchase double number of toffees as she was purchasing on the ground floor. Again to purchase the same number of toffees she had to spend Rs. 2 less than spending on the ground floor :

| Rate | | Number of toffee/Re | | Total Number of toffees |
|---|---|---|---|---|
| 4 | × | 3 | = | 12 |
| 2 | × | 6 | = | 12 |

and if you check other options (c) and (d) they will not satisfy the given conditions.

**46.** Go through options.

| | Total no. of plants | | No. of plants |
|---|---|---|---|
| Previous scheme $\Rightarrow$ | 1800 | = | 100 |

Again after $\frac{1}{3}$rd days, remaining plants

$$= \frac{1800 \times 2}{3} + 120 = 1320$$

$$1320 = (100 + 20) \times 11$$

This shows that in the second case 1 day was saved than planned no. of day.

**47.** Go through options.

$$\frac{810}{54} - \frac{900}{75} = 3 = (6 - 3 = 3)$$

$$15 - 12 = 3$$

$$3 = 3$$

Hence choice (c) is correct.

*i.e.,* if $A$ writes 54 page, then $B$ writes 75 (= 54 + 21) pages per hour.

**48.**

| | $A$ | $B$ | $C$ | $D$ |
|---|---|---|---|---|
| Initial amount of soda water | $(x+3)$ | $(x+1)$ | $(x)$ | 0 |
| final amount of soda water | $\left(\frac{3x}{4}+1\right)$ | $\left(\frac{3x}{4}+1\right)$ | $\left(\frac{3x}{4}+1\right)$ | $\left(\frac{3x}{4}+1\right)$ |

Therefore to be the integral value $x$ must be $4m$; $m = 1, 2, 3$

So at $m = 1$

Hence option (a) is correct since $B$ had contributed 1 tumbler

| | A | B | C | D |
|---|---|---|---|---|
| Initial amount | 7 | 5 | 4 | 0 |
| Final amount | 4 | 4 | 4 | 4 |
| | 3 | 1 | 0 | |
| | 2 | 1 | | |

**49.** Ratio of fruits (by dozen) $= 3 : 2 : 7$

Ratio of fruits by weight $= 120 : 150 : 24$

$\therefore$ Ratio of fruits (combined) by weight

$$= 3 \times 120 : 2 \times 150 : 7 \times 24$$

$$= 30 : 25 : 14$$

Compiled By Jasjeet

yoursmahboob.wordpress.com


1.

| | 1st Alloy | | 2nd Alloy | |
|---|---|---|---|---|
| | Iron | Copper | Iron | Copper |
| | 4 | 3 | 6 | 1 |
| Proportion of iron in the alloys | $\frac{4}{7}$ ⇩ $\frac{8}{14}$ (×2) | | $\frac{6}{7}$ ⇩ $\frac{36}{42}$ (×6) | |

So in the new alloy total iron will be 44 kg and copper will be 12 kg.

$\because$ Iron = 8 + 36 = 44

and Copper = (14 + 42) − (8 + 36) = 12

$\therefore$ Ratio of copper to iron = 12 : 44 = 3 : 11, hence (d)

2. Suppose there are all the pigeons then total no. of heads are 340 and total no. of legs are 680. Now since 380 (= 1060 − 680) legs are extra, it means there will be $190\left(=\frac{380}{2}\right)$ rabbits. As we know a rabbit has 2 extra legs than that of a pigeon who has only two legs.

Therefore, number of rabbits = 190

and number of pigeons = 340 − 190 = 150

**Alternatively :** go through options and consider choice (b)

| | Pigeons | Rabbits |
|---|---|---|
| Heads (340) | 150 (×2) | 190 ] 340 (×4) |
| Legs (1060) | 300 | 760 ] 1060 |

**Alternatively :** $P + R = 340$ ...(1)

and $2P + 4R = 1060$ ...(2)

Solve these two equations and you will get the answer.

**Alternatively :** It can be solved through alligation rule.

3. By the replacement formula

Decreased amount

$$= \text{Original amount}\left(1 - \frac{\text{replacing amount}}{\text{original amount}}\right)^{\text{no. of times } (n)}$$

Now, since the ratio of petrol and kerosene is 1701 and 27 it means initially there was (1701 + 27) = 1728 unit of kerosene and the decreased amount of kerosene is 27 unit.

$$\therefore \quad 27 = 1728\left(1 - \frac{6}{k}\right)^3 \Rightarrow k = 8 \text{ litre}$$

**NOTE** Here 27 : 1728 just show the ratio not the exact amount.

4. The ratio of milk in 3 vessels

$$= \frac{3}{4} \times \frac{5\times7}{5\times7} : \frac{2}{5} \times \frac{4\times7}{4\times7} : \frac{4}{7} \times \frac{4\times5}{4\times5}$$

$$= \frac{105}{140} : \frac{56}{140} : \frac{80}{140}$$

**Remember**, The value of 25 litre does not matter, the basic thing is that the amount of mixture in all the three quantities is same.

So the total quantity of milk in mixture = 105 + 56 + 80 = 241

So the total amount of water in mixture

$$= [(3 \times 140) - 241] = 179 \text{ litre}$$

Therefore ratio of water to milk in the new mixture

= 179 : 241

5. $\because$ Profit = $33\frac{1}{3}$%, it means cost price = Rs. 15

Now, by alligation

$$\frac{(x+7)-15}{(15-x)} = \frac{3}{4}$$

$(x + 7)$ $x$ 15 4 : 3

$\Rightarrow \quad x = 11$

$\therefore \quad x = 11$ and $(x + 7) = 18$

Thus the total value of both the prices = 11 + 18 = 29

6.

| $A_1$ | | $A_2$ | |
|---|---|---|---|
| C | T | C | T |
| 1 | 3 | 2 | 5 |

Copper → $\frac{1}{4}$ Copper → $\frac{2}{7}$

Required copper → $= \frac{3}{11}$

So, the required ratio is 4 : 7

Since it is clear from the above values

(1 + 2 → 3 and 4 + 7 → 11)

**Alternatively :** By Alligation

$\frac{1}{4}$ $\frac{2}{7}$ $\frac{3}{11}$ $\left(\frac{2}{7} - \frac{3}{11}\right)$ $\left(\frac{3}{11} - \frac{1}{4}\right)$

$$\frac{1}{77} : \frac{1}{44}$$

$$\Rightarrow \quad \frac{1}{7} : \frac{1}{4}$$

$$4 : 7$$

7. Ratio of $W_1$ $M_1$ $W_2$ $M_2$ $W_3$ $M_3$

1 : 3 2 : 3 2 : 5

Proportion of water $\frac{1}{4} : \frac{2}{5} : \frac{2}{7}$

$$\Rightarrow \quad \frac{1}{4} \times \frac{5\times7}{5\times7} : \frac{2}{5} \times \frac{4\times7}{4\times7} : \frac{2}{7} \times \frac{4\times5}{4\times5}$$

$$\Rightarrow \quad \frac{35}{140} : \frac{56}{140} : \frac{40}{140}$$

Now since all these three mixtures are mixed in the ratio of 2 : 3 : 5

$$\text{Therefore new ratio} = \frac{35}{140} \times \frac{2}{2} : \frac{56\times3}{140\times3} : \frac{40\times5}{140\times5}$$

$$= \frac{70}{280}, \frac{168}{420}, \frac{200}{700}$$

Now, the amount of water = 70 + 168 + 200 = 438

$\therefore$ The amount of milk = (280 + 420 + 700) − 438 = 962

$\therefore$ Ratio of milk to water = 962 : 438

Compiled By Jasjeet

yoursmahboob.wordpress.com



**8.** $B_1 : B_2 : B_3 = 3x : 4x : 5x$

again $B_1 : B_2 : B_3 = 5y : 4y : 3y$

Since there is increase in no. of oranges in first two basket only, it means the no. of oranges remains constant in the third basket

$\therefore$ $5x = 3y$

Hence $3x : 4x : 5x$

$\Rightarrow$ $\frac{9y}{5} : \frac{12y}{5} : \frac{15y}{5} = 9y : 12y : 15y$

and $5y : 4y : 3y \Rightarrow 25y : 20y : 15y$

Therefore, increase in first basket = 16

and increase in second basket = 8

$\therefore$ the required ratio = 2 : 1

**9.** Amount of alcohol in first vessel = $0.25 \times 2 = 0.5$ litre

amount of alcohol in second vessel = $0.4 \times 6 = 2.4$ litre

Total amount of alcohol out of 10 litres of mixture is $0.5 + 2.4 = 2.9$ litre

Hence, the concetration of the mixture is 29% $\left(= \frac{2.9}{10} \times 100\right)$

**10.** Assume the weight of Alloy $A$ is 100 kg

$\therefore$ The weight of Alloy $B$ is 400 kg

| | | Gold | Silver | Copper |
|---|---|---|---|---|
| $\therefore$ | $A$ | 40 kg | 60 kg | 0 kg |
| | $B$ | 140 kg | 160 kg | 100 kg |
| $\therefore$ | total → | 180 kg | 220 kg | 100 kg |

$\therefore$ Ratio of Gold and Silver in new alloy $= \frac{180}{500} : \frac{200}{500}$

$= 36\% : 44\%$

**11.**

| Urea | | | Dia | | |
|---|---|---|---|---|---|
| $N$ | $P$ | $K$ | $N$ | $P$ | $K$ |
| $x$ | $y$ | 0 | 20% | 70% | 10% |

Mixture

| $N$ | $P$ | $K$ |
|---|---|---|
| 26% | 68% | 6% |

This 6% of $K$ is obtained only from Dia.

$\therefore$

| Urea | | | Dia | | |
|---|---|---|---|---|---|
| $N$ | $P$ | $K$ | $N$ | $P$ | $K$ |
| $x$ | $y$ | 0 | 120 | 420 | 60 |

Mixture

| $N$ | $P$ | $K$ |
|---|---|---|
| 260 | 680 | 60 |

$N_U + N_D = N_M \Rightarrow N_U + 120 = 260$

$N \to$ Nitrogen, $P \to$ Phosphorus

and $P_U + P_D = P_M \Rightarrow P_U + 420 = 680$

$U, D, M \to$ Urea, Dia and mixture

$\therefore$ Amount of Nitrogen in Urea = 140

and amount of Phosphorus in Dia = 260

$\therefore$ Ratio of $N : P = 7 : 13 \Rightarrow 35 : 65$

**12.**

| $X$ | | $Y$ | |
|---|---|---|---|
| $C$ | $N$ | $C$ | $N$ |
| 2 | 7 | 5 | 4 |

Copper $\to \frac{2}{9} = \frac{4}{18}$ Copper $\to \frac{5}{9} = \frac{10}{18}$

$\therefore$ By alligation

$$\frac{4}{18} \qquad \frac{10}{18}$$
$$\frac{9}{18}$$
$$1 : 5$$

$\therefore$ amount of $X = \frac{1}{6} \times 42 = 7$ kg

and amount of $Y = \frac{5}{6} \times 42 = 35$ kg

**13.**

| First Alloy | | Second Alloy |
|---|---|---|
| $C$ | $Al$ | $C$ |
| 1 | 2 | 3 |

$\therefore$

| Required alloy | |
|---|---|
| $C$ | $Al$ |
| 2 | 1 |

$\therefore$ Copper in first alloy $= \frac{1}{3}$

copper in second alloy $= \frac{3}{4}$

copper in required alloy (mixture) $= \frac{2}{3}$

Now, **by alligation**

$$\frac{1}{3} \qquad \frac{3}{4}$$
$$\frac{2}{3}$$
$$\left(\frac{3}{4} - \frac{2}{3}\right) \qquad \left(\frac{2}{3} - \frac{1}{3}\right)$$
$$\frac{1}{12} : \frac{1}{3}$$
$$\Rightarrow 1 : 4$$

Therefore, second alloy be mixed 4 times the first alloy.

**14.** Note in this type of question individual prices does matter. To prove this solve it algebrically.

$$\text{Exchanged amount} = \frac{3 \times 150 + 5 \times 90}{2(3+5)}$$

$$= \frac{450}{8} = 56.25 \text{ litre}$$

Here 3 and 5 are obtained from the ratio of amounts *i.e.*, 90 and 150.

**15.** Here the ratio of mixtures (*i.e.*, milk, water) does not matter. But the important point is that whether the total amount (either pure or mixture) being transferred is equal or not. Since the total amount (*i.e.*, 5 cups) being transferred from each one to another, hence $A = B$.

**HINT** You can verify it very easly by considering a simple example.

**16.** CP. of rasgulla = Rs. 9 (since profit is 66.66%)

Now by alligation

$$(\text{Flour})\ 3x \qquad 7x\ (\text{Sugar})$$
$$9$$
$$5 \qquad 3$$

$$\frac{(9 - 3x)}{(7x - 9)} = \frac{3}{5} \Rightarrow x = 2$$

Price of sugar $= 7x =$ Rs. 14 per kg.

Compiled By Jasjeet

yoursmahboob.wordpress.com

# 5 PERCENTAGES

It is one of the most important chapters which is the backbone of calculations either involved in commercial arithmetic or in real life. Personally I do maximum arithmetical calculation using percentage and others too. So in the context of calculation it is necessary to know the clear concepts of percentage which plays a very vital role in Data Interpretation besides quantitative Aptitude section. On an average two problems *i.e.*, nearly 4–5 % problems in QA only, are being asked in CAT every year.

In other entrance/competitive exams like MAT, XAT and UPMCAT, etc there are too many questions asked from this chapter.

## PERCENTAGE AND ITS APPLICATION

A fraction with denominator 100 is called a per cent. Per cent is an abbreviation for the latin word "percentum" meaning "per hundred " or "hundredhs" and is denoted by symbol %.

**NOTE** A fraction with denominator 10 is called as decimal.

Since per cent is a form of fraction, we can express per cent as fractions (or decimals) and *vice-versa.*

## CONVERSION OF A FRACTION INTO PERCENTAGE

To convert a fraction into a percentage, multiply the fraction by 100 and put "%" sign.

**EXAMPLE 1** *Convert the following fractions into percentages:*

*(i)* $\frac{1}{2}$ *(ii)* $\frac{3}{4}$ *(iii)* $\frac{4}{5}$ *(iv)* $\frac{7}{8}$

**SOLUTION** (i) $\frac{1}{2} \rightarrow \frac{1}{2} \times 100 = 50\%$

(ii) $\frac{3}{4} \rightarrow \frac{3}{4} \times 100 = 75\%$

(iii) $\frac{4}{5} \rightarrow \frac{4}{5} \times 100 = 80\%$

(iv) $\frac{7}{8} \rightarrow \frac{7}{8} \times 100 = 87.5\%$

## CONVERSION OF A PERCENTAGE INTO A FRACTION

To convert a percentage into a fraction, replace the % sign with $\frac{1}{100}$ and reduce the fraction to simplest form.

**EXAMPLE 2** *Express the following percentage as fraction*

*(i)* 20% *(ii)* 30% *(iii)* 45% *(iv)* $5\frac{1}{8}$ % *(v)* 155%

**SOLUTION** (i) $20\% = \frac{20}{100} = \frac{1}{5}$

(ii) $30\% = \frac{30}{100} = \frac{3}{10}$

(iii) $45\% = \frac{45}{100} = \frac{9}{20}$

(iv) $5\frac{1}{8}\% = \frac{41}{8 \times 100} = \frac{41}{800}$

(v) $155\% = \frac{155}{100} = \frac{31}{20} = 1\frac{11}{20}$

## CONVERSION OF A PERCENTAGE INTO A RATIO

To convert a percentage into a ratio, first convert the given percentage into a fraction in simplest form and then to a ratio.

**EXAMPLE 3** *Solve the following :*

*(i) 38%* *(ii) 25%* *(iii) 66.66%*

**SOLUTION** (i) $38\% = \frac{38}{100} = \frac{19}{50} = 19 : 50$

(ii) $25\% = \frac{25}{100} = \frac{1}{4} = 1 : 4$

(iii) $66.66\% = 66\frac{2}{3}\% = \frac{200}{3 \times 100} = \frac{2}{3} = 2 : 3$

## CONVERSION OF A RATIO INTO A PERCENTAGE

To convert a ratio into a percentage, first convert the given ratio into a fraction then to a percentage.

Compiled By Jasjeet

yoursmahboob.wordpress.com



**EXAMPLE 4** *Express the following ratios as percentage :*
*(i) 1 : 5 (ii) 2 : 3 (iii) 4 : 9*

**SOLUTION** (i) $1:5=\frac{1}{5}=\frac{1}{5}\times 100=20\%$

(ii) $2:3=\frac{2}{3}=\frac{2}{3}\times 100=66.66\%$

(iii) $4:9=\frac{4}{9}=\frac{4}{9}\times 100=44.44\%$

## CONVERSION OF A PERCENTAGE INTO A DECIMAL

To convert a percentage into a decimal remove the % sign and move the decimal point two places to the left.

**EXAMPLE 5** *Convert the following percentages into decimals :*
*(i) 36% (ii) 250% (iii) 57.5% (iv) $17\frac{1}{5}$% (v) 7%*

**SOLUTION** (i) $36\% = 0.36$

(ii) $250\% = 2.50 = 2.5$

(iii) $57.5\% = 0.575$

(iv) $17\frac{1}{5}\% = 17.2\% = 0.172$

(v) $7\% = 0.07$

## CONVERSION OF A DECIMAL INTO A PERCENTAGE

To convert a decimal into a percentage, move the decimal point two place to the right (adding zeros if necessary) and put % sign.

**EXAMPLE 6** *Convert the following decimals into percentages :*
*(i) 0.35 (ii) 8.12 (iii) 0.018*

**SOLUTION** (i) $0.35 = 35\%$

(ii) $8.12 = 812\%$

(iii) $0.018 = 1.8\%$

- Work out some more examples so that all these things are on your fingure tips.

**Remember** $\frac{1}{2}=\frac{2}{4}=\frac{3}{6}=\frac{4}{8}=\ldots=50\%$ etc.

Learn and practice all the values given below.

## CONVERSION OF FRACTION INTO PERCENTAGE

**NUMERATORS**

| DENOMINATORS | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 100 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900 | 1000 | 1100 | 1200 |
| 2 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 550 | 600 |
| 3 | 33.33 | 66.66 | 100 | 133.33 | 166.66 | 200 | 233.33 | 266.66 | 300 | 333.33 | 366.60 | 400 |
| 4 | 25 | 50 | 75 | 100 | 125 | 150 | 175 | 200 | 225 | 250 | 275 | 300 |
| 5 | 20 | 40 | 60 | 80 | 100 | 120 | 140 | 160 | 180 | 200 | 220 | 240 |
| 6 | 16.66 | 33.33 | 50 | 66.66 | 83.33 | 100 | 116.66 | 133.33 | 150 | 166.66 | 183.33 | 200 |
| 7 | 14.28 | 28.56 | 42.85 | 57.13 | 71.42 | 85.71 | 100 | 114.28 | 128.56 | 142.85 | 157.13 | 171.42 |
| 8 | 12.5 | 25 | 37.5 | 50 | 62.5 | 75 | 87.5 | 100 | 112.5 | 125 | 137.5 | 150 |
| 9 | 11.11 | 22.22 | 33.33 | 44.44 | 55.55 | 66.66 | 77.77 | 88.88 | 100 | 111.11 | 122.22 | 133.33 |
| 10 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
| 11 | 9.09 | 18.18 | 27.27 | 36.36 | 45.45 | 54.54 | 63.63 | 72.72 | 81.81 | 90.9 | 100 | 109.09 |
| 12 | 8.33 | 16.66 | 25 | 33.33 | 41.66 | 50 | 58.33 | 66.66 | 75 | 83.33 | 91.66 | 100 |
| 15 | 6.66 | 13.33 | 20 | 26.66 | 33.33 | 40 | 46.66 | 53.33 | 60 | 66.66 | 73.33 | 80 |

**(PERCENTAGE-FRACTION CONVERSION TABLE)**

**Remember :** $\frac{1}{7}=14.28\%$ and $\frac{1}{14}=7.14\%$

$\frac{1}{6}=16.66\%$ and $\frac{1}{15}=6.66\%$

$\frac{1}{9}=11.11\%$ and $\frac{1}{11}=9.09\%$

$\frac{1}{15}=6.66\%$ and $\frac{1}{16}=6.25\%$

$\frac{1}{3}=33.33\%$ and $\frac{3}{10}=30\%$

99.99% is equivalent to 100% (in calculation)

## SOME OTHER TYPICAL VALUES

$\frac{1}{13}=7.69\%\approx 7.7\%$, $\frac{1}{17}=5.88\%$, $\frac{1}{19}=5.26\%$,

$\frac{1}{21}=4.76\%$, $\frac{1}{23}=4.35\%$, $\frac{1}{24}=4.166\%$

**Learnings from the table :**

(i) This table is a first hand support as a percentage values of some frequently used fractions.

(ii) All the percentage values whose decimal part is 0.33, 0.66, 0.00 contain the denominator 3 in the fraction.

(iii) Similarly if there is 0.16, 0.33, 0.50, 0.66, 0.83, 0.00 means there is a 6 in the denominator of the fraction.

Compiled By Jasjeet

yoursmahboob.wordpress.com



(iv) Similarly if there is 0.28, 0.56, 0.85, 0.13, 0.42, 0.71 it means there is a 7 as denominator.

(v) If there is 0.11, 0.22, 0.33, 0.44 ... 0.99 etc. It means there is 9 as the denominator of the fraction.

(vi) If there is 0.09, 0.18, 0.27 ... it means there is 11 as the denominator of the fraction.

(viii) If two percentage values have different decimal values (there must be different denominators) then their addition or subtraction results always in decimal *i.e.*, never as an integer.

## PERCENTAGE OF A QUANTITY

**EXAMPLE 1** *Find the no. of male students (i.e., boys), if there are 42% male students in the school and the total no. of students in the school is 1000.*

**SOLUTION** Required number of male students

$$= 42\% \text{ of } 1000$$
$$= \frac{42}{100} \times 1000 = 420$$

**EXAMPLE 2** *A student scored 85% marks. Total marks were 400. How much did he score?*

**SOLUTION** Marks scored = 85% of 400

$$= \frac{85}{100} \times 400$$
$$= 340$$

**EXAMPLE 3** *In an orchard $16\frac{2}{3}$% of the trees are mango trees. If the total number of trees in the orchard is 360, find the number of other types of trees in the orchard.*

**SOLUTION** Total number of trees = 360

Number of mango trees = $16\frac{2}{3}$% of 360

$$= \frac{50}{3 \times 100} \times 360 = 60$$

Therefore, the number of other trees = 360 − 60 = 300

**Alternatively:** Number of mango trees = $16\frac{2}{3}$%

It means no. of other types of trees = $\left(100 - 16\frac{2}{3}\right)$%

$$= 83\frac{1}{3}\%$$

Thus number of other types of trees = $83\frac{1}{3}$% of 360 = 300

## INTRODUCTORY EXERCISE-5.1

1. Find the value of :
   (i) 25% of 200 (ii) 30% of 180
   (iii) 37.5% of 300 (iv) 83.33% of 480
   (v) 100% of 2 quintal (vi) 165% of 330 litre
   (vii) $5\frac{1}{2}$% of Rs. 1600 (viii) 10% of 1 hour
   (ix) 66.66% of 300
   (x) 20% of 1 million rupees.
2. Mr. Arvind Vidyarthi spends 30% of his money on education and he has total Rs, 15,000. How many rupees he spends on education?
3. Sonia purchased 80 metres of cloth, out of which 35% was used for making trousers. How much cloth was used by her for making trousers?
4. The total no. of students in the school are 1250. 40% of the students are girls. Find the number of boys.
5. William's monthly salary was Rs. 1140 . His salary is increased by 16.66%. How much increase has he gotten? Also find the salary if his salary increased by 33.33%.
6. The population of Vatican city is 700. If it increases by 7.14% per annum (*i.e.*, every year). Find the population of the Vatican city after one year.
7. The speed of a car is 85 km/hr. It is increased by 20%. Find the increased speed of the car?
8. A shopkeeper annonces a reduction of 8.33% on all its prices after new year. If a wrist watch was earlier for Rs. 2400. How much would it costs now?
9. 44% of the students in a class are females and the number of male students is 42. Find the total no. of students in the class.
10. 30% of a number is 225. Find the number.
11. A horse costing Rs 80,000 one year ago now costs 25% less. Find the changed price.
12. 1700 students took an exam 85% students passed it. Find the number of students who failed in the exam.

**CAT Tips** Now I would like to suggest you that all the problems mentioned in the exercise must be done using fractions instead of percentage, in order to make the calculation simple and handy.

**For example see the solution of question 2 :**

$15000 \times 0.3 = 4500$ $\left[\text{Recall } \frac{x \times 30}{100} = 0.3x\right]$

**Solution for question 5 :** Since $16.66\% = \frac{1}{6}$

So the new salary will increase by $\frac{1}{6}$ it means the absolute value of new salary will be $\frac{7}{6}\left(= 1 + \frac{1}{6}\right)$ times of the original salary.

So the increase in salary = $1140 \times \frac{1}{6}$ = Rs. 190

and increased salary = original salary + increase in salary

Compiled By Jasjeet

yoursmahboob.wordpress.com



$$= 1 + \frac{1}{6} = \frac{7}{6} = \frac{7}{6} \times 1140 = \text{Rs.}1330$$

Similarly if the salary is increased by 33.33% it means

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

Therefore new salary $= 1 + \frac{1}{3} = \frac{4}{3} = \frac{4}{3} \times 1140 = 1520$

**Solution for question 6:** Since $7.14\% = \frac{1}{14}$

So the new population of the city $= 700 \times \left(1 + \frac{1}{14}\right)$

$$= 700 \times \frac{15}{14} = 750$$

**Solution for question 8:** The reduced price of the watch

$$= 2400\left(1 - \frac{1}{12}\right) \qquad \left\{\because 8.33\% = \frac{1}{12}\right\}$$

$$= 2400 \times \frac{11}{12} = 2200$$

## EXPRESSING ONE QUANTITY AS A PERCENTAGE OF ANOTHER QUANTITY

**EXAMPLE 1** *What per cent is number 3 of number 20 ?*

**SOLUTION** As per cent means out of 100. Then by unitary method

out of $20 \rightarrow 3$

out of $1 \rightarrow \frac{3}{20}$

out of $100 \rightarrow \frac{3}{20} \times 100 = 15\%$

Hence to find what per cent the first number is of second number, we divide the first number by the second number and multiply the result by 100.

**EXAMPLE 2** *Ravi obtained 325 marks out of a maximum of 400 marks. Find the percentage of marks obtained by him.*

**SOLUTION** Required percentage of marks $= \frac{325}{400} \times 100 = 81.25\%$

**EXAMPLE 3** *In a factory of 150 workers, 18 were absent in a day, what percentage were present?*

**SOLUTION** Present $= 150 - 18 = 132$

Percentage presence $= \frac{132}{150} \times 100 = 88\%$

**EXAMPLE 4** *Kurla obtained 480 marks out of 600 and Birla obtained 560 marks out of 800. Whose performance is better?*

**SOLUTION** % marks of Kurla $= \frac{480}{600} \times 100 = 80\%$

% marks of Birla $= \frac{560}{800} \times 100 = 70\%$

So, obviously Kurla's performance is better than that of Birla even though getting less absolute marks.

## INTRODUCTORY EXERCISE-5.2

1. What per cent is :
   (i) 30 out of 600 ?
   (ii) 25 out of 160 ?
   (iii) 75 out of 225 ?
   (iv) 36 kg of 150 kg ?
   (v) 90 cm of 4.5 metre.
   (vi) 60 litres of 40 litres
   (vii) 800 shirts out of 1200 shirts?
   (viii) 875 m of 2 km. ?
2. Express:
   (i) 20 as a percentage of 500.
   (ii) 60 kg as a per cent age of 80 kg .
   (iii) 350 ml as a percentage of 5.6 litre.
   (iv) Rs. 13 as a percentage of Rs. 39.
   (v) 15 seconds as a percentage of 1 hour.
   (vi) 27° as a percentage of 360°.
3. Manu scored 384 marks out of 450. What per cent marks did she get?
4. In an election, out of 60,000 eligible voters 42000 cast their vote. Calculate the percentage of voters casting their votes.
5. A tin contains 24 litres of milk. Due to leakage, 720 ml is lost. What per cent of milk is still present in the tin?
6. Price of an item increased from 16.50 to Rs. 41. 25. Find the percentage increase in price.
7. The excise duty on a certain item has been reduced to Rs. 3480 from Rs. 5220 . Find the percentage reduction in the excise duty for that item.
8. Out of total production of 6450 tonnes of a coalmine a quantity of 645 tonnes was lost during extraction. What per cent of the total production was the net coal extracted?
9. A cricket team played 24 matches. The team won 9 matches and lost 3 matches. 12 matches ended in draw. What per cent of the total matches did the team lose?
10. In a particular month, Rs. 10,000 were allocated for the food items in a hostel out of total Rs. 50,000 budget. Further Rs. 2000 is allocated for the fruits out of Rs.10,000 (allocated for food items) what per cent of total budget is spend on fruits only?

Compiled By Jasjeet

yoursmahboob.wordpress.com



## SOME MOST IMPORTANT VALUES

| | |
|---|---|
| $\frac{1}{2} \to 50\%$, | $\frac{1}{3} = 33.33\%$, |
| $\frac{2}{3} = 66.66\%$, | $\frac{1}{4} \to 25\%$, |
| $\frac{3}{4} \to 75\%$, | $\frac{1}{5} \to 20\%$, |
| $\frac{2}{5} \to 40\%$, | $\frac{3}{5} \to 60\%$, |
| $\frac{1}{6} \to 16.66\%$, | $\frac{5}{6} \to 83.33\%$ |

**NOTE** The application of percentage is very diverse in nature *e.g.* profit and loss, Simple and compound interest etc. All these are exactly based on the percentage increase/decrease of the original (or actual) value.

Percentage increase/decrease in a quantity

$$= \left(\frac{\text{change in quantity}}{\text{original quantity}} \times 100\right)\%$$

**EXAMPLE 1** *The height of Abhimanyu some times ago was 110 cm. Now his height is 120 cm. Find the percentage change in his height.*

**SOLUTION** $\frac{120-110}{110} \times 100 = 9.09\%$

**SHORTCUT** $\frac{10}{110} \to \frac{1}{11} \to 9.09\%$

**Alternatively:** $\frac{12}{11} \to 109.09\%$, so increase = 9.09%

**EXAMPLE 2** *The total expenses of a hostel were Rs. 8000 per month. Some students left the hostel due to which the new expenses come down by Rs. 1000. Find the percentage decrease in expenses of the hostel.*

**SOLUTION** $\frac{1000}{8000} \to \frac{1}{8} \to 12.5\%$

**EXAMPLE 3** *Salary of Raja is Rs. 9000 per month and salary of Rani is Rs. 10,000 per month.*

*(i) What per cent is the salary of Rani to that of Raja ?*

*(ii) What per cent is the salary of Raja to that of Rani?*

**SOLUTION** (i) $\frac{10,000}{9,000} \times 100 = 111.11\%$

**Alternatively:**

$$\frac{10}{9} \to \frac{9}{9} + \frac{1}{9} \to 100\% + 11.11\% \to 111.11\%$$

(ii) $\frac{9}{10} \to 90\%$ $\left(\because \frac{1}{10} \to 10\%\right)$

Hence, salary of Raja is 90% to the salary of Rani.

## PERCENTAGE CHANGE AND PERCENTAGE POINT CHANGE

Last year Abhijeet's salary was Rs. 10,000 and Sonu's salary was Rs. 8,000. This year Abhijeet's salary is Rs. 12,000 while Sonu's salary is Rs. 10,000.

1. (i) What is the percentage increase of Abhijeet's salary?
   (ii) What is the percentage increase of Sonu's salary?
   (iii) Percentage increase in Sonu's salary is how much percent greater than the percentage increase in Abhijeet's salary?
   (iv) What is the percentage point change in the salary of Sonu and Abhijeet?

**SOLUTION** (i) $\frac{12,000-10,000}{10,000} \times 100 = 20\%$

or $\frac{2}{10} \to \frac{1}{5} \to 20\%$

(ii) $\frac{2}{8} \to \frac{1}{4} \to 25\%$

(iii) Percentage increase of Sonu's salary = 25

Percentage increase of Abhijeet's salary = 20

So the required percentage $= \frac{25-20}{20} \times 100 = 25\%$

It means percentage increase of Sonu's salary is 25% greater than the percentage increase of Abhijeet's salary.

(iv) Percentage point change

= ( Percentage increase in Sonu's salary

– Percentage increase in Abhijeet's salary)

= 25 – 20 = 5 percentage point

Infact percentage point change is the difference between two percentage values.

## ADVANCED CONCEPT OF PERCENTAGE CHANGE

(A) If a value $p$ is increased by $x\%$, then we have to decrease the resultant value by $\left(\frac{x}{x+100} \times 100\right)\%$ to get back to the original value $p$.

Original value $p$ $\xrightarrow{\text{increasing value}}$ $\underset{\text{increasing value}}{\frac{p \times x}{100}}$ $\longrightarrow$ Increased value $\left(p + \frac{px}{100}\right)$

$$= p\left(\frac{100+x}{100}\right)$$

Now the percentage decrease

$$= \frac{\left[p\left(\frac{100+x}{100}\right) - p\right]}{p\left(\frac{100+x}{100}\right)} \times 100 = \left(\frac{x}{100+x} \times 100\right)\%$$

In other words (*i.e.*, in terms of fraction) if a value is increased by $\frac{n}{d}$ then to get back the same number $p$ from the resultant value, we have to decrease the increased value by $\left(\frac{n}{d+n}\right)$.

Compiled By Jasjeet

yoursmahboob.wordpress.com





**EXAMPLE 1** *Salary of Rajeev Ratan in 2001 was \$100 per day and his salary in 2002 was \$ 125 per day. Again in 2003 his salary was \$ 100 per day.*

*(i) What is the percentage increase in his salary in 2002?*

*(ii) What is the percentage decrease in his salary in 2003 over 2002?*

**SOLUTION** (i) $\frac{125-100}{100} \times 100 = 25\%$

(ii) $\frac{125-100}{125} \times 100 = 20\%$

In fact there is same absolute change but percentage change is different due to different denominator (*i.e.*, base change). So the base change is as much important as the numerator or absolute change in quantity.

**EXAMPLE 2** *Age of Ravi is 20 years. If the Shyam's age is 25% greater than that of Ravi then how much per cent Ravi's age is less than Shyam's age ?*

**SOLUTION** Age of Ravi Age of Shyam

$$20 \underset{(-20\%)}{\overset{(+25\%)}{\rightleftarrows}} 25$$

**Solution using percentage change formula**

Here $x = 25$, then

percentage decrease (or less) $= \frac{25}{125} \times 100 = 20\%$

**Solution using fractional change formula**

Since increase $= \frac{1}{4}$ $\quad \because \left(25\% = \frac{1}{4}\right)$

Therefore decrease $= \frac{1}{4+1} = \frac{1}{5} \rightarrow 20\%$

**EXAMPLE 3** *Gautam has 33.33% more pencils than Rahul has. By how much per cent less pencils Rahul has than that of Gautam?*

**SOLUTION**

$$\text{Rahul} \underset{-25\% = \frac{1}{4} = \frac{1}{3+1}}{\overset{33.33\% \rightarrow \frac{1}{3}}{\rightleftarrows}} \text{Gautam}$$

So Rahul has 25% less pencils than Gautam has.

**EXAMPLE 4** *Height of Amitabh is 50% greater than the height of Amir Khan. Height of Amir Khan is how much per cent less than that of Amitabh?*

**SOLUTION**

$$\text{Amir} \underset{-33.33\% = \frac{1}{3} = \frac{1}{2+1}}{\overset{+50\% \rightarrow \frac{1}{2}}{\rightleftarrows}} \text{Amitabh}$$

Thus the height of Amir is 33.33% less than Amitabh.

**Explanation of Concept :** Assume $A$ has 10 apples and $B$ has 20 apples, then we say that $B$ has 100% more apples than $A$ has. Again we can say that $A$ has 50% less apples than $B$ has.

To calculate the percentage change :

$$A \underset{-50\% = \frac{1}{2} = \frac{1}{1+1}}{\overset{100\% \rightarrow \frac{1}{1}}{\rightleftarrows}} B$$

**Consider another example :** Let us assume $A$ has 6 chocolates and $B$ has 10 chocolates then we can say that $B$ has 66.66% more chocolates than $A$. So again we can also say that $A$ has 40% less chocolates than $B$.

$$A \underset{-40\% = \frac{2}{5} = \frac{2}{3+2}}{\overset{66.66\% \rightarrow \frac{2}{3}}{\rightleftarrows}} B$$

Remember the percentage change graphic is almost 70–80% better in giving quick and simple results. So instead of using the percentage formula, use the percentage change graphic method. For this you are just required to know the percentage fraction conversion table.

**(B)** If a value $P$ is first decreased by $x\%$ then to get back the original value $P$, we have to increase the decreased (resultant) value by $\left(\frac{x}{100-x} \times 100\right)$

$$\underset{P}{\text{original value}} \xrightarrow[\frac{Px}{100}]{\text{(decreasing value)}} \overset{\text{decreased value}}{\left(P - \frac{Px}{100}\right)} = P\left(1 - \frac{x}{100}\right)$$

Now, the per cent increase $= \frac{\left[P - P\left(1 - \frac{x}{100}\right)\right]}{P\left(1 - \frac{x}{100}\right)} \times 100$

$$= \frac{x}{100-x} \times 100$$

In terms of fraction, if a value $P$ is first decreased by $n/d$ then to get back the original number $P$. We have to increase the decreased (or resultant) value by $\frac{n}{d-n}$.

**EXAMPLE 5** *Due to irregular working habits of Ramachandran his salary was reduced by 20% but after some months his salary was increased to the original salary. What is the percentage increase in salary of Ramachandran?*

**SOLUTION** Let initial salary be Rs. 100

$$100 \underset{+25\%}{\overset{-20\%}{\rightleftarrows}} 80$$

**Alternatively :** Here $x = 20$

then % increase $= \frac{20}{(100-20)} \times 100 = 25\%$

Compiled By Jasjeet

yoursmahboob.wordpress.com



**Alternatively:**

$$-20\% \rightarrow \frac{1}{5}$$

(Initial salary) $P$ → $Q$ (Decreased salary)

$$+25\% = \frac{1}{4} = \frac{1}{(5-1)} \qquad \left[\frac{n}{d-n}\right]$$

Hence his salary will be incresed by 25%.

**EXAMPLE 6** *Kajol usually wears saree, which is 16.66% less than the actual length of the saree. By how much per cent the actual length of the saree is greater than the length of saree which kajol usually wears?*

**SOLUTION** Actual length → $A$; Usual length → $U$

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

$$+20\% = \frac{1}{5} = \left(\frac{1}{6-1}\right) \qquad \because \left[\frac{n}{d-n}\right]$$

So the actual length of the saree is 20% greater than the usually used saree.

**NOTE** (1) If a value $X$ is first increased by $p$% to $Y$ then $Y$ is again decreased to $X$ by $q$% then $p$ is always greater than $q$ (for positive values)

(2) If a value $X$ is first decreased by $p$% to $Y$ and then $Y$ is increased by $q$% to $X$, then $p$ is always less than $q$.

(3) If a value $A$ is increased by $p$% then again by $q$% once again it is increased by $r$%, then the final value will be same as if you change the order of $p, q, r$ *i.e.*, $A$ can be first increased by $r$% then by $q$% and then by $p$% still the result will be same.

(4) The rule 3 is also applicable for the decreasing of the values. A value '$A$' is first decreased by $p$%, then by $q$% and then by $r$% and so on, the resultant value will be same as when $A$ is first decreased by $q$% then by $p$% and then by $r$% etc.

**Note :** In case 3 and 4 we are discussing the successive increase or decrease in the value.

(5) A value '$A$' is first increased by $p$% then by $q$% and then it is reduced by $r$% will give the same results as when $A$ is first decreased by $r$%, then increased by $q$% and then by $p$% etc.

**EXAMPLE 7** *Initially Ms. Rakhi Sawant has Rs. 200 in her wallet then she increased it by 20%. Once again she increased her amount by 25%. The final value of money in her wallet will be how much per cent greater than the initial amount.*

**SOLUTION**

$$200 \xrightarrow{+20\%} 240 \xrightarrow{+25\%} 300$$

So the required % increase $= \dfrac{300-200}{200} \times 100 = 50\%$

**EXAMPLE 8** *The age of B is 50% greater than the age of A. The age of C is 20% less than the age of B. By how much percentage the age of C is greater than the age of A.*

**SOLUTION**

$$\underset{100}{A} \xrightarrow{+50\%} \underset{150}{B} \xrightarrow{-20\%} \underset{120}{C}$$

So the required percentage change $= \dfrac{20}{100} \times 100$

$= 20\%$

## CONCEPT OF PRODUCT CONSTANCY

It is the same as we know the inverse proportion in the chapter of Ratio, Proportion and Variation.

*e.g.*, When the rate of a pencil is Rs. 1.25 then we can purchase 16 pencils by paying Rs. 20. If the rate of a pencil is decreased by Rs. 0.25 then we can purchase 20 pencils by paying Rs. 20.

**Explanation :** Rate × No. of pencils = Price

$$1.25 \times 16 = 20$$

$$1.00 \times 20 = 20$$

So you can see that here the product (20) is constant in both the cases. Thus it is clear that if we reduce the price of a pencil to Rs. 0.50, then we can purchase 40 pencils in Rs. 20.

Some more examples of product constancy :

(i) speed × time = distance
(ii) rate × time = cost
(iii) efficiency × time = work
(iv) length × breadth = area
(v) average × no of elements = total value
(vi) rate × quantity = price (or expenditure)

*e.g.*, The price of sugar is increased by 25% then by how much per cent should a customer reduce the consumption (*i.e.*, quantity used) of sugar so that he has not to increase his expenses on sugar.

price × quantity = expenditure

$$100 \times 100 = 10{,}000$$

$$125 \times x = 10{,}000$$

$$\Rightarrow x = \frac{10{,}000}{125} = 80. \text{ Therefore \% reduction} = 20\%$$

or $\quad 1 \times 1 = 1$

$$1.25 \times k = 1 \Rightarrow k = 0.8$$

thus there will be 20% decrease in the consumption of sugar in order to maintain the same expenditure on sugar.

## PRODUCT CONSTANCY CONDITIONS

- When one factor of a product is increased by $p$% then the other factor will be decreased by $\left(\dfrac{p}{100+p} \times 100\right)$%

  It means when one factor of a product is increased by $\dfrac{n}{d}$ then the other factor is decreased by $\dfrac{n}{(d+n)}$

- When one factor of a product is decreased by $p$% then the other factor will be increased by $\left(\dfrac{p}{100-p} \times 100\right)$%

  It means when one factor of a product is decreased by $\dfrac{n}{d}$ then the other factor will must be increased by $\dfrac{n}{(d-n)}$.

Compiled By Jasjeet

yoursmahboob.wordpress.com



**EXAMPLE 1** *If the price of a commodity be raised by 20% then by how much per cent a house holder reduce his consumption of the same commodity so that his expenditure does not increase.*

**SOLUTION** Since here product (*i.e.*, expenditure) is constant

rate × consumption = expenditure

initially → $1 \times 1 = 1$

After change $1.2 \times x = 1$

$\Rightarrow x = 0.833 \therefore$ decrease in value = 16.66%

**Alternatively:**

Increase in rate $\boxed{+20\% = +\frac{1}{5}}$ ⟶ Decrease in consumption $\boxed{-16.66\% = -\frac{1}{6}}$

**EXAMPLE 2** *If the price of petrol falls down by 20% by how much per cent must a person increase its consumption, so as not to decrease the expenditure on this item?*

**SOLUTION** Since product is constant

decrease by $20\% = \frac{1}{5}$ ⟶ increase by $\frac{1}{4} = 25\%$ $\left[\because \frac{n}{d} \to \frac{n}{(d-n)}\right]$

**EXAMPLE 3** *Due to 50% increase in the price of rice. We purchased 5 kg less rice with the same amount of Rs. 60. What is the new price of rice?*

(a) Rs. 4.66 (b) Rs. 5
(c) Rs. 4 (d) Rs. 6

**SOLUTION** Increase in price $50\% = \frac{1}{2}$ ⟶ Decrease in amount $\frac{1}{3} = 33.33\%$

Since the new quantity of rice decreases by 33.33% which is equal to 5 kg it means initially there was 15 kg rice to be used.

So, the initial price = Rs. 4 $\left(\because \frac{60}{15} = 4\right)$

and final price = Rs. 6 $\left(\because \frac{60}{10} = 6\right)$

**Alternatively:** From the options.

Let us consider choice (d).

Therefore $[6 \times 10 = 60]$ (finally)

Hence $[4 \times 15 = 60]$ (initialy)

**EXAMPLE 4** *The length of a plot is decreased by 33.33%. By how much % the breadth of the plot will be increased so that the area remains constant?*

**SOLUTION** (Decrease) ( Increase)

$33.33 = \frac{1}{3}$ ⟶ $\frac{1}{2} = 50\%$ $\left[\frac{1}{2} = \frac{1}{3-1}\right]$

## CONCEPT OF 'BY' AND 'TO'

Please note that there is a clear difference between "by" and "to". *e.g.*, the income is reduced by 40% it means the new income is 60% of the original and the income is reduced to 40% means the new income is 40% of the original value. Thus "by" represents difference and "to" represents final value.

*e.g.*, The income of Sarika is increased by 20% means the new income is $100 + 20 = 120$ % of the original income. The income of Sarika is increased to 120% means the new income of Sarika is 120% of the original income.

**EXAMPLE 1** *In an election between two candidates, the candidate who got 57% valid votes won by a majority of 420 votes. Find the total no. of valid votes.*

**SOLUTION** Winner Loser

$0.57x$ $0.43x$ $[100 - 57 = 43]$

$0.14x$ $[57 - 43 = 14]$

$0.14x = 420$

$x = 3000$

Hence total valid votes = 3000

**EXAMPLE 2** *Due to fall in manpower, the production in the factory decreases by 60%. By what per cent should the working hour be increased to restore the original production in the factory?*

**SOLUTION** Manpower × Working hours = Production

$(-60\%) = \frac{3}{5} \longrightarrow \frac{3}{2} = (+150\%)$ $\left[\frac{3}{5} \to \frac{3}{5-3} = \frac{3}{2}\right]$

Hence by 150% working hours will be increased. It means the new working hours will be 2.5 times (not 1.5 times) of the original time.

**EXAMPLE 3** *Two numbers are respectively 25% and 40% less than a third number. What per cent is the second of the first?*

**SOLUTION** Consider $A, B, C$ three numbers and assume $C = 100$ (as a base)

$A$ $B$ $C$

75 60 ← (−40%) 100

(−25%)

Now $\frac{60}{75} \times 100 = 80\%$

**EXAMPLE 4** *A person gives 10% to his wife 10% of the remaining to a hospital (as a donation) again 10% of the remaining to prime minister's relief Fund. Then he has only 7290 Rs. with him. What was the initial sum of money with that person?*

**SOLUTION** Since he gives 10% so he is left with 90% of the original sum and since he does the same with the remaining (or left) amount. So it forms a chain.

$\therefore$ Remaining amount $= (x) \times 0.9 \times 0.9 \times 0.9$

$= 0.729\,x = 7290$

$\Rightarrow x = 10{,}000$, where $x$ is supposed to be initial amount.

Compiled By Jasjeet

yoursmahboob.wordpress.com



**EXAMPLE 5** *Initially a shopkeeper had n chocolates. A customer bought 10% chocolate from n then another customer bought 20% of the remaining chocolates, after that one more customer purchased 25% of the remaining chocolates. Finally shopkeeper is left with 270 chocolates in his shop. How many chocolates were there initially in his shop?*

*(a) 300 (b) 450 (c) 500 (d) 600*

**SOLUTION**

$$n \times 0.9 \times 0.8 \times 0.75 = 270$$

$$n = \frac{270 \times 10{,}000}{9 \times 8 \times 75}$$

$$n = 500$$

**NOTE** These type of problems (see example no. 4 and 5) can be solved with a great convenience if we solve in reverse order, with the aid of given choices.

Let us consider option (c)

$500 \times 0.9 = 450$

$450 \times 0.8 = 360$

$360 \times 0.75 = 270$

Hence presumed option is correct.

## POPULATION RELATED MATHEMATICAL PROBLEMS

If the original population of a locality (*i.e.*, region) be $P$ and the annual growth rate be $r\%$. The population after $n$ years $= P\left(1+\frac{r}{100}\right)^n$

change (or increase) in the population

$$= P\left[\left(1+\frac{r}{100}\right)^n - 1\right]$$

If there is decrease in population be $r\%$ then,

total population after $n$ years $= P\left(1-\frac{r}{100}\right)^n$

and decrease in population $= P\left[1-\left(1-\frac{r}{100}\right)^n\right]$

**EXAMPLE 1** *If the annual increase in the population be 20% and the present population be 10,000. What will be the population after 3 years hence?*

*(a) 16,000 (b) 17,280*
*(c) 14,400 (d) 1,728*

**SOLUTION** $10{,}000\left(1+\frac{20}{100}\right)^3 = 10{,}000\left(\frac{6}{5}\right)^3$

$$= 10{,}000 \times (1.2)^3 = 17{,}280$$

Hence (b) is correct.

**EXAMPLE 2** *The population of a town in the first year increases by 10% in the next year it decreases by 10%. Once again in the third year it increase by 10% and in the fourth year it decrease by 10%. If the present population be 20,000 then the population after four years will be :*

*(a) 16,902 (b) 19,602*
*(c) 20,000 (d) none of these*

**SOLUTION** $20{,}000\left(1+\frac{10}{100}\right)\left(1-\frac{10}{100}\right)\left(1+\frac{10}{100}\right)\left(1-\frac{10}{100}\right)$

$$= 20{,}000\,(1.1)\,(0.9)\,(1.1)\,(0.9)$$

$$= 20{,}000 \times 1.21 \times 0.81 = 19{,}602$$

Thus option (b) is correct.

**NOTE** If the value of a number is first increased by $x\%$ and then decreased by $x\%$, the net change is always a decreases (or loss) in original value.

Hence, $\%\ \text{loss} = \left(\frac{x}{10}\right)^2\%$

**EXAMPLE 1** *Shweta is a very expert in bargaining. Once she went to a nearby shop. When Shweta asked the price of Shampoo Sachet the shopkeeper told her the price by increasing 15% of the original cost. But Shweta insisted to decrease the price by 15% so the shopkeeper sold it by decreasing the price by 15%. What is the loss or profit of shopkeeper and by how much percent?*

*(a) no loss (b) profit of 1.5%*
*(c) loss of 2.25% (d) none of these*

**SOLUTION** Let the actual price be 100

$$100 \xrightarrow{+15\%} 115 \xrightarrow{-15\%} 97.75 \qquad \text{(loss of 2.25\%)}$$

**Alternatively:** $\text{loss}\% = \left(\frac{15}{10}\right)^2 = 2.25\%$

There is always a loss.

**EXAMPLE 2** *If the length and breadth of a rectangle are changed by + 20% and − 10%. What is the percentage change in area of rectangle?*

*(a) 8% (b) 10.8%*
*(c) 20% (d) data insufficient*

**SOLUTION**

$$l \times b = \text{area}$$

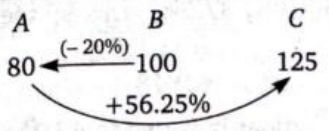
$$1 \times 1 = 1$$

$$1.2 \times 0.9 = 1.08$$

So there is 8% increase in the area of rectangle.

**EXAMPLE 3** *The salary of A is 20% lower than B's salary and the salary of C is 56.25% greater than A's salary. By how much percent the salary of B is less than the salary of C.*

**SOLUTION**




(Consider the salary of $B = 100$)

The required value $= \frac{25}{125} \times 100 = 20\%$

**Remember:** Percentage change

$$= \left(\frac{\text{difference between original value and new value}}{\text{original value}}\right) \times 100$$

Compiled By Jasjeet

yoursmahboob.wordpress.com

$$\text{Percentage increase} = \frac{\text{increased value} - \text{original value}}{\text{original value}} \times 100$$

$$\text{Percentage decrease} = \frac{\text{original value} - \text{decreased value}}{\text{original value}} \times 100$$

**NOTE** (1) There is a huge difference between "decreased value" and "decrease in value" and between "increased value" and "increase in value".

**For example :** Initial value = 70

Final value = 90

it means increased value is = 90

but increase in value is 20

and % increase $= \frac{90 - 70}{70} \times 100 = 28.57\%$

(2) If there is increase of $\frac{x}{y}$ in any value $P$ then the increased value will be $P\left(1 + \frac{x}{y}\right)$.

(3) If there is decrease of $\frac{x}{y}$ in any value, then the decreased value will be $P\left(1 - \frac{x}{y}\right)$.

**EXAMPLE 1** *Nishith is now 20 years old. Some years later his age will increase by 50% of himself. What will be the new age at that time?*

**SOLUTION** $20\left(1 + \frac{1}{2}\right) = 30$ years $\left[\because 20 + 20 \times \frac{1}{2} = 20\left(1 + \frac{1}{2}\right)\right]$

**EXAMPLE 2** *The average salary of Purushottam in Infosys is 20% less than that was in Microsoft. If the salary of Purushottam in Microsoft be \$ 80,000 per month then what is the salary of Purushottam in Infosys?*

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

So new salary $= 80{,}000\left(1 - \frac{1}{5}\right)$

$= 80{,}000 \times \frac{4}{5} = \$\,64{,}000$

**NOTE** Remember this type of problems can also be solved ex through percentages.

As $80{,}000 \times 0.8$ $(100 - 20 = 8)$

$= 64{,}000$

but the technique given above is not less important. Some w it becomes very necessary to solve through fractions. So, keep your eyes open mind focussed and use your wits solve the problems intelligently as per the situation.

**EXAMPLE 3** *Which one of the following is greatest* $\frac{3}{4}, \frac{7}{8}, \frac{16}{19}, \frac{13}{15}$

**SOLUTION**

$$\frac{3}{4} = 75\%$$

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

$$\frac{16}{19} = 84.21\%$$

$$\frac{13}{15} = 86.66\%$$

So, $\frac{7}{8}$ is the greatest fraction (or rational number)

## INTRODUCTORY EXERCISE-5.3

1. What per cent of $\frac{3}{7}$ is $\frac{1}{105}$?
   (a) 10% (b) 2.22%
   (c) 45% (d) 450%
2. What per cent is 3% of 15%?
   (a) 15% (b) 20%
   (c) 40% (d) 66.66%
3. If the cost of a calculator worth Rs 250 is increased by Rs. 100, the rate of increase is
   (a) 100% (b) 40%
   (c) 25% (d) none of these
4. A number increased by 37.5% gives 99 the number is
   (a) 140 (b) 61.5
   (c) 72 (d) 48
5. When 40% of a number is added to 42, the result is the number itself. The number is:
   (a) 105 (b) 72
   (c) 70 (d) 82
6. In an examination 52% of the candidates failed in Science 42% in Mathematics and 17% in both. The no. of those who passed in both the subjects, is :
   (a) 83% (b) 64%
   (c) 23% (d) 55.55%
7. The price of an item is increased by 20% and th decreased by 20%. The final price as compared original price
   (a) 4% more (b) 20% more
   (c) 20% less (d) 4% less
8. Two candidates fought an election. One got 65% of votes and won by 600 votes. The total no. of votes pol is:
   (a) 12,000 (b) 10,000
   (c) 2,000 (d) 8,000
9. Out of a no. of electronic items, a person purchases 6 coloured TVs 5% of these were found to be defec The percentage of defective TVs in all is
   (a) 3% (b) 6%
   (c) 12% (d) can't be determined
10. *A*'s salary is half that of *B*. If *A* got a 50% rise in his sa and *B* got a 25% rise in his salary, then the percen increase in combined salaries of both is
   (a) 30% (b) 33.33%
   (c) 55% (d) 28%

Compiled By Jasjeet

yoursmahboob.wordpress.com

# EXERCISE

## LEVEL 1

1. In our Singapore office there are 60% female employees. 50% of all the male employees are computer literate. If there are total 62% employees computer literate out of the total 1600 employees, then the no. of female employees who are computer literate :
(a) 690 (b) 672
(c) 960 (d) can't be determined

2. The price of a car depreciates in the first year by 25% in the second year by 20% in the third year by 15% and so on. The final price of the car after 3 years, if the present cost of the car is Rs. 10,00,000 :
(a) 7,80,000 (b) 5,10,000
(c) 6,90,000 (d) 1,70,000

3. A shopkeeper charges sales tax of $x$% up to Rs. 2,000 and above it he charges $y$%.A customer pays total tax of Rs 320, when he purchases the goods worth Rs. 6,000 and he pay's the total tax of Rs. 680 for the goods worth Rs. 12,000. The value of $(x - y)$ is :
(a) 0 (b) – 2
(c) – 4 (d) 5

4. 40% of a number when added to the square of the same number, then it is increased to 4040% of itself the actual number is :
(a) 175 (b) 400
(c) 40 (d) 120

5. In my office there are 30% female employees and 30% of these earn greater than Rs. 8,000 per month and 80% of male employees earn less than Rs. 8,000 per month. What is the percentage of employees who earn more than Rs. 8,000 per month?
(a) 30% (b) 23%
(c) 60% (d) can't be determined

6. 600 students took the test on physics and chemistry. 35% students failed in Physics and 45% students failed in chemistry and 40% of those who passed in chemistry also passed in Physics, then how many students failed in both :
(a) 162 (b) 138
(c) 60 (d) none of these

7. In an examination 70% of the candidates passed in History and 50% in Geography and 20% students failed in both the subjects. If 500 students passed in both the subjects, then how many candidates appeared for the exam ?
(a) 1,000 (b) 1,500
(c) 2,500 (d) none of these

8. My salary is Rs. 12,345 per month. The salary of my brother is 10% greater than that of mine. The salary of my only sister is 9.09% greater than my only brother. The salary of my wife is $56\frac{12}{23}$% less than the total salary of my brother and sister together, then the salary of my wife is :
(a) greater than my sister's salary
(b) $33\frac{11}{23}$% less than my sister's salary
(c) equal to my salary
(d) $44\frac{11}{23}$% greater than my own salary

9. MDTV is a very popular TV channel. It telecasts the programmes from 8 : 00 a.m. to 12 : 00 p.m. It telecasts 60 advertisements each of 8 seconds and 16 advertisements each of 30 seconds. What is the percentage of time devoted in a day for the advertisements?
(a) 1.5% (b) 1.66%
(c) 2% (d) 2.5%

10. Lagaan is levied on the 60% of the cultivated land. The revenue department collected total Rs. 3,84,000 through the lagaan from the village of Sukhiya. Sukhiya, a very rich farmer, paid only Rs. 480 as lagaan. The percentage of total land of Sukhiya over the total taxable land of the village is :
(a) 0.15% (b) 15%
(c) 0.125% (d) none of these

11. The actual area of a rectangle is 60 $cm^2$, but while measuring its length a student decreases it by 20% and the breadth increases by 25%. The percentage error in area, calculated by the student is :
(a) 5% (b) 25%
(c) can't be determined (d) none of these

12. The cost of packaging of the mangoes is 40% the cost of fresh mangoes themselves. The cost of mangoes increased by 30% but the cost of packaging decreases by 50%, then the percentage change of the cost of packed mangoes, if the cost of packed mangoes is equal to the sum of the cost of fresh mangoes and cost of packaging :
(a) 14.17% (b) 7.14%
(c) 6.66% (d) none of these

13. Abhinav scores 80% in Physics and 66% in chemistry and the maximum marks of both the papers are 100. What per cent does he score in maths which is of 200 marks, if he scores 80% marks in all the three subjects :
(a) 74% (b) 84%
(c) 87% (d) 83%

14. In the New York Stock Exchange there are 45% female employees and thus the number of male employees is exceeded by 72. Hence the total no. of employees in the New York Stock Exchange is :
(a) 540 (b) 720
(c) 7200 (d) 550

Compiled By Jasjeet

yoursmahboob.wordpress.com



**15.** Three candidates $A$, $B$ and $C$ contested an election. Out of the total votes on a voter list 25% did not vote and 6.66% votes polled were invalid. $C$ got 2450 valid votes, which were 40% more than that of $B$. If $A$ got only 40% of the total votes, then who is the winner?
(a) A (b) B
(c) C (d) can't be determined

**16.** The cost of a car is 400% greater than the cost of a bike. If there is an increase in the cost of the car is 15% and that of bike is 20%. Then the total increase in the cost of the 5 cars and 10 bikes is :
(a) 17.5% (b) $16\frac{3}{7}$%
(c) 18.5% (d) 18.25%

**17.** The square of a positive number is 2,000% greater than the number itself, then the square of that number is :
(a) 1762 (b) 1635
(c) 441 (d) 139

**18.** The monthly salary of Shahid and Kareena together is \$ 28,000. The salary of Shahid and Kareena is increased by 25% and 12.5% respectively then the new salary of Kareena becomes 120% of the new salary of Shahid. The new (or increased) salary of Shahid is :
(a) \$ 15,000 (b) \$ 18,000
(c) \$ 14,000 (d) \$ 16,000

**19.** 80% of a smaller number is 4 less than 40% of a larger number. The larger number is 85 greater than the smaller one. The sum of these two numbers is :
(a) 325 (b) 425
(c) 235 (d) 500

**20.** 220% of a number '$X$' is 44. What is 44% of '$X$' ?
(a) 88 (b) 8.8
(c) 66 (d) data insufficient

**21.** The shopkeeper increased the price of a product by 25% so that customer finds it difficult to purchase the required amount. But somehow the customer managed to purchase only 70% of the required amount. What is the net difference in the expenditure on that product ?
(a) 10% more (b) 5% more
(c) 12.5% less (d) 17.5% less

**22.** In the previous government, party $Q$ was in the opposition. Now increasing the seats by 33.33% Q is the ruling party and thus party Q enjoys twice the majority than that of party $P$ in the previous government. If there were only two parties $P$ and $Q$ and the fix no. of seats be 500 in the parliament of Hum-Tum, then the no. of seats of the Q in the new government is :
(a) 225 (b) 200
(c) 275 (d) 300

**23.** In an examination a candidate got 30% marks and failed by 30 marks. If the passing marks are 60% of the total marks, then the maximum marks will be :
(a) 450 (b) 600
(c) 300 (d) 100

**24.** In a school there are 1800 students. Last day except 4% of the boys all the students were present in the school. Today except 5% of the girls all the students are present in the school, but in both the days no. of students present in the school, were same. The no. of girls in the school is :
(a) 1200 (b) 800
(c) 1000 (d) 600

**25.** In a library 60% of the books are in Hindi, 60% of the remaining are in English and rest of the books are in Urdu. If there are 3600 books in English, then the total no. of books in Urdu are :
(a) 2400 (b) 2500
(c) 3000 (d) none of these

**26.** In a test there are total $n$ questions. Bhanu answers 20 out of 25 questions correctly in the first section. In the second section he answers 60% question correct and thus his total score is 66.66% in the test. Given that all the questions carry equal marks, without any negative marking. The total no. of question in the test is :
(a) 50 (b) 60
(c) 75 (d) 100

**27.** In a class of MBA students 16.66% students are from Science background and 12.5% students are from commerce background and 6.66% students from arts background and rest are from Engineering background. The minimum possible students of engineeering background are :
(a) 45 (b) 77
(c) 100 (d) 120

**28.** An alloy contains the copper and aluminium in the ratio of 7 : 4. While making the weapons from this alloy, 12% of the alloy got destroyed. If there is 12 kg of aluminium in the weapon, then the weight of the alloy required is :
(a) 48 kg (b) 40 kg
(c) 37.5 kg (d) 14.4 kg

**29.** Hariharan goes to a shop to buy an FM radio costing Rs. 1404 including sales tax at 8%. He asks the shopkeeper to reduce the price of radio so that he can save the amount equal to the sales tax. The reduction of the price of the radio is :
(a) Rs. 108 (b) Rs.104
(c) Rs. 112.32 (d) none of these

**30.** The average weight of a class of students is 67.5 kg. The weight of the class teacher is 25% more than the average weight of the class. The average weight of the class is less than the class teacher by $x$%. The value of $x$ is :
(a) 33.33% (b) 25%
(c) 20% (d) can't be determined

**31.** Last year in CAT, each section of the question paper had different weightage. The weightage of QA, DI and VA/RC sections was 8, 9 and 10 respectively. The maximum marks in all the three sections together were 810. Wrong answer did not carry negative marks as a penalty. If Padma had gotten 20% more marks in QA and 8% more marks in DI and 7.14...% more marks in VA/RC, then she must had gotten 100% marks in all the three sections. The total marks that Padma had scored :
(a) 730 (b) 700
(c) 750 (d) 775

**32.** A salesman gets commission on total sales at 9%. If the sale is exceeded Rs. 10,000 he gets an additional commission as bonus of 3% on the excess of sales over Rs. 10,000. If he gets total commission of Rs. 1380, then the bonus he received is :
(a) Rs. 180 (b) Rs. 120
(c) Rs. 480 (d) data insufficient

**33.** In Veeru Bhai Pvt. limited company 60% of the employees are men and 48% of the employees are Engineer and 66.6% of these are men. The percentage of women who are not engineers :
(a) 33.33% (b) 60%
(c) 52% (d) 46.66%

Compiled By Jasjeet

yoursmahboob.wordpress.com



34. Initially Veer had 60% more love letters than that of Zara. In the last month the no. of love letters of Veer increased by 25% and that of Zara decreased by 25%. Again in the present month the no. of love letters of Veer decreased to 60% and that of Zara increased by 60%. Then which of the following statements is correct regarding the present no. of love letters :
(a) Veer has 40% more letters than that of Zara
(b) Zara has 20% less letters than that of Veer
(c) Veer and Zara have equal no of letters
(d) Zara has 37.5% less letters than that of Veer.

35. The charges per hour of internet surfing is increased by 25% then find the percentage decrease in the time period of surfing of a user (a net savy) who can afford only a 10% increase in expenditure :
(a) 22% (b) 12%
(c) 15% (d) 9.09%

36. The average earning of each member of the Ambani family is 20% less than the average earning of each member of the Sahara family and the total earning of Ambani's family is 20% more than the total earning of Saharas's family. The no. of family members in the Sahara is what per cent of the no. of family members of Ambani :
(a) 25% (b) 20%
(c) 66.66% (d) none of these

37. From 2000 onwards, till 2003 the price of computers increased every year by 10%. After that due to government subsidy the price of computers decreases every year by 10%. The price of a computer in 2006 will be approx. how much per cent less than the price in 2000 if the same pattern of price is continued :
(a) 2 (b) 3
(c) 4 (d) none of these

38. A book consists of 30 pages, 25 lines on each page and 35 characters on each line. If this content is written in another note book consisting of 30 lines and 28 characters per line, then the required no. of pages will how much per cent greater than the previous pages?
(a) 4.16% (b) 5%
(c) 6.66% (d) none of these

39. The rate of increase of the price of sugar is observed to be two per cent more than the inflation rate expressed in percentage. The price of sugar on January 1, 2004 is Rs. 20 per kg. The inflation rates of the years 2004 and 2005 are expected to be 8% each. The expected price of sugar on January 1, 2006 would be :
(a) Rs. 23.60 (b) Rs. 24.00
(c) Rs. 24.20 (d) Rs. 24.60

40. A club has raised 75% of the amount it needs for a new building by receiving an average donation of Rs. 600 from the people already solicited. The people already solicited represents 60% of the people the club will ask for donations. If the club is to raise exactly the amount needed for the new building, what should be the average donation from the remaining people to be solicited?
(a) 250 (b) 300
(c) 400 (d) 600

41. A number $x$ is mistakenly divided by 10 instead of being multiplied by 10. What is the percentage error in the result?
(a) – 99% (b) + 99%
(c) – 100% (d) + 100%

42. What is the percentage change in the result when we add 50 to a certain number $x$, instead of subtracting 50 from the same number $x$ ?
(a) 50% (b) 100%
(c) 300% (d) can't be determined

43. In the Regional Science Centre, Lucknow the rate of ticket is increased by 50% to increase the revenue, but simultaneously 20% of the visitors decreased. What is percentage change in the revenue of Regional Science Centre. If it is known that the centre collects the revenue only from the visitors and it has no other financial supports :
(a) + 20% (b) – 25%
(c) + 30% (d) can't be determined

44. Recently when I visited a show room of shoes shopkeeper told me that he could reduce the price of Bata shoes by 49% and if I were to purchase woodland shoes he could reduce the price to 51% of the original price. If the marked price (*i.e.*, printed price) of both the shoes was same, then which shoes was cheap to buy :
(a) Wood land (b) Bata
(c) both (d) can't say

45. Selling price of a shirt and a coat is Rs. 4000. The cost price of a shirt is 58.33% of the cost price of a coat and so amount of profit on both the shirt and coat is same, then the price of the shirt could be :
(a) Rs 2100 (b) Rs. 2525
(c) Rs. 2499 (d) Rs. 1120

46. On the April 1, 2005 my salary increased from Rs. 10,000 to Rs. 16,000. Simultaneously the rate of income tax decreased by 37.5% , So the amount of income tax paid by me remains constant what is the value of income tax paid by me :
(a) Rs. 3000 (b) Rs. 6000
(c) Rs. 1600 (d) can't be determined

47. In the previous question, if the difference in the rate of income tax be 9 (in percent) then the income tax paid by me :
(a) Rs. 2000 (b) Rs. 2400
(c) Rs. 1600 (d) none of these

48. The average of a set of whole numbers is 27.2. When the 20% of the elements (ie numbers) are eliminated from the set of numbers then the average becomes 34. The number of elements in the new set of numbers can be :
(a) 27 (b) 35
(c) 52 (d) 63

49. In a class, the no. of boys is more than the no. of girls by 12% of the total strength. The ratio of boys to girls is :
(a) 15 :11 (b) 11 : 14
(c) 14 :11 (d) 8 : 11

50. The population of a village is 5000 and it increases at the rate of 2% every year. After 2 years, the population will be :
(a) 5116 (b) 5202
(c) 5200 (d) 5204

51. A customer asks for the production of $x$ number of goods. The company produces $y$ number of goods daily. Out of which $z$% are unfit for sale. The order will be completed in :
(a) $\frac{x}{100\,y\,(1-z)}$ days (b) $\frac{100\,yz}{x}$ days
(c) $\frac{100\,x}{y\,(100-z)}$ days (d) $\frac{100}{y\,(z-1)}$ days

Compiled By Jasjeet

yoursmahboob.wordpress.com



## LEVEL 2

1. In the Awadh school Gomti Nagar, there are 500 students. 60% of the students are boys, 40% of whom play hockey and the girls don't play hockey, 75% of girls play badminton. There are only two games to be played. The number of students who don't play any game is :
(a) 10% (b) 36%
(c) 46% (d) can't be determined

2. A fraction in reduced form is such that when it is squared and then its numerater is increased by 25% and the denominator is reduced to 80% it results in 5/8 of the original fraction. The product of the numerator and denominator is :
(a) 6 (b) 12
(c) 10 (d) 7

3. In the Chidambaram's family the ratio of expenses to the savings is 5 : 3. But his expenses is increased by 60% and income increases by only 25% thus there is a deficit of Rs. 3500 in the savings. The increased income of Mr. Chidambaram's family is :
(a) Rs. 35,000 (b) Rs. 28,000
(c) Rs. 25,000 (d) Rs. 18,500

4. In the Presidency College two candidates contested a presidential election. 15% of the voters did not vote and 41 votes were invalid. The elected contestant got 314 votes more than the other candidate. If the elected candidate got 45% of the total eligible votes, which is equal to the no. of all the students of the college. The individual votes of each candidate are :
(a) 2250 and 1936 (b) 3568 and 3254
(c) 2442 and 2128 (d) 2457 and 2143

5. The annual earning of Mr. Sikkawala is Rs. 4 lakhs per annum for the first year of his job and his expenditure was 50%. Later on for the next 3 years his average income increases by Rs. 40,000 per annum and the saving was 40%, 30% and 20% of the income. What is the percentage of his total savings over the total expenditure if there is no any interest is applied on the savings for these four years :
(a) $49\frac{37}{87}\%$ (b) $41\frac{73}{83}\%$
(c) 53% (d) none of these

6. In an election only two candidates contested 20% of the voters did not vote and 120 votes were declared as invalid. The winner got 200 votes more than his opponents thus he secured 41% votes of the total voters on the voter list. Percentage votes of the defeated candidate out of the total votes casted is :
(a) 47.5% (b) 41%
(c) 38% (d) 45%

***Directions for questions 7, 8 and 9:*** *Pujari ji, the chief of a temple's trust, has a beautiful daughter Nirjala and a son in law, Radhey. Pujarin, the wife of Pujari ji, lives her own life by receiving the alms from the devotees and receives 9.09% earning of her husband and the daughter together. The earning of Nirjala in each month is Rs. 8000 less than her husband Radhey. The earning of Pujari ji and Radhey together is Rs. 30,000 per month. The earning of Radhey and Nirjala together is Rs. 133.33% greater than that of Pujari ji.*

7. The average earning of each Pujari ji. Nirjala and Radhey is :
(a) Rs. 13333.33 (b) Rs. 888.88
(c) Rs. 15,000 (d) none of these

8. What is the earning of Pujarin from the alms?
(a) Rs. 1800 (b) Rs. 2000
(c) Rs. 3600 (d) can't be determined

9. The earning of Radhey is how much per cent greater than that of his wife?
(a) 50% (b) 80%
(c) $47\frac{11}{13}\%$ (d) none of these

10. A sales executive gets 20% bonus of the total sales value and 10% commission besides the bonus on the net profit after charging such commission. If the total sales value be Rs. 10 lakh per annum and the total profit of the company be Rs. 1.32 lakh, then his total earning per annum will be, given that he is not entitled to receive any fixed salary from the company :
(a) 2.3 lakh (b) 3.2 lakh
(c) 2.32 lakh (d) 2.12 lakh

11. Mr Scindia after selling 5.5% stock at Rs. 92 realizes Rs. 32200. Then he invested $\frac{1}{3}$ of the amount in 4.5% stock at Rs. 92, $\frac{2}{5}$ of the amount at Rs. 115 in 5% stock and the remaining in 6% stock at Rs. 56. The change in his income is :
(a) Rs. 56 loss (b) Rs. 78 profit
(c) Rs. 80 profit (d) Rs. 70 loss

12. Each edge of a cube is increased by 20% then the percentage increase in surface area of the cube is :
(a) 144% (b) 40%
(c) 44% (d) 72.8%

***Directions for question number 13 and 14:*** *Pati, Patni and Woh (the three persons) were playing a game. At the begining of the game Pati and Patni together had 100% more money than Woh. Patni and Woh together had 300% more than Pati. By the end of the game Pati and Patni together had 100% more money than Woh had and Pati had 12.5% less money than Patni and Woh together had. Finally Pati gained Rs. 800 by the end of the game.*

13. Who has suffered the loss?
(a) Patni (b) Woh
(c) Patni and Woh both (d) can't be determined

14. The percentage change of money of Patni is :
(a) 40% (b) 30%
(c) 57.1428% (d) 42.857%

15. The raw material and manufacturing cost formed individually 70% and 30% of the total cost and the profit percentage is 14.28% of the raw material. If the cost of raw material increase by 20% and the cost of manufacturing is increased by 40% and the selling price is increased by 80% then the new profit percentage is :
(a) 57% (b) 65.8%
(c) 60% (d) can't determined

Compiled By Jasjeet

yoursmahboob.wordpress.com



16. $A, B, C$ and $D$ purchased a one-multiplex for Rs. 56 lakhs. The contribution of $B, C$ and $D$ together is 460% that of $A$, alone. The contribution of $A, C$ and $D$ together is 366.66% that of $B$'s contribution and the contribution of $C$ is 40% that of $A, B$ and $D$ together. The amount contributed by $D$ is :
(a) 10 lakh (b) 12 lakh
(c) 16 lakh (d) 18 lakh

17. In a village three people contested for the post of village Pradhan. Due to their own interest, all the voters voted and no one vote was invalid. The losing candidate got 30% votes. What could be the minimum absolute margin of votes by which the winning candidate led by the nearest rival, if each candidate got an integral per cent of votes?
(a) 4 (b) 2
(c) 1 (d) none of these

18. Every day a mango seller sells half his stock, 10% of the stock overnight gets spoiled. If 1983 mangoes rotted over 3 nights then how many did he start with on the first day?
(a) 25,000 (b) 24,000
(c) 30,000 (d) 32,000

19. A man lost half of his initial amount in the gambling after playing 3 rounds. The rule of gambling is that if he wins he will receive Rs. 100, but he has to give 50% of the total amount after each round. Luckily he won all the three rounds. The initial amount with which he had started the gambling was :
(a) $\frac{500}{3}$ (b) $\frac{700}{3}$
(c) 300 (d) 600

20. In a factory there are three types of Machines $M_1, M_2$ and $M_3$ which produces 25% , 35%, and 40% of the total products respectively. $M_1, M_2$ and $M_3$ produces 2%, 4% and 5% defective products, respectively. What is the percentage of non-defective products?
(a) 89% (b) 97.1%
(c) 96.1% (d) 86.1%

21. A company has 12 machines of equal efficiency in its factory. The annual manufacturing expenses are Rs. 24,000 and the establishment charges are Rs. 10,000. The annual output of the company is Rs. 48,000. The annual output and manufacturing costs are directly proportional to the no. of machines while the share holders get the 10% profit, which is directly proportional to the annual output of the company. If 8.33% machines remained close throughout the year. Then the percentage decrease in the amount of Share holders is :
(a) 16.66% (b) 14.28%
(c) 8.33% (d) none of these

22. In every month Ravindra consumes 25 kg rice and 9 kg wheat. The price of rice is 20% of the price of wheat and thus he spends total Rs. 350 on the rice and wheat per month. If the price of wheat is increased by 20% then what is the percentage reduction of rice consumption for the same expenditure of Rs. 350? Given that the price of rice and consumption of wheat is constant :
(a) 36% (b) 40%
(c) 25% (d) 24%

23. My friend Siddhartha Ghosh is working in the life insurance. Corporation of India (LIC). He was hired on the basis of commission and he got the bonus only on the first years commission. He got the policies of Rs. 2 lakh having maturity period of 10 year. His commission in the first second, third, fourth and for the rest of the years is 20%, 16% 12% 10% and 4% respectively. The bonus is 25% of the commission. If the annual premium is Rs. 20,000 then what is his total commission if the completion of the maturity of all the policies is mandatory :
(a) Rs. 174,00 (b) RS. 23, 600
(c) Rs. 15,000 (d) Rs. 15,500

***Directions for question number 24 and 25:*** *DELL Computer has two branches : One in Ohio and second in Texas : The total no. of employees in Ohio office grew this year by 25% to 750 but the ratio of male to female employees is same as in the previous year. The no. of employees in the Texas office grew this year by 9.09% to 1200. The ratio of male to female employees last year in the Texas office was 5 : 6 and the no. of male employees in the Ohio office was 20% less than that of Texas office.*

24. The total no. of female employees this year in both the offices is :
(a) 654 (b) 546
(c) 950 (d) can't be determined

25. The total no. of employees in both the offices last year was :
(a) 1500 (b) 1700
(c) 1650 (d) can't be detemined

26. A shepherd had $n$ goats in the year 2000. In 2001 the no. of goats increased by 40%. In 2002 the no. of goats declined to 70%. In 2003 the no. of goats grew by 30%. In 2004, he sold 10% goats, then he had only 34,398 goats. The percentage increase of the no. of goats in this duration was :
(a) 14.66% (b) 16.66%
(c) 20% (d) 33.33%

27. In the above question in which year the no. of goats was minimum?
(a) 2000 (b) 2001
(c) 2002 (d) 2004

***Directions for questions number 28, 29 and 30:*** *In the IGNOU (Indira Gandhi National Open University) there are total 16,000 students pursuing MBA, which offers the specialization only in Finance, HR and Marketing. IGNOU accepts only Science, Commerce and Engineering students for the two years course of MBA. The number of science. students is 166.66% of the Commerce students. Number of Engineering students is equal to the number of Science and Commerce students together. Each student can specialize in only one of the marketing, HR and Finance. 20% of Science students opted the Finance, which is 16.66% less than the no. of Commerce students who opted Finance. The total Finance students is equal to 18% the total strength of the MBA students. 32% of Science students opted HR. Commerce students who opted HR is equal to 25% of total students specializing in Finance and Engineering students equal to 6.5% of the total strength of the MBA students opted HR.*

Compiled By Jasjeet

yoursmahboob.wordpress.com



**28.** The number of Engineering students who opted marketing is :
(a) 7850 (b) 7500
(c) 8850 (d) none of these

**29.** The percentage of Commerce students who opted HR over the total strength of the MBA students is :
(a) 6.6% (b) 42.5%
(c) 4.5% (d) 62.5%

**30.** The most preferable course among the MBA students is :
(a) Finance (b) HR
(c) Marketing (d) I. T and systems

**31.** $P$% of the students of a class passed the exam. $g$% of the passed students are girls and $b$% of the fail students are boys. The percentage of passed boys over the failed girls is :
(a) $\left(\frac{bg}{p} \times 100\right)$ (b) $\frac{100(100-g).p}{(100-p)(100-b)}$
(c) $\frac{(100-g)(100-b)}{(100-p)}$ (d) none of these

**32.** In the Polo hospital some patients who were suffering from the Hepatites-B were admitted for the treatment , but 9% of the patients were died within half an hour. After treatment, the percentage of patients cured out of the remaining was only 80%. Out of these patients only 70% are completely cured out and the remaining were partially cured out which were equal to 153 patients. The no. of patients (approx.) who were admitted for the treatment for the same was :
(a) 400 (b) 678
(c) 560 (d) 700

**33.** The total cost of setting up a sugar cane factory is Rs. 1 crore, which produces 5000 ton per annum. Sugar is being sold at Rs. 18 per kg. Manufacturing cost including raw material is Rs. 3.2 per kg, labour and packing charges are Rs. 1.8 per kg. Maintenance and utilities expenses are Rs. 2 per kg and the general expenses (ie all the rest charges) are Rs. 3 per kg, 20% taxes are being paid of the gross annual earnings, then the net profit of the production of the factory per annum is :
(a) Rs. 4.2 crore (b) Rs. 3.2 crore
(c) 5.4 crore (d) none of these

**34.** A student appeard in the Mock CAT. The test paper contained 3 sections namely QA, DI and VA. The percentage marks in VA was equal to the average of the percentage marks in all the 3 sections. Coincidentally, if we reverse the digits of the percentage marks of QA we get the percentage marks of DI. The percentage marks in VA scored by the student could be :
(a) 48 (b) 66
(c) 69 (d) 81

**35.** The pressure of a definite mass of a gas is directly proportional to the temperature and inversely proportional to the volume under the given conditions. If temperature is increased by 40% and the volume is decreased by 20% then the new pressure will:
(a) be increased by 75% (b) reduce to 25%
(c) be increase by 20% (d) increase by 28%

**36.** A computer typist types a page with 20 lines in 10 minutes but he leaves 8% margin on the left side of the page. Now he has to type 23 pages with 40 lines on each page which he leaves 25% more margin than before. How much time is now required to type these 23 pages
(a) $7\frac{1}{2}$ hrs (b) $7\frac{2}{3}$ hrs
(c) $23\frac{1}{2}$ hrs (d) 3.916 hrs

**37.** A company made a cuboidal box of size $16 \times 12 \times 5$ to sell the ice cream, but later on it was found that the capacity of the box was 14.28% less than the required capacity while the height of the box was correct, which is 5 inches. As per the requirement he had to increase the length and breadth of the box in equal amount then the percentage increase in the area of the base of the box is
(a) 12.5% (b) 6.66%
(c) 16.66% (d) none of these

**38.** In Sabarmati Express, there are as many wagons as there are the no. of seats in each wagon and not more than one passanger can have the same berth (seat). If the middlemost compartment carrying 25 passangers is filled with 71.428% of its capacity, then find the maximum no. of passangers in the train that can be accommodated if it has minimum 20% seats always vacant
(a) 500 (b) 786
(c) 980 (d) can't be determined

**39.** The prepaid card of Reliance Infocom gives 19% less talktime than the prepaid card of Tata Indicom, having same price. Again the post-paid card of same price of Tata Indicom gives 10% less talktime than its prepaid card.
Similarly the post paid card of same price of Reliance gives 11.11% less talk time than its prepaid card. How much percent less talk time we get from the Reliance post paid card than the post paid card of Tata Indicom?
(a) 21.11% (b) 20%
(c) 30.11% (d) none of these

**40.** In the half yearly exam only 70% of the students were passed. Out of these (passed in half yearly) only 60% student are passed in annual exam. Out of those who did not pass the half yearly exam, 80% passed in annual exam. What per cent of the students passed the annual exam ?
(a) 42% (b) 56%
(c) 66% (d) none of these

**41.** The marks obtained by the students of a school is given below : maximum marks are 50.

| Marks | Percentage of Students |
|---|---|
| < 10 | 15% |
| < 20 | 32% |
| < 30 | 40% |
| < 40 | 70% |
| < 50 | 100% |

The ratio of no. of boys to no. of girls who passed the exam is 7 : 6. It is known that a student can pass the exam only when he obtained at least 20 marks in the exam. The total no. of students in the school if the no. of girls who are passed is 408
(a) 1100 (b) 1200
(c) 1300 (d) 1430

Compiled By Jasjeet

yoursmahboob.wordpress.com





***Direction for question number 42 to 45:*** *After defeating Ravana, Ram and his family won a lot of valuable assets in the war. It consists of horses, chariots and some land of Ravans's kingdom. The cost of each horse and chariot was Rs. 20,000 and Rs. 8,000 respectively while the cost of 1 acre land was Rs. 5000. All the property was shared among the four persons in such a way that Ram and Sita got together the same wealth as Laxman and Urmila got together. Ram got more than Sita and Laxman got more than Urmila. Ram got $\frac{1}{3}$ rd horses and 20% chariots while Laxman received 50%chariots as the 50% of his total wealth. The no. of horses that Ram and Sita got together was 50% more than that of Laxman and Urmila together had. Sita got 8 horses and Urmila got 7 horses but the Ram and Sita got equal no. of Chariots and Urmila got 20 chariots less than that of Laxman. Urmila got twice the land than that of Sita but 20% less than Laxman.*

42. What is the difference between the wealth of Ram and wealth of Urmila?
(a) 1.2 lakh (b) 1 lakh
(c) 1.4 lakh (d) can't be determined

43. If Laxman wanted to exchange all his chariots with the horses, then who can exchange with his/her horses in terms of wealth :
(a) Ram (b) Sita
(c) Urmila (d) can't be determined

44. The wealth of Urmila is how many per cent less than that of Laxman :
(a) 42% (b) 45%
(c) 35% (d) none of these

45. The wealth due to land and chariot together is how much greater, in per cent, than the wealth due to horses.
(a) 25% (b) 20%
(c) 33.33% (d) none of these

46. A big cube is formed by rearranging the 160 coloured and 56 non-coloured similar cubes in such a way that the exposure of the coloured cubes to the outside is minimum. The percentage of exposed area that is coloured is:
(a) 25.9% (b) 44.44%
(c) 35% (d) none of these

47. Selection into IIMs (Indian Institutes of Management) is quite simple. In our coaching institute some students qualified CAT (The first stage of entrance into IIMs) but coincidentally the no. of boys who qualified the CAT was equal to the no. of girls. Besides these boys and girls got the calls from only IIM Ahamedabad and IIM Bangalore, but each of these from both the IIMs. 60% of the boys failed in the group discussion (the second phase of the selection process) and thus equal no of boys (but distinct) appeared for the personnel interview of IIM-A and IIM-B (interview is the third and final stage of selection of a candidate) but 20% of the boys who appeared for the interview of IIM-A and 60% of the boys who appeared for the interview of IIM-B failed. If it is possible that a candidate can receive the calls from more than one IIMs but he/ she can face the interview of only one IIM. Given that only 24 boys from our coaching institute were selected by the IIM-A and IIM-B also a candidate can appear for the next stage only if he/she qualifies the previous stage of the exam, then find the no. of girls who qualified the CAT (Common Admission Test).
(a) 100 (b) 250
(c) 300 (d) 600

**48.** In an office there were initially $n$ employees. The HR manager first hired $P$% employees then after a month $q$% employees left the office, then there were finally $n$ employees remained in the office, the value of $p-q$ is :
(a) $pq$ (b) $\frac{pq}{100}$
(c) $\frac{p}{q}$ (d) none of these

**49.** In the Garbar Jhala, Aminabad a shopkeeper first raises the price of a Jewellery by $x$% then he decreases the new price by $x$%. After one such up down cycle, the price of a Jewellery decreased by Rs. 21025.After a second updown cycle the jewellery was sold for Rs. 484416. What was the original price of the jewellery.
(a) Rs. 5,00,000 (b) Rs. 6,00,625
(c) Rs. 525625 (d) RS. 5,26,000

**50.** The amount of work in a leather factory is increased by 50%. By what per cent is it necessary to increase the number of workers to complete the new amount of work in previously planned time, if the productivity of the new labour is 25% more.
(a) 60% (b) 66.66%
(c) 40% (d) 33.33%

Compiled By Jasjeet

yoursmahboob.wordpress.com

***Directions for question number 1, 2 and 3:*** *The bar graph shown below reveals the data about the no. of students in different disciplines of MBA at a prominent Business School in India.*

1. The growth rate of Finance compared to that of marketing is:
   (a) less (b) equal
   (c) greater (d) none of these
2. Total no. of MBA students in the session of 2004-05 if the no. of students in 2004-2005 is increasing by 9.09% over the previous year :
   (a) 555 (b) 600
   (c) 777 (d) none of these
3. In the session of 2002-03 what percentage of MBA students are studying International Business?
   (a) 13.33% (b) 25%
   (c) 6.66% (d) 24%

***Directions for question number 4 to 7:*** *The following table gives the sales details of the books for CAT written by Sarvesh.*

| Year | Quant. Aptitude | Data Interpretation | Verbal Ability | Log. Reasoning |
|---|---|---|---|---|
| 2000 | 4000 | 3750 | 4140 | 4350 |
| 2001 | 4200 | 3870 | 4260 | 4400 |
| 2002 | 4370 | 3990 | 4255 | 4500 |
| 2003 | 4268 | 3868 | 5371 | 4690 |
| 2004 | 4750 | 4900 | 5476 | 4710 |
| 2005 | 4800 | 5000 | 5500 | 4800 |

4. What is the growth rate of sales of Quantitative Aptitude from 2000 to 2005?
   (a) 8% (b) 25%
   (c) 20% (d) 40%
5. Which of the categories shows the lowest growth rate from 2000 to 2005?
   (a) Q.A (b) DI
   (c) VA (d) LR
6. Which category had the highest growth rate in the period?
   (a) QA (b) DI
   (c) VA (d) LR
7. Which of the categories had either a consistent growth or consistent decline in the period shown?
   (a) QA (b) DI
   (c) VA (d) LR

***Directions for question number 8 to 10 :*** *In India there were only three bicycle making companies in the given period. The following table shows the production of units (in 000)*

| Year | HERO | ATLAS | AVON |
|---|---|---|---|
| 1990 | 2.97 | 1.75 | 3.77 |
| 91 | 4.22 | 2.48 | 4.55 |
| 92 | 5.95 | 3.14 | 4.5 |
| 93 | 6.28 | 3.01 | 4.76 |
| 94 | 6.33 | 4.12 | 4.74 |
| 95 | 8.50 | 4.21 | 4.26 |

UPTREND IN BICYCLES PRODUCTION IN INDIA

8. The simple average rate of growth of production of Hero cycles from 1990-95 :
   (a) 37% (b) 42%
   (c) 27% (d) 31.5%
9. Which of the following statements is/are correct ?
   (i) Atlas cycles have recorded the fastest growth rate.
   (ii) Total bicycles production was the highest in 1993
   (iii) Hero cycles on an average account for 48% of total bicycles production
   (a) I only (b) II only
   (c) III only (d) none of these
10. Atlas cycles on an average account for what percentage of the total bicycles production :
    (a) 15% (b) 23.4%
    (c) 34.5% (d) 29%

***Directions for question number 11 to 14 :*** *Answer the questions based on the following information, which gives data about certain butter producer companies in India.*

| Name of the Company | Production ('000) tonnes | Capacity Utilisation (%) | Sales ('000) tonnes | Total sales value (in crore) |
|---|---|---|---|---|
| Amul | 1.54 | 59.35 | 1.47 | 17.45 |
| Nestle | 1.64 | 64.80 | 1.26 | 15.25 |
| Parag | 2.48 | 71.20 | 2.03 | 26.75 |
| Amrit | 2.97 | 76.50 | 2.55 | 31.15 |
| **Total** (including others) | 11.60 | 61.30 | 10.67 | 132.80 |

11. What is the maximum production capacity (in '000 tonnes) of Nestle for Butter?
    (a) 2.53 (b) 2.07
    (c) 2.84 (d) 2.97
12. Which company out of the four companies mentioned above has the maximum unutilised capacity in ('000 tonnes)?
    (a) Amul (b) Nestle
    (c) Parag (d) Amrit

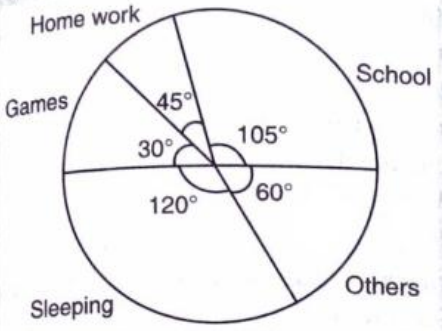
Compiled By Jasjeet

yoursmahboob.wordpress.com


13. What is the approximate total production capacity (in 000 tonnes) for butter in India?
(a) 7.8 (b) 18.9
(c) 11.60 (d) data insufficient

14. What per cent of the total market share (by sales value) is controlled by others?
(a) 32% (b) 83%
(c) 67% (d) data insufficient

***Directions for (Q. no. 15 to 19):*** *The following pie chart shows the hourly distribution of all the major activities of a student.*




15. The percentage of time which he spends in school is :
(a) 38% (b) 30%
(c) 40% (d) 25%

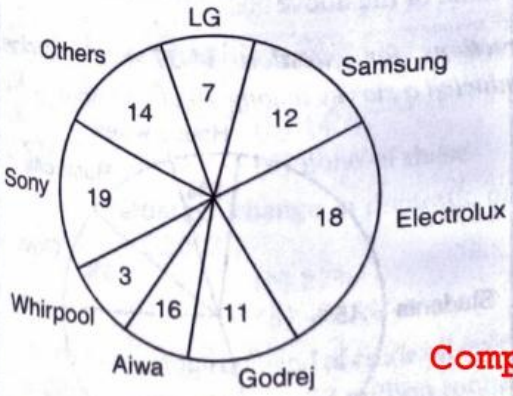
16. How much time (in per cent) he spends in games in comparison to sleeping?
(a) 30% (b) 40%
(c) 25% (d) none of these

17. If he spends the time in games equal to the home work and remains constant in other activities, then the percentage decrease in time of sleeping :
(a) 15% (b) 12.5%
(c) 20% (d) none of these

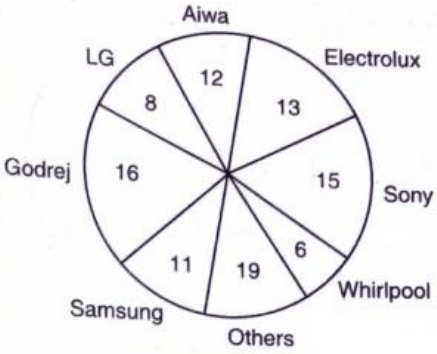
18. What is the difference in time (in hours) spends in school and in home work :
(a) 2 (b) 3
(c) 4 (d) 8

19. If he spends $\frac{1}{3}$rd time of home work in Mathematics then the no. of hours spends in rest of the subjects in homework :
(a) 1 (b) 2
(c) 3 (d) 4

***Directions for question number 20 to 23 :*** *The two pie charts show the market share of different companies which produces TV and Refrigerator (both) in the first quarter of 2005-06.*




T.V.




REFRIGERATOR

**NOTE** The graph is not shown to scale.

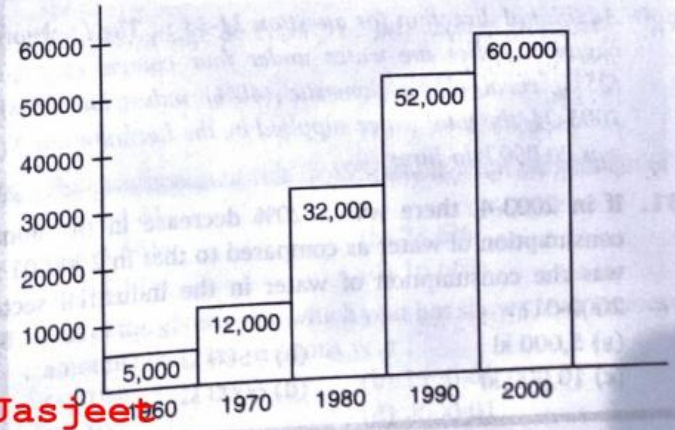
20. The difference in the angle subtended by Sony TV. and refrigerator is :
(a) 7.2° (b) 14.4°
(c) 21.6° (d) none of these

21. If the turn over of Samsung TV is Rs. 31 crores and of Samsung refrigerator is Rs. 9 crore, then what is the overall market share of Electrolux TV and refrigerater combined?
(a) 33.33% (b) 28%
(c) 16.7% (d) 65%

22. If the turnover in the first quarter of 2005-06 of Electrolux TV and Refrigerator is Rs. 42 crores and Rs. 6 crores respectively, then what is the average annual turnover of Godrej and Aiwa in both the product categories together?
(a) Rs. 304 crores
(b) Rs. 284 crores
(c) RS. 178 crores
(d) none of the above

23. Which of the following cann't be deduced from the given data :
(a) The angular difference between Samsung TV and Electrolux refrigerator is 3.6°.
(b) Sony is the market leader in the TV and Refrigerator segment combined.
(c) For every Rs. 100 turnover of Whirlpool Refrigerator, the difference in the turnover of Electrolux and Samsung Refrigerator is Rs. 33.34 crore
(d) none of the above

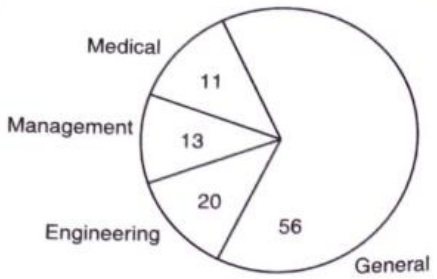
***Directions for question number 24 to 28 :*** *Number of different colleges in India in different years is given in the graph below. Distribution of different colleges in the years 1980 and 1990 shown in the pie charts below :*



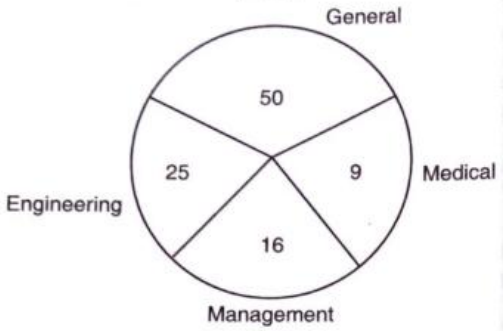

Compiled By Jasjeet

yoursmahboob.wordpress.com






(1980)




(1990)

**NOTE** General courses include all the courses except Medical, Engineering and management

**24.** What is percentage increase in the number of colleges from 1960 to 1990?
(a) 1000% (b) 940%
(c) 1040% (d) 470%

**25.** The growth rate in no. of medical colleges in 1980 to 1990 is :
(a) 33% (b) 52%
(c) 36% (d) 39%

**26.** By what percentage did the no. of Engineering colleges go up from 1960 to 1970?
(a) 38% (b) 28%
(c) 42% (d) cann't of be determind

**27.** Till 1990 what was the highest increase in the number of colleges in any decade?
(a) 150% (b) 166.66%
(c) 200% (d) 140%

**28.** If the projected increase in the number of colleges in 2000 over 1990 is to be the same in all the categories of colleges, the percentage of Medical colleges in 2000 will be :
(a) 9% (b) 11%
(c) 7% (d) 13%

***Directions for question number 29 to 33 :*** *Answer the questions based on the following information. The following table gives the tariff (in paise per kilo-litre) levied by the Lucknow jal Nigam in 2003-04 in four sectors and the region within them. (Each sector is divided in 5 regions). The table gives the percentage change in the tariff as compared to 2000-01.*

| | Region 1 | | Region 2 | | Region 3 | | Region 4 | | Region 5 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | P/kl | % | P/kl | % | P/kl | % | P/kl | % | P/kl | % |
| **Sector 1** | 1000 | + 25 | 400 | + 14.28 | 250 | – 16.66 | 625 | + 4.166 | 720 | + 20% |
| **Sector 2** | 800 | + 33.33 | 375 | + 7.14 | 350 | – 12.5 | 750 | + 7.14 | 360 | – 10 |
| **Sector 3** | 625 | – 16.66 | 525 | – 12.5 | 400 | + 14.28 | 240 | – 4% | 320 | – 20 |
| **Sector 4** | 575 | – 4.166 | 800 | – 20% | 500 | – 16.66 | 360 | + 20% | 400 | – 11.11 |

**29.** If the amount of water consumed by the various regions in sector 1 is the same, then as compared to 2000-01 the net tariff in 2003-04 :
(a) increased by 20% (b) increased by 13%
(c) decreased by 12% (d) decreased by 20%

**30.** What was the approximate average tariff in region 2 in 2000-01?
(a) 450 (b) 675
(c) 575 (d) 525

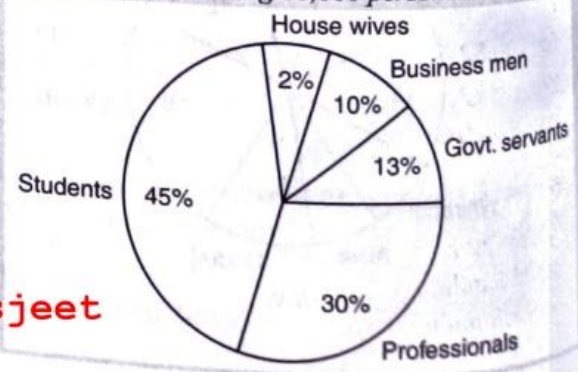
***Additional direction for question 31-33 :*** *The Lucknow Jal Nigam supplies the water under four categories : Urban (25%) rural (15%) domestic (40%) industrial (20%). In 2003-04, the total water supplied by the Lucknow Jal Nigam was 20,000 kilo-litres.*

**31.** If in 2003-4, there was a 20% decrease in the domestic consumption of water as compared to that in 2000-01 what was the consumption of water in the industrial sector in 2000-01?
(a) 5,000 kl (b) 7500 kl
(c) 10,000 kl (d) 6000 kl

**32.** In the given two years, what is the total tariff paid by the Urban sector?
(a) Rs. 16,000 (b) Rs. 48,000
(c) Rs. 23,000 (d) can't be determined

**33.** Which of the following statements is true?
(a) The average tariff in region 2 is 625
(b) The average tariff in region 4 is greater than the average tariff in region 5
(c) In 2000-01 the industrial sector contributed about 30% of the total revenue from water supply
(d) none of the above

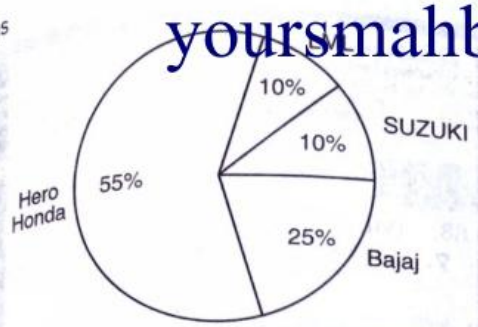
***Directions for question 34-37 :*** *A marketing company conducted a survey among 10,000 person in Kanpur :*




Compiled By Jasjeet

yoursmahboob.wordpress.com






*It was observed that some people have more than one bike but from only one company i.e., a particular person can have more than one bike of HeroHonda, but not from bajaj etc. and vice versa. Thus there were total 12,000 bikes with 10,000 persons used for survey. There are only four companies operating in this market.*

34. If each of Students, Govt. Servants and housewives use a Hero Honda bike (motorcycle), what per cent of the remaining people drive Hero Honda bike?
(a) 15% (b) 25%
(c) 20% (d) none of these

35. If the number of people who drive one, two and three bikes are in the ratio 15 : 3 : 1 what is the number of people in the survey who do not drive even a single bike?
(a) 750 (b) 400
(c) 600 (d) 500

36. If all the persons driving more than one bike drive only Hero Honda what is the number of people who drive single Hero Honda bike (the data can be used from previous question if necessary)?
(a) 2400 (b) 2100
(c) 4200 (d) 2600

37. If 20% of the persons who drive Bajaj's bike also drive another bike. What is the number of people who drive only Bajaj' bike ?
(a) 2400 (b) 2500
(c) 2660 (d) none of these

***Directions for question 38-42 :*** *A table below shows the production and imports of crude oil (in '000 tonnes). Domestic production of crude oil is total of on-shore and off-shore production, which is supplemented by imports to meet the total demand of crude oil in the country.*

| Year | 2001 | 2002 | 2003 |
|---|---|---|---|
| On shore | 12,000 | 11,500 | 11,000 |
| Off shore | 11,000 | 19,000 | 16,000 |
| Imports | 21,000 | 24,000 | 30,000 |

(in '000 tonnes)

38. What was the percentage of domestic production of crude oil over imports in 2001?
(a) 80% (b) 140%
(c) 109.52% (d) none of these

39. What was the percentage change in domestic production of crude oil from 2001-2003 ?
(a) 14% (b) 27%
(c) 17.4% (d) – 10%

40. What is the average of total demand of crude oil over the period?
(a) 185 million tonnes (b) 52 million tonnes
(c) 18.5 million tonnes (d) 35 million tonnes

41. What was the approx-percentage increase in imports of crude oil from 2001 to 2003 :
(a) 49% (b) 65%
(c) 43% (d) none of these

42. If in the year 2004, off-shore production declines by 12.5% production on-shore remains the same and total demand increases by 2% what will be the imports of crude oil in 2004 ?
(a) 33.14 million tonnes (b) 63 million tonnes
(c) 39 million tonnes (d) 25 million tonnes.

***Directions :*** *(Q. no. 43 to 50) Solve the following question on the basis of given data in the following table :*

**Production of Rice in India**

| Year | Quantity (in tonnes) | Percentage change over the previous year |
|---|---|---|
| 1920-21 | 1,34,300 | + 06.25% |
| 1930-31 | 10,97,172 | + 12.50% |
| 1940-41 | 2,64,280 | + 11.11% |
| 1950-51 | 1,27,890 | – 09.09% |
| 1960-61 | 2,01,924 | + 20.00% |
| 1970-71 | 1,12,325 | – 16.66% |
| 1980-81 | 2,13,465 | – 25.00% |
| 1990-91 | 1,69,368 | + 33.33% |
| 2000-01 | 100,956 | + 50.00% |
| 2010-11 | 23,800 | – 83.33% |

43. What is the production of rice in 1959-60?
(a) 1,84,250 (b) 1,68,270
(c) 242308.8 (d) none of these

44. What is the production of rice in 1949-50?
(a) 116263.6 3 (b) 1,23,460
(c) 1,40,679 (d) none of these

45. What is the total production of rice in 1919-20and 1929-30 and 1939-40 ?
(a) 13,26,400 (b) 13,39,516
(c) 1142693.75 (d) can't be determined

46. The production of rice in 2000-01 forms what percentage of total production out of the given years?
(a) 3.12% (b) 3.23%
(c) 4.128% (d) 6.45%

47. What is the difference in production of rice in 1969-70 and 1979-80 ?
(a) 149830 (b) 175752
(c) 53,890 (d) none of these

48. The percentage decrease in production of rice from 1929-30 to 1949-50
(a) 88.3% (b) 85.57%
(c) 66.66% (d) none of these

49. The production of rice in 1959-60 is what percentage of rice in 1960-61.
(a) 86.66% (b) 75.6%
(c) 83.33% (d) 16.66%

50. Out of the given years which year has shown least increase (in amount) over the previous year :
(a) 1940-41 (b) 1960-61
(c) 1920-21 (d) 2000-01

Compiled By Jasjeet

yoursmahboob.wordpress.com



# Answers

## INTRODUCTORY EXERCISE-5.1

**1.** (i) 50, (ii) 54, (iii) 112.5, (iv) 400, (v) 2 quintal, (vi) 544.5, (vii) 88, (viii) 6 minutes, (ix) 200, (x) 2 lakh rupees
**2.** Rs. 4,500 **3.** 28 metres **4.** 750 **5.** 190 and 1520 **6.** 750 **7.** 102 km/hr **8.** Rs. 2200 **9.** 75 **10.** 750
**11.** 60000 **12.** 255

## INTRODUCTORY EXERCISE-5.2

**1.** (i) 5%, (ii) 15.625, (iii) 33.33%, (iv) 24%, (v) 20%, (vi) 150%, (vii) 66.66%, (viii) 43.75%
**2.** (i) 4%, (ii) 75%, (iii) 6.25%, (iv) 33.33%, (v) 0.4166%, (vi) 7.5%
**3.** 85.33% **4.** 70% **5.** 97% **6.** 150% **7.** $33\frac{1}{3}\%$ **8.** 90% **9.** 12.5% **10.** 4%

## INTRODUCTORY EXERCISE-5.3

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1** (b) | **2.** (b) | **3.** (b) | **4.** (c) | **5.** (c) | **6.** (c) | **7.** (d) | **8.** (c) | **9.** (a) | **10.** (b) |

## LEVEL-1

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1** (b) | **2.** (b) | **3.** (b) | **4.** (c) | **5.** (d) | **6.** (d) | **7.** (d) | **8.** (c) | **9.** (b) | **10.** (d) |
| **11.** (d) | **12.** (b) | **13.** (c) | **14.** (b) | **15.** (a) | **16.** (b) | **17.** (c) | **18.** (a) | **19.** (c) | **20.** (b) |
| **21.** (c) | **22.** (d) | **23.** (d) | **24.** (b) | **25.** (a) | **26.** (c) | **27.** (b) | **28.** (c) | **29.** (b) | **30.** (c) |
| **31.** (a) | **32.** (b) | **33.** (b) | **34.** (c) | **35.** (b) | **36.** (c) | **37.** (b) | **38.** (c) | **39.** (c) | **40.** (b) |
| **41.** (a) | **42.** (d) | **43.** (a) | **44.** (c) | **45.** (d) | **46.** (d) | **47.** (b) | **48.** (c) | **49.** (c) | **50.** (b) |
| **51.** (c) | | | | | | | | | |

## LEVEL-2

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1** (d) | **2.** (c) | **3.** (a) | **4.** (d) | **5.** (d) | **6.** (d) | **7.** (a) | **8.** (d) | **9.** (b) | **10.** (d) |
| **11.** (c) | **12.** (c) | **13.** (a) | **14.** (c) | **15.** (a) | **16.** (d) | **17.** (c) | **18.** (b) | **19.** (b) | **20.** (c) |
| **21.** (b) | **22.** (a) | **23.** (a) | **24.** (d) | **25.** (b) | **26.** (a) | **27.** (c) | **28.** (d) | **29.** (c) | **30.** (c) |
| **31.** (b) | **32.** (d) | **33.** (b) | **34.** (b) | **35.** (a) | **36.** (a) | **37.** (c) | **38.** (c) | **39.** (b) | **40.** (c) |
| **41.** (c) | **42.** (a) | **43.** (a) | **44.** (c) | **45.** (b) | **46.** (b) | **47.** (a) | **48.** (b) | **49.** (c) | **50.** (c) |

## FINAL ROUND

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1** (a) | **2.** (b) | **3.** (a) | **4.** (c) | **5.** (d) | **6.** (b) | **7.** (d) | **8.** (a) | **9.** (d) | **10.** (b) |
| **11.** (a) | **12.** (a) | **13.** (b) | **14.** (a) | **15.** (b) | **16.** (c) | **17.** (b) | **18.** (c) | **19.** (b) | **20.** (b) |
| **21.** (c) | **22.** (a) | **23.** (b) | **24.** (b) | **25.** (a) | **26.** (d) | **27.** (b) | **28.** (b) | **29.** (b) | **30.** (c) |
| **31.** (a) | **32.** (d) | **33.** (b) | **34.** (a) | **35.** (d) | **36.** (b) | **37.** (a) | **38.** (c) | **39.** (c) | **40.** (b) |
| **41.** (c) | **42.** (a) | **43.** (b) | **44.** (c) | **45.** (b) | **46.** (c) | **47.** (a) | **48.** (b) | **49.** (c) | **50.** (c) |

Compiled By Jasjeet

yoursmartboob.wordpress.com


## LEVEL 1

1.

| F | M |
|---|---|
| $60x$ | $40x$ |
| $42x$ | $20x$ |

$62x$ (comp. lit.)

$\therefore$ Female comp. literate $1600 \times \frac{42}{100} = 672$

2. $(10,00,000) \times 0.75 \times 0.80 \times 0.85 =$ Rs.5,10,000

3. $2000 \times \frac{x}{100} + 4000 \times \frac{y}{100} = 320$

and $2000 \times \frac{x}{100} + 10,000 \times \frac{y}{100} = 680$

$\therefore$ $x = 4$ and $y = 6$

$\therefore$ $x - y = -2$

4. Go through option $(40 \times 0.4) + (40)^2 = 1616$

$\left(100 \times \frac{1616}{40} = 4040\right)$

**Alternatively:** $(x \times 0.4) + x^2 = \frac{x \times 4040}{100}$

$\Rightarrow$ $x^2 = 40x \Rightarrow x = 40$

5. Can't be determined. We don't that whether there are some male employees who have exactly Rs. 8000 per month as their salary or not.

6.

| | Physics | Chemistry |
|---|---|---|
| Failed | 35% | 45% |
| Passed | 65% | 55% |

Passed in both = 22% of total student

Percentage of students who are passed in any of the Physics or Chemistry or both = (65 + 55) − 22 = 98%

So, the percentage of students who are failed in both = 2%

Therefore total failed (in both the subject) students = 12

7.

| | History | Geography |
|---|---|---|
| Pass | $70x$ | $50x$ |
| Fail | $30x$ | $50x$ |

both $20x$

$\therefore$ Total failed candidates $= (30x + 50x) - 20x = 60x$

Passed in both $= (100x - 60x) = 40x = 500$

Therefore total students $= 100x = 1250$ $\quad \because x = \frac{25}{2}$

8.

My salary = 100

Salary of my brother = 110

Salary of my sister = 120

Salary of my wife $= 230 - \left(230 \times \frac{1300}{23 \times 100}\right) = 100$

$\because$ $56\frac{12}{23} = \frac{1300}{23}$

9. $\frac{60 \times 8 + 16 \times 30}{16 \times 60 \times 60} \times 100 = 1.66\%$

10. Total land of Sukhiya $= \frac{480x}{0.6} = 800x$

$\therefore$ Cultivated land of village $= 384000x$

$\therefore$ Required percentage $= \frac{800x}{384000} \times 100 = 0.20833$

11.

Area $= l \times b$

$1 = 1 \times 1$

$1 = 0.8 \times 1.25$

So the area remained constant

12. Cost of fresh Mangoes + Packaging cost = Total cost

$1 + 0.4 = 1.4$

$1.3 + 0.2 = 1.5$

Percentage increase in cost $= \frac{0.1}{1.4} \times 100 = 7.14\%$

13. $\frac{80}{100} + \frac{66}{100} + \frac{x}{200} = \frac{320}{400}$

$\Rightarrow$ $x = 174 \Rightarrow 87\%$

14.

| Male | Female |
|---|---|
| $55x$ | $45x$ |

$\Rightarrow$ $10x = 72$

$x = 7.2$

$100x = 7.2 \times 100$

15. Let the total votes be $x$,

Polled votes $= 0.75x$

valid votes $= 0.70x$

$A + B + C = 0.70x$

2450

1750

$0.4x$

It means $B + C = 0.3x$ since given that $A = 0.4x$

Hence $A$ is the winner.

16.

| Bike | Car |
|---|---|
| $x$ | $5x$ |
| $1.2x$ | $5.75x$ |

Initially total cost $= 25x + 10x = 35x$

Changed cost $= 28.75x + 12x = 40.75x$

Percentage change $= \frac{5.75}{35} \times 100 = 16\frac{3}{7}\%$

18. Go through option

| S | K |
|---|---|
| 15,000 | 18,000 |
| 12,000 | 16,000 |

Going in the reverse direction.

Hence, the presumed option is correct.

Compiled By Jasjeet

yoursmahboob.wordpress.com



**Alternatively:**

| | Sahid | Kareena |
|---|---|---|
| 25% | $4x$ | $\frac{48x}{9}$ |
| | $5x$ | $6x$ |

$\xrightarrow{+120\%}$

$\Rightarrow$ Initially $S : K = 4x : \frac{48x}{9} = 3 : 4$

$\Rightarrow$ Sahid's initial salary = 12,000

Sahid's changed salary = 15000

**19.** Let the smaller number be $x$ and larger number be $y$

$$0.8x + 4 = 0.4y$$

$\Rightarrow$ $4y - 8x = 40$

and $y - x = 85$

$\Rightarrow$ $x = 75$ and $y = 160$

$\therefore$ $x + y = 235$

**20.** $\frac{x \times 220}{100} = 44$

$\Rightarrow$ $x = 20$ So $\frac{20 \times 44}{100} = 8.8$

**21.** Quantity × Rate = Price

$1 \times 1 = 1$

$0.7 \times 1.25 = 0.875$

$\therefore$ Decrease in price $= \frac{0.125}{1} \times 100 = 12.5\%$

**22.** Go through options

| | P | Q | |
|---|---|---|---|
| In the Ist government | 275 ← | 225 | Difference = 50 |
| In the 2nd government | 200 ← | 300 | Difference = 100 |

Hence, the presumed option (d) is correct

**NOTE** It can also be solved through the equation and variables

**23.** Passing marks are $0.6x$

So $0.3x + 30 = 0.6x \Rightarrow x = 100$

**24.** Go through options

| Girls | Boys |
|---|---|
| 800 | 1000 |

Now, $0.95 \times 800 + 1000 = 0.96 \times 1000 + 800$

Hence the presumed option is correct.

**25.**

| H | E | U |
|---|---|---|
| $0.6x$ | $0.24x$ → | $0.16x$ |
| | ↓ | |
| | 3600 ⟶ | 2400 |

$(\because E : U = 24 : 16 = 3 : 2)$

**26.** Go through option

75

25 → 20 ; 50 → 30 (60%)

$\frac{50}{75} \times 100 = 66.66\%$

Hence, the presumed option is correct.

**27.**

| Science | Commerce | Arts | Engineering |
|---|---|---|---|
| $\frac{x}{6}$ + | $\frac{x}{8}$ + | $\frac{x}{15}$ | $K$ |

No. of Engineering student $= 1 - \left(\frac{x}{6} + \frac{x}{8} + \frac{x}{15}\right) = k = \frac{77x}{120}$

When $x = 120$ (the least possible number) then the no of Engineering students = 77

**28.**

| Copper | : | Aluminium | |
|---|---|---|---|
| 7 | : | 4 | |
| 21 kg | | 12 kg | → 33 kg |

Required total alloy $= \frac{33}{0.88} = 37.5$ kg

**29.** $1.08x = 1404$

$x = 1300$

Therefore reduction in price = 1404 − 1300 = Rs. 104

$\left[\text{Since } 1300 + 1300 \times \frac{8}{100} = 1404\right]$

So you can solve it by using options.

**30.** Very fundamental question.

**31.** $8x + 9x + 10x = 810$

$\Rightarrow$ $x = 30$

Total marks in QA ⟶ 240

DI ⟶ 270

$\frac{VA}{RC}$ ⟶ 300

Now her score in QA ⟶ $\frac{240}{1.2} = 200$

Her score in DI $= \frac{270}{1.08} = 250$

Her score in $\frac{VA}{RC} = \frac{300}{1.0714} = 280$

Her total score = 200 + 250 + 280 = 730

**32.** Commission up to 10000 $= 10000 \times \frac{9}{100} = 900$

Again after 10000,

| Commission | : | Bonus |
|---|---|---|
| 9 | : | 3 |
| $3x$ | : | $x$ |

$\Rightarrow$

$\therefore$ Bonus $= (1380 - 900) \times \frac{1}{4} =$ Rs. 120

**33.**

| Men | Women |
|---|---|
| $600x$ | $400x$ |

Total Engineer = $480x$

Male Engineer $= 480x \times 0.66 = 320x$

$\therefore$ Women who are Engineers = $160x$

$\therefore$ Women who are not Engineers = $400x - 160x = 240x$

Required percentage $= \frac{240}{400} \times 100 = 60\%$

**34.**

| | Veer | Zara |
|---|---|---|
| In the last month | 160 | 100 |
| After the first change | 200 | 75 |
| After final change | 120 | 120 |

Compiled By Jasjeet

yoursmahboob.wordpress.com


Time × Rate = Total changes

35. $1 \times 1 = 1$

$x \times 1.25 = 1.1$

$$x = \frac{1.1}{1.25} \times 100 = 88\%$$

Thus decrease in time = 12%

36.

| | Ambani | Sahara |
|---|---|---|
| Average earning | $4x$ | $5x$ |
| No. of family members | $k$ | $l$ |
| Total earning | $6y$ | $5y$ |

Average earning × Number of family members = Total earning

$$l = \frac{5y}{5x} = \frac{y}{x}$$

$$k = \frac{6y}{4x}$$

$$\text{Required percentage} = \frac{l}{k} \times 100 = \frac{\frac{y}{x}}{\frac{6y}{4x}} \times 100$$

$$= \frac{4}{6} \times 100 = 66.66\%$$

**Alternatively :** After some steps you can use the options.

37.

| Year | Value |
|---|---|
| 2000 | 100 |
| 2001 | 110 |
| 2002 | 121 |
| 2003 | 133.1 |
| 2004 | 119.79 |
| 2005 | 107.811 |
| 2006 | 97.0299 |

**SOLN** $(100) \times 1.1 \times 1.1 \times 1.1 \times 0.9 \times 0.9 \times 0.9 = 97.0299$

Now, $\frac{100 - 97.0299}{100} \times 100 \approx 3\%$

38. $30 \times 25 \times 35 = x \times 30 \times 28$

$\Rightarrow$ $x = 31.25$

It means 32 pages.

So, the percentages increase in the no. of pages

$$= \frac{2}{30} \times 100 = 6.66\%$$

39. Rate of increase of the price

= (rate of inflation + 2)% = 8 + 2 = 10%

| Jan 2004 | Jan 2005 | Jan 2006 |
|---|---|---|
| 20 | 20 | 22 |
| | +2 | +2.2 |
| | | 24.2 |

**Alternatively:** Expected price after 2 years

$= 20 \times 1.1 \times 1.1 = 24.2$

40. Let the total number of people = $x$

then the amount donated by $0.6x$ people

$= 600 \times 0.6x = 360\,x$

Now since Rs. $360x$ is equal to 75% of the required amount. Hence we need only 25% more amount from the rest of the people *i.e.*, from $0.4x$ people

Hence average requirement $= \frac{120x}{0.4x} = 300$

**Alternatively:** $(600 \times 0.6 + k \times 0.4)\frac{3}{4} = 600 \times 0.6$

$\Rightarrow$ $k = 300$

41. By mistake $= \frac{x}{10}$

Actual value $= x \times 10$

$$\text{\% change} = \frac{10x - \frac{x}{10}}{10x} \times 100 = \frac{99}{100} \times 100$$

= 99% (negative)

Since actual value is greater than the wrong value

**Alternatively :**

Actual result $= 10 \times 10 = 100$ (suppose $x = 10$)

wrong result $= \frac{10}{10} = 1$

% change $= \frac{100 - 1}{100} \times 100 = 99\%$

**NOTE** Percentage error is always calculated on the basis of actual (*i.e.*, correct) value.

42. Use some different values for $x$ then verify.

Let $x = 150$ then % error $= \frac{200 - 100}{100} \times 100 = 100\%$

Again if $x = 100$ then % error $= \frac{150 - 50}{50} \times 100 = 200\%$

Hence, we cannot determine.

43. Number of visitors × Rate = Revenue collected

$1 \times 1 = 1$

−20% $\downarrow$ 0.8 $\times 1.5$ +50% $= 1.2$

Therefore percentage change in the revenue

$$= \frac{1.2 - 1}{1} \times 100 = 20\%$$

44.

| | Bata | Woodland |
|---|---|---|
| M.P | 100 | 100 |
| S.P. | 51 | 51 |

(Since the marked prices are same)

**NOTE** M.P. → Marked price, S.P. → Selling price
decreased by 49% = reduced to 51%

45. Selling price = cost price + profit

Shirt $= 7y + x$

Coat $= 12y + x$

Since, the profit is same, so the selling price of shirt will certainly be less than Rs. 2000 (which is half of the total value) as it is clear that cost price of shirt is less than the cost price of coat.

**NOTE** If selling price of shirt is equal to or greater than the selling price of coat then the C.P. of coat will be equal to or less than the C.P. of shirt which is wrong. Hence the only possible choice is (d).

46. Since we don't have sufficient data. Further any value is possible as the required income tax.

Compiled By Jasjeet

yoursmahboob.wordpress.com



**47.** $2004 \longrightarrow 10000 \times x\% = k$

$2005 \longrightarrow 16000 \times \frac{5}{8} x\% = k$

but $\quad x - \frac{5}{8}x = 9 \Rightarrow x = 24\%$

So, the income tax = 2400.

**48.** Only (c) is correct since it is divisible by 4.
Let the original number of element be $x$ then the new no. of elements will be

$$\frac{4x}{5} = K$$

So $K$ must be divisible by 4

Since, $\quad x = \frac{K \times 5}{4}$

**49.** Go throught option

| Boys | Girls | Total |
|---|---|---|
| 14 | 11 | 25 |
| 56 | 44 | 100 |

(12)

Since out of 50 students no. of boys are greater than the no. of girls by 12 *i.e.*, 12% Hence correct.

**Alternatively :**

Let the no. of boys and girls be $x$ and $y$ respectively

then $\quad (x - y) = \frac{12 \times (x + y)}{100}$

$\Rightarrow \quad \frac{x}{y} = \frac{14}{11}$

**50.** Population after 2 years $= 5000\left(1 + \frac{2}{100}\right)^2$

$$5000 \times \frac{51}{50} \times \frac{51}{50} = 5202$$

**51.** Daily supply $= (100 - z)\%$ of $y = \frac{(100 - z)y}{100}$

$\therefore \quad$ Required no. of days $= \frac{x \times 100}{(100 - z)y}$

## LEVEL 2

**1.**

Total Students (100)
- Boys (60)
  - Hockey (24)
  - Badminton (don't know about badminton)
- Girls (40)
  - Badminton (30)
  - Hockey (0)

Since we do not have information that whether the rest of the boys playing badminton or not. So we can not determine the total no. of students who are not playing any of the two games.

**2.** Go through option. Let us assume option (c)

$$10 = 2 \times 5 = 5 \times 2 = 1 \times 10 \times 10 \times 1$$

Consider the proper fraction $= \frac{2}{5}$

[Since the given percentage values are 25% and 20% that's why we have picked up option (c)].

$$\frac{2}{5} \rightarrow \frac{4}{25} \rightarrow \frac{5}{20}$$

To verify : $\quad \frac{2}{5} \times \frac{5}{8} = \frac{1}{4} = \frac{5}{20}$

Hence presumed option is correct

**Alternatively:** $\frac{x}{y} \rightarrow \frac{x^2}{y^2} \rightarrow \frac{1.25x^2}{0.8y^2} = \frac{25}{16}\frac{x^2}{y^2}$

Now since $\quad \frac{25x^2}{16y^2} = \frac{5}{8}\left(\frac{x}{y}\right)$

$\Rightarrow \quad \frac{x}{y} = \frac{2}{5}$

**3.** Income = Expenditure + Savings

$$8x = (5x + 3x)$$
$$10x = (8x + 2x) - x$$

Now the deficit $= (3x - 2x) = x = 3500$

and $\therefore$ the new salary $= 10x = 35{,}000$

**Alternatively :** Go through options.

**4.** Go through options

$$2457 - 2143 = 314 \quad \text{(True)}$$

Again $(2457 + 2143) + 41 = 4641$

Now $\quad \frac{4641}{0.85} \rightarrow 5460$

Again $\quad \frac{5460 \times 45}{100} = 2457 \quad$ (True)

Hence the presumed option is correct.

**Alternatively:** Let there be total $x$ eligible voters, and the no. of votes goes to loser is $k$ then

$$0.85x - 41 = 2k + 314 \quad \ldots(1)$$
$$k + 314 = 0.45x \quad \ldots(2)$$

Therefore $\quad x = 5460$

then, $\quad 5460 \times 0.85 = 4641$

Again $\quad 4641 - 41 = 4600$

Again $\quad k + (k + 314) = 4600$

$\Rightarrow \quad k = 2143 \quad$ (loser)

and $\quad k + 314 = 2457 \quad$ (winner)

**5.**

| | | | | | | |
|---|---|---|---|---|---|---|
| Income → | 4 | 4.4 | 4.8 | 5.2 ] | 18.4 | lakh |
| Saving → | 2 | 1.76 | 1.44 | 1.04] | 6.24 | lakh |
| Exp. → | 2 | 2.64 | 3.36 | 4.16] | 12.16 | lakh |

So, $\quad \frac{6.24}{12.16} \times 100 = 51\frac{6}{19}\%$

**6.** Let there be $x$ voters and $k$ votes goes to loser then

$$0.8x - 120 = k + (k + 200)$$

$\Rightarrow \quad k + 200 = 0.41x$

and $\quad k = 1440$

$(k + 200) = 1640$

Therefore $\quad \frac{1440}{3200} \times 100 = 45\%$

Compiled By Jasjeet

yoursmahboob.wordpress.com



**Solutions for 7 – 9 :**

$$P + R = 30{,}000 \quad ...(1)$$

$$N = R - 8000 \quad ...(2)$$

$$(R + N) = 233.3\,(P)$$

$$3\,(R + N) = 7P \quad ...(3)$$

$$\Rightarrow \quad 6R - 7P = 24{,}000 \quad ...(4)$$

$$\Rightarrow \quad R = 18{,}000$$

$$\therefore \quad P = 12{,}000$$

and $N = 10{,}000$

and $\dfrac{P+R+N}{3} = \dfrac{40{,}000}{3} = 1333.33$

7. Can't be determined

8. $\dfrac{8}{10} \times 100 = 80\%$

9. (Bonus) Commission $= \dfrac{20 \times 10{,}00{,}000}{100} = 2$ lakh

but total profit = net profit + $\dfrac{10}{100}$ × net profit

$\Rightarrow$ 1.32 lakh = 1.1 × net profit

$\Rightarrow$ net profit = 1.2 lakh = 1,20,000

$\therefore$ commission = total profit − net profit

= 1,32,000 − 1,20,000 = 12,000

hence total earning = 2,00,000 + 12,000 = 2,12,000

10. Let Mr. Scindia has $x$ shares of 5.5%

$$x \times 92 = 32{,}200$$

$$\Rightarrow \quad x = 350 \text{ shares}$$

$$\text{Income} = 350 \times 5.5 = 1925$$

Now, after investment his income is

$$\left(\frac{1}{3} \times \frac{32200}{92} \times 4.5\right) + \left(\frac{2}{5} \times \frac{32200}{115} \times 5\right) + \left(\frac{4}{15} \times \frac{32{,}200}{56} \times 6\right)$$

$$= 525 + 560 + 920 = 2005$$

Profit = 2005 − 1925 = Rs. 80

11. The surface area of a cube = $6a^2 = 6 \times (\text{side})^2$

New surface area = $6 \times 1.44\,a^2$

$$\therefore \quad \frac{0.44\,a^2}{a^2} \times 100 = 44\%$$

**Solution for 13 and 14 :**

$Pati \to Pt, \quad Patni \to Pn, \quad Woh \to W$

$$(Pt + Pn) = 2W \quad ...(i)$$

$$(Pn + W) = 4\,Pt \quad ...(ii)$$

Solving equation (i) and (ii) we get

$$\frac{Pn}{W} = \frac{7}{5} \text{ and } \frac{Pt}{W} = \frac{3}{5}$$

$$\Rightarrow \quad Pt : Pn : W = 3 : 7 : 5$$

Again

$$(Pt + Pn) = 2W \quad ...(iii)$$

and

$$(Pn + W) \times 7 = 8 \times Pt \quad ...(iv)$$

Therefore

$$\frac{Pn}{W} = \frac{3}{5}, \quad \frac{Pt}{W} = \frac{7}{5}$$

$$\Rightarrow \quad Pt : Pn : W = 7 : 3 : 5$$

Gain of Pati $= 7x - 3x = 4x = 800$

$$\Rightarrow \quad x = 200$$

| | Pati | Patni | Woh |
|---|---|---|---|
| Amount at the begining of Game = | 600 | 1400 | 1000 |
| Amount at the end of the game = | 1400 | 600 | 1000 |

**13.** Only Patni has suffered the loss

**14.** $\dfrac{1400 - 600}{1400} \times 100 = 57.1428\%$

**15.**

RM + MC = Total cost

Total cost + Profit = Sale price

70 + 30 = 100  100 + 10 = 110 ┐
84 + 42 = 126  126 + 72 = 198 ◄ + 80%

Therefore profit % $= \dfrac{72}{126} \times 100 = 57.14\%$

**16.**

$$A + B + C + D = 56$$

$$B + C + D = 4.6A$$

$$\Rightarrow \quad A + B + C + D = 5.6A \text{ (adding } A \text{ in both sides)}$$

$$56 \text{ lakh} = 5.6A$$

$$\Rightarrow \quad A = 10 \text{ lakh}$$

Similarly $\quad A + C + D = \dfrac{11}{3}B$

$$\Rightarrow \quad A + B + C + D = \frac{14}{3}B$$

$$\Rightarrow \quad B = 12 \text{ lakh}$$

Similarly $\quad 4\,(A + B + D) = C$

$$\Rightarrow \quad A + B + D = 2.5C$$

$$\Rightarrow \quad A + B + C + D = 3.5C$$

$$\Rightarrow \quad C = 16 \text{ lakh}$$

Therefore $D = (A + B + C + D) - (A + B + C) = 18$ lakh

**17.** Losing candidate = 0.3 $x$

$\therefore$ Other two candidates = 0.7 $x$

The share of winning candidate = 0.36 $x$

and the second ranker = 0.34 $x$

$\therefore$ Margin (min. possible) = 0.02 $x$

$\Rightarrow$ 2% of $x$

Let the minimum possible voters be 50 then

$$\frac{2 \times 50}{100} = 1$$

Hence the minimum possible margin of votes = 1

**18.**

| Day | Initial amount | Sales | Remaining over night | Rotten | Stock for next day |
|---|---|---|---|---|---|
| I | $x$ | $0.5x$ | $0.5x$ | $0.05x$ | $0.45x$ |
| II | $0.45x$ | $0.225x$ | $0.225x$ | $0.0225x$ | $0.2025x$ |
| III | $0.2025x$ | $0.10125x$ | $0.10125x$ | $0.010125x$ | |

$\therefore$ Total rotten amount $= 0.082625x = 1983$

$$\Rightarrow \quad x = 24{,}000$$

Compiled By Jasjeet

yoursmahboob.wordpress.com



**19.** Check through option

**Alternatively :** Let the initial amount be $x$ (with gambler), then

$$\left(\left((x+100)\frac{1}{2}+100\right)\frac{1}{2}+100\right)\frac{1}{2}=\frac{x}{2}$$

$$\Rightarrow \qquad x=\frac{700}{3}$$

**20.** Non-defective products

$$\frac{25\times 0.98+35\times 0.96+40\times 0.95}{100}\times 100=96.1$$

**21.**

| No. of Machines | Output | Manf. cost | Est. cost | Total cost | Profit |
|---|---|---|---|---|---|
| 12 | 48,000 | 24,000 | 10,000 | 34,000 | 14,000 |
| 11 | 44,000 | 22,000 | 10,000 | 32,000 | 12,000 |

Profit = out put – Total cost

= 44,000 – 32,000 = 12,000

Initial value of share holders $= 14{,}000\times\frac{10}{100}=1400$

Changed value of share holders $= 12{,}000\times\frac{10}{100}=1200$

% decrease $=\frac{200}{1400}\times 100=14.28\%$

**22.**

| Rice | Wheat |
|---|---|
| 25 | 9 |
| $\times x$ | $\times 5x$ |
| $25x$ | $45x$ |

$$70x=350$$

$$\Rightarrow \qquad x=5$$

Hence the price of Rice = Rs. 5 per kg

Price of wheat = Rs. 25 per kg

Now, the price of wheat = Rs. 30 per kg

Let the new amount of Rice be $M$ kg, then

$$M\times 5+9\times 30=350$$

$$M=16$$

Hence decrease (in%) of amount of rice

$$=\frac{25-16}{25}\times 100=36\%$$

**23.**

| Year | Rate of Commission | Commission in values |
|---|---|---|
| 1 | 20% | $0.2\times 20{,}000=4000$ |
| | 25% (bonus) | $0.25\times 4000=1000$ |
| 2 | 16% | $0.16\times 20{,}000=3200$ |
| 3 | 12% | $0.12\times 20{,}000=2400$ |
| 4 | 10% | $0.1\times 20{,}000=2000$ |
| 5–10 | 4% | $6\times 0.04\times 20{,}000=4800$ |

Total commission

= (4000 + 3200 + 2400 + 2000 + 48 00) + (1000) = 17,400

**Solution for 24-25**

| | OHIO | TEXAS |
|---|---|---|
| Last year : | $600\leftarrow\overset{(M:F)}{(2:1)}$ | $\overset{(M:F)}{(5:6)}\rightarrow 1100$ |
| This year : | $750\leftarrow(2:1)$ | (unknown) $\rightarrow 1200$ |

**24.** Since we don't know the number of female employees in the Texas office this year so we can't determine

**25.** 1100 + 600 = 1700

**26.** There is no need to use the no. of goats *i.e.*, (34, 396) initially there be 1000 goats then

$$1000\rightarrow 1400\rightarrow 980\rightarrow 1274\rightarrow 1146.6$$

Thus the % increase $=\frac{1146.6-1000}{1000}\times 100=14.66\%$

**27.** In 2002 (980 goats) as per the flow chart

| Optional | Science | Commerce | Engi-neering | Total |
|---|---|---|---|---|
| | 5000 | 3000 | 8000 | 16,000 |
| Finance | 1000 | 1200 | 680 | 2880 |
| HR | 1600 | 720 | 1040 | 3360 |
| Marketing | 2400 | 1080 | 6280 | 9760 |

**28.** 6280 Students of Engineering opted marketing

**29.** $\frac{720}{16{,}000}\times 100=4.5\%$

**30.** Marketing, since maximum students have opted marketing

**31.** Consider some values and then verify the option.

**32.** Go through option :

700
↓
91% = (100 – 9)%
↓
637
↓
80%
↓
509.6 ≈ 510 persons
↓
70% (completely cured out)
↓
357
↓
(Partially cured) 153 = (510 – 357)

Hence, the presumed option is corret

**33.** Total expenditure per kg

= 3.2 + 1.8 + 2 + 3 = 10 = cost price

Selling price = Rs. 18 (per kg)

Gross profit = Rs. 8 per kg = (18 – 10)

Net profit $=8\times\frac{80}{100}$ (since 20% is tax) = Rs. 6.4

Hence the net profit of the factory = 6.4 × 50,00,000

= Rs. 3,20,00,000 = Rs. 3.2 crore

**34.** Let the percentage marks in QA = $(10a+b)\%$

Let the percentage marks in DI = $(10b+a)\%$

Let the percentage marks in VA = $x\%$

then $\frac{(10a+b)+x+(10b+a)}{3}=x$

$$\Rightarrow \qquad 11a+11b+x=3x$$

$$\Rightarrow \qquad x=\frac{11}{2}(a+b)$$

Thus the percentage of the VA section is a multiple of 11

Compiled By Jasjeet

yoursmahboob.wordpress.com



$$P_1 = k\frac{T}{V}$$

$$P_2 = k\frac{1.4T}{0.8} = K\frac{7T}{4V}$$

$$\frac{P_2 - P_1}{P_1} = \frac{\frac{7}{4}\frac{T}{V} - \frac{T}{V}}{\frac{T}{V}} = \frac{\frac{3}{4}\frac{T}{V}}{\frac{T}{V}} = \frac{3}{4}$$

Hence, the new pressure will be increased by 75%.

36. $20 \times 0.92 \Rightarrow$ 10 minutes.

$$\frac{23 \times 40 \times 0.90}{20 \times 0.92} = 45$$

Thus the required time is 45 times than the previous time

Hence, 450 minutes $= 7\frac{1}{2}$ hrs.

37. Original volume $= 16 \times 12 \times 5 = 960\ (\text{inch})^3$

Required capacity $= 1120\ (\text{inch})^3$

Increase in area $= \frac{1120}{5} - 16 \times 12$

$= 224 - 192 = 32\ (\text{inch})^2$

% increase $= \frac{32}{192} \times 100 = 16.66\%$

38. The total passengers in each compartment $= 25 \times \frac{7}{5} = 35$

Total no. of seats $= (35)^2 = 1225$

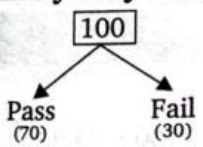
Maximum available capacity $= 1225 \times \frac{80}{100} = 980$ seats

39.

| | Tata | Reliance |
|---|---|---|
| Prepaid | 100 | 81 |
| Postpaid | 90 | 72 |

Thus the % decrease in talk time $= \frac{90 - 72}{90} \times 100 = 20\%$

40. **Half yearly exam**




**Annual exam**

$$\underbrace{70 \times 0.6}_{42} + \underbrace{30 \times 0.8}_{24}$$

$\therefore$ Total pass in annual exam $= 42 + 24 = 66$

41. Percentage of passed students $= 68\%$ $[100 - 32]\%$

Number of girls passed the exam $= 408$

Number of boys passed the exam $= 476$

Total passed students $= 884$

Therefore total no. of students $= \frac{884}{68} \times 100 = 1300$



**Solution for 42- 45 :**

| Name | Horse | Chariot | Land | Total (in Rs.) |
|---|---|---|---|---|
| Ram | 2 lakh (10) | 80,000 (10) | 20 acre = 1 lakh | 3.8 lakh |
| Sita | 1.6 lakh (8) | 80,000 (10) | 8 acre = 40,000 | 2.8 lakh |
| Laxman | 1 lakh (5) | 2 lakh (25) | 20 acre = 1 lakh | 4 lakh |
| Urmila | 1.4 lakh (7) | 40,000 (5) | 16 acre = 80,000 | 2.6 lakh |

*1.* $R + S = L + U$ *and* $R > S$ *and* $L > U$

*2. Horses* $\rightarrow (R + S) : (L + U) = 3x : 2x = 18x : 12x$

*Again Ram have* $\frac{1}{3}$ *rd horses*

*Therefore* $30x \times \frac{1}{3} = 10x$

*Therefore the horse of Sita* $= 18x - 10x = 8x$

$\Rightarrow$ $x = 1$

*Therefore the horse of Ram* $= 10$ *and Laxman* $= 5$

*No. of chariots of Sita = No. of chariots of Ram* $= \frac{K}{5}$

*and* *no. of chariots of Laxman* $= \frac{K}{2}$

*Hence the no. of chariots of Urmila* $= K - \left(\frac{K}{5} + \frac{K}{5} + \frac{K}{2}\right) = \frac{K}{10}$

*Again* $\frac{k}{2} - \frac{k}{10} = 20 \Rightarrow k = 50$ *chariots*

*Now the 50% property of Laxman = 25 chariots = 2,00,000*

*Hence the total property of Laxman = 4,00,000*

*Thus the area of Land of Laxman* $= \frac{2,00,000 - 5 \times 20,000}{5000}$

$= 20$ acre $= (1$ lakh$)$

*Total property of Urmila*

$= 1,40,000 + 40,000 + 80,000 = 2,60,000$

*Thus the total property of Laxman and Urmila = 6.6 lakh*

**42.** $3.8 - 2.6 = 1.2$ lakh

**43.** Value of chariots of Laxman = 2 lakh

Now since only Ram has the horses of worth Rs. 2 lakh. So only Ram can exchange with Laxman.

**45.** $\frac{7.2 - 6.0}{6.0} \times 100 = 20\%$

**46.** Total cubes $160 + 56 = 216$

Therefore the side of cube = 6 unit

No. of cubes without any exposure $= (6 - 2)^3 = 64$

Thus 64 cubes will be inside of the big cube

Now rest of the cubes $= 160 - 64 = 96$

Again the no. of cubes with one face outside

$= 6 \times (4 \times 4) = 96$

Hence the required percentage $= \frac{96}{216} \times 100 = 44.44\%$

Compiled By Jasjeet

yoursmahboob.wordpress.com

**47.**

(Qualified CAT)
↓
$x$ boys and $x$ girls
↓
(Qualified G.D)
↓
$0.4x$ boys
↓
(Interview)

| IIM-A | IIM-B | |
|---|---|---|
| [ $0.2x$ | $0.2x$ ] | appeared |
| ↓ | ↓ | |
| Qualified | Qualified | |
| ↓ | ↓ | |
| $0.8 \times 0.2x$ | $0.4 \times 0.2x$ | |
| $= 0.16x$ | $= 0.08x$ | |

Total boys qualified the final stage = 0.24%

Thus $0.24x = 24$

$\Rightarrow$ $x = 100$

**48.** Go through option and consider some appropriate values

**Alternatively :** $\frac{p}{100+p} = \frac{q}{100}$

$\Rightarrow$ $100(p-q) = pq$

$\Rightarrow$ $(p-q) = \frac{pq}{100}$

**49.** Let the original price be $P$, then the decrease in value of $P$ after one cycle

$$= P\left(\frac{x}{100}\right)^2 = 21025 \quad \ldots(i)$$

Again the final value after second cycle

$$\Rightarrow P\left(1+\frac{x}{100}\right)\left(1-\frac{x}{100}\right)\left(1+\frac{x}{100}\right)\left(1-\frac{x}{100}\right) = 484416$$

$$\Rightarrow P\left[1-\left(\frac{x}{100}\right)^2\right]^2 = 484416 \quad \ldots(ii)$$

Dividing equation (ii) by equation (i)

$$\frac{\left[1-\left(\frac{x}{100}\right)^2\right]^2}{\left(\frac{x}{100}\right)^2} = \frac{484416}{21025} = \frac{2304}{100}$$

$$\Rightarrow \frac{1-\left(\frac{x}{100}\right)^2}{\left(\frac{x}{100}\right)} = \sqrt{\frac{2304}{100}} = \frac{48}{10}$$

Let $\frac{x}{100} = k$, then

$$\frac{1-k^2}{k} = \frac{48}{10}$$

$\Rightarrow$ $10k^2 + 48k - 10 = 0$

$\Rightarrow$ $5k^2 - 24x - 5 = 0$

$\Rightarrow$ $k = 5$ or $k = -\frac{1}{5}$ (inadmissible value)

So $x = 20\%$

Hence, $P\left(\frac{x}{100}\right)^2 = 21025$

$\Rightarrow$ $P = 525625$

**50.** Men × Time = Work

100 × 1 = 100 unit

150 × 1 = 150 unit

Extra man power required = 50

but since new workers are $\frac{5}{4}$ times as efficient as existing workers.

$\therefore$ Actual no. of workers $= \frac{50}{5/4} = 40$ men

Hence, required percentage $= \frac{40}{100} \times 100 = 40\%$

## Final Round

**1.** Growth rate of Finance

$$= \frac{125-75}{75} \times 100 = \frac{2}{3} \times 100 = 66.66\%$$

Growth rate of Marketing $= \frac{250-100}{100} \times 100 = 150\%$

**2.** Total no. of students in 2003-04 is

$= (250 + 125 + 100 + 75) = 550$

No. of student in 2004-05

$$= 550\left(1+\frac{1}{11}\right) = 600 \text{ students}$$

**3.** $\frac{50}{(150+100+75+50)} \times 100 = \frac{50}{375} \times 100 = 13.33\%$

**4.** $\frac{4800-4000}{4000} \times 100 = 20\%$

**5.** $\frac{450}{4350} \times 100 = 10.34\%$, which is lowest in comparison to others

Thus the growth rate of logical reasoning book is lowest.

**6.** DI $\rightarrow \frac{5000-3750}{3750} \times 100 = 33.33$

and VA $\rightarrow \frac{5500-4140}{4140} \times 100 = 32.85\%$

**7.** Only LR has consistent growth, others have been fluctuating (QA – 2003, DI – 2003, VA – 2002)

**8.** $\frac{\left[\frac{8.5-2.97}{2.97} \times 100\right]}{5} = 37.23\%$

**9.** Growth rate of Hero = 37.23%

Growth rate of Atlas = 28.1%

Avon is least which is clear from the data.

Total bicycle production is highest in 95 hence false

Hero cycle's share $= \frac{2.97 + 4.22 + \ldots 8.5}{79.84} = 43\%$

Hence, (d) since none of (a), (b) and (c) is correct.

Compiled By Jasjeet

yoursmahboob.wordpress.com



10. $\frac{1.75 + 2.48 + \ldots 4.8}{79.84} = 28.4\%$

11. $\frac{1.64}{64.8} \times 100 = 2.53$

12. Amul has max. unutilised capacity

$\left(\frac{1.54}{59.35} \times 100\right) - 1.54 = 1.05$

**NOTE** Similarly for others can also be find out

13. $\frac{11.6}{61.3} \times 100 \approx 18.9$

14. $\frac{42.20}{132.8} \times 100 = 31.81\%$

15. $\frac{105}{360} \times 100 = \frac{7}{24} \times 100 = 29.166\%$

16. $\frac{30}{120} \times 100 = 25\%$

17. $\frac{15}{120} \times 100 = 12.5\%$

18. $105 - 45 = 60° = 4$ hours

19. $15° = 1$ hour (Maths)
$30° = 2$ hour (other subjects)

20. Sony TV → 19%
Sony Refrigerator → 15%
difference = 4% = 14.4° (Since 1% = 3.6°)

21. 12% → Samsung TV = 31 crore
18% → Electrolux TV = 46.5 crore
100% → Total market = 258 crore

11% → Samsung Refrg. = 9 crore
13% → Electrolux Refrg. = 10.6 crore
100% → Total market = 81.8 crore

$$\text{Market share} = \frac{46.5 + 10.6}{258 + 81.8} \approx 16.7\%$$

22. 18% = Rs. 42 crores, so 27% (= 16 + 11) = Rs. 63 crore
13% = Rs. 6 crore, so 28% (= 12 + 16) = Rs. 13 crore
Total Rs. 76 crores
∴ Annual approx. turnover = 4 × 76 = Rs. 304 crores

23. (a) (13 − 12) = 1% = 3.6
(b) We don't know the turnover of TV and refrigerator market for each brand.
(c) 6% total refrigerator market = 100 crore
⇒ Total refrigerator market ≅ 1667 crore
∴ Difference = 2% of 1667 = 33.34 crore
Thus, (b) can't be inffered.

24. $\frac{52,000 - 5,000}{5000} \times 100 = 9.4 \times 100 = 940\%$

25. Medical college in 1980 $= \frac{11}{100} \times 32,000 = 3520$

$$1990 = \frac{9}{100} \times 52,000 = 4680$$

$$\therefore \frac{4680 - 3520}{3520} \times 100 = 32.95$$

26. We don't have the information about the proportion (share) of Engineering colleges in the given years.

27. $\frac{32,000 - 12,000}{12,000} \times 100 = 166.66\%$

28. Number of medical colleges in 1990

$$= \frac{52,000 \times 9}{100} = 4680$$

Increase in the total no. of colleges

$$= 60,000 - 52000 = 8000$$

Increase in the no. of medical colleges $= \frac{8000}{4} = 2000$

Therefore, percentage of medical colleges in 2000

$$= \frac{4680 + 2000}{60,000} \times 100 = 11\%$$

29. If the amount of water consumed of sector 1 is the same then we can directly compare the tariffs to the two years.

| | Tariff 2003–04 | % change | Tariff 2000–01 |
|---|---|---|---|
| Region 1 | 1000 | + 25% | 800 |
| Region 2 | 400 | + 14.28% | 350 |
| Region 3 | 250 | –16.66% | 300 |
| Region 4 | 625 | + 4.166% | 600 |
| Region 5 | 720 | + 20% | 600 |
| | **2995** | | **2650** |

$$\frac{2995 - 2650}{2650} \times 100 = \frac{345}{2650} \times 100$$
$$= 13.01\%$$

30.

| | Tariff 2003–04 | % change over 2000-01 | Tariff 2000–01 |
|---|---|---|---|
| Sector 1 | 400 | + 14.28% | 350 |
| Sector 2 | 375 | + 7.14% | 350 |
| Sector 3 | 525 | –12.5% | 600 |
| Sector 4 | 800 | –20% | 1000 |
| | **2100** | | **2300** |

$$\text{Average tarrif} = \frac{2300}{4} = 575$$

31. In 2003-04 the water consumed by various secters out of 20,000 kilo-litres can be given as follow:

| Category | Percentage | Consumption in 2003–04 |
|---|---|---|
| Domestic | 40 | 8,000 |
| Urban | 25 | 5,000 |
| Rural | 15 | 3,000 |
| Industrial | 20 | 4,000 |
| | | **20,000** |

Since there was a 20% decrease in the domestic consumption in 2003-04 the domestic consumption in

2000-01 $= \frac{8,000}{0.8} = 10,000$

Compiled By Jasjeet

yoursmahboob.wordpress.com



But this constitutes 40% of total water consumed in 2000-01 and the industrial consumption constitutes 20% of total water in 2000-01. Hence in 2000-01 the industrial consumption $= 10,000 \times \frac{20}{40} = 5,000$ kilo-liters

**32.** We do not know the category-wise break up of tariffs ie the rates of Urban sector is unknown.

**33.** The average of Region 2 $= \frac{400 + 375 + 525 + 800}{4} = 525$

Average tariff in region 4 $= \frac{62.5 + 750 + 240 + 360}{4} = 487.5$

Average tariff in region 5 $= \frac{220 + 360 + 320 + 400}{4} = 450$

Statements (c) can not be determined

**34.** Total number of people = 10,000

| | | |
|---|---|---|
| Business men | 10% | 1000 |
| Govt. Servant | 13% | 1300 |
| Professionals | 30% | 3000 |
| Students | 45% | 4500 |
| Housewives | 2% | 200 |

| | |
|---|---|
| LML | 1200 |
| SUZUKI | 1200 |
| BAJAJ | 3000 |
| HERO HONDA | 6600 |

The total number of Hero Honda bikes = 6600

Total numbers of Government servants housewives and students = 6000

Total no. of Businessmen and professional = 4000

∴ Percentage of remaining (*i.e.*, Businessmen and prof.) driving Hero Honda $= \frac{600}{4000} \times 100 = 15\%$

**35.** Let the no. of people who drive one two and three bikes be $15k$, $3k$ and $k$ respectively.

Number of bikes which are being driven

$$= 15k + 2(3k) + 3(k) = 24k$$

Since LML and Suzuki can not be driven by same person and a person can drive maximum 3 bikes.

Total bikes which are being used to drive = 12,000

$$\therefore \quad 24k = 12,000 \Rightarrow k = 500$$

Total number of people driving the bikes

$$= 15k + 3k + k = 19k = 9500$$

∴ Number of people who do not drive any bike

$$= 10,000 - 9500 = 500$$

**36.** From the previous solution, number of people who drive more than 1 bike *i.e.*, 2 bikes and 3 bikes are 1500 and 500 respectively.

These people have total 4500 bikes

$$(= 1500 \times 2 + 500 \times 3)$$

Hence, the remaining Hero Honda bikes

$$= 6600 - 4500 = 2100$$

Thus, the number of persons who drive single Hero Honda

$$= 2100$$

**37.** Since 20% drive other bikes 80% drive only bajaj bike number of people who drive only Bajaj bike

$$= 0.8 \times 3000 = 2400$$

**38.** $\frac{11000 + 12000}{21,000} \times 100 = 109.52\%$

**39.** $\frac{27,000 - 23,000}{23,000} \times 100 = 17.4\%$

**40.** Demand = Domestic Production + Imports

Average demand $= \frac{44 + 54.5 + 57}{3} \approx 52$ million tonnes

**41.** (c) $\frac{30,000 - 21,000}{21,000} \times 100 \approx 43\%$

**42.** Offshore production in 2004 $= 16,000 \times 0.875$

$= 14,000$ thousand tonnes

Onshore production = 11,000 thousand tonnes

Demand in 2004 $= 57,000 \times 1.02 = 5814$ thousand tonnes

imports = 33.14 million tonnes (∵ 1 million = $10^6$)

**43.** $201924 \times \frac{5}{6} = 33654 \times 5 = 168270$

**44.** $127890 \times \frac{11}{10} = 140679$

**45.** $126400 + 975264 + 237852 = 1339516$

**46.** $\frac{100956}{2445480} \times 100 = 4.128\%$

**Alternatively:** $\frac{1}{24} \times 100 \approx 4.16\%$

**47.** $1969 - 70 \rightarrow 134790$
$1979 - 80 \rightarrow 284620$ ] 149830

**48.** $1929 - 30 \rightarrow 9,75,264$
$1949 - 50 \rightarrow 1,40,679$

% decrease $= \frac{975264 - 140679}{975264} \times 100 = 85.57\%$

**49.** $1959 - 60 \longrightarrow 1960 - 61$

$168020 \xrightarrow{+20\%} 201924$

Therefore $\frac{168020}{201924} \times 100 = 83.33\%$

**Alternatively:** From percentage charge graphic

| Increase | Decrease |
|---|---|
| 20% | 16.66% |
| 1/5 | 1/6 |

∴ The required value = 83.33% (100 – 16.66%)

**Alternatively:** $x \times \frac{6}{5} = k$

$\Rightarrow \quad x = \frac{5k}{6}$

$(x)\% = \frac{5k}{6} \times 100 = 83.33\%$ of $k$

**50.** Only 7,900 tonnes increase over the 1919 – 20.

Compiled By Jasjeet

yoursmahboob.wordpress.com

# 7 CI/SI/INSTALMENTS

The concept of simple interest and compound interest is one of those concepts which are widely used in Business and Banking etc. Questions are rarely asked in CAT from this chapter, but it is important for the purpose of Data interpretation. Since the questions based on the concept of 'interest' are rather easy so it is common that MAT, FMS, CET etc. asked enough questions from this chapter. The questions of this chapter are so easy that 95% questions can be solved orally or using unitary methods *i.e.,* sometimes you don't need to apply the given formula and I think that is essential.

**Simple interest** is nothing but the fix percentage of the principal (invested/borrowed amount of money)

Some key words used in the concept of interest.

**Principal :**($P$) It is the sum of money deposited/loaned etc. also known as **capital.**

**Interest :** It is the money paid by borrower, calculated on the basis of **Principal.**

**Time** ($T/n$) : This is the duration for which money is lent/borrowed.

**Rate of Interest** ($r/R$) : It is the rate at which the interest is charged on principal.

**Amount** ($A$) = Principal + Interest

**Simple Interest :** When the interest is calculated uniformly only on the principal for the given time period.

**Compound Interest :** In this case for every next period of time the interest is charged on the total previous amount (which is the sum of principal and interest charged on it so far.) *i.e.,* every time we calculate successive increase in the previous amount.

## IMPORTANT FORMULAE

**Simple Interest (SI)**

$$\text{SI} = \frac{P \times r \times t}{100}$$

$P$ = Principal

$r$ = rate of interest (in %)

$t$ = time period (yearly, half yearly etc.)

$$\text{Amount } (A) = P + \frac{Prt}{100} = P\left(1 + \frac{rt}{100}\right)$$

**NOTE** Out of the five variables $A$, SI, $P$, $r$, $t$ we can find any one of these if we have the requisite information.

## CONVERSION OF TIME PERIOD-RATE OF INTEREST

| Given ($r$%) | Given ($t$) | Required ($r$%) | Required ($t$) |
|---|---|---|---|
| $r$% annual | $t$ years | $\frac{r}{2}$(%) half-yearly | $2t$ |
| $r$% annual | $t$ years | $\frac{r}{4}$% quarterly | $4t$ |
| $r$% annual | $t$ years | $\frac{r}{12}$% monthly | $12t$ |

**Compound Interest (CI)**

1. CI = $A - P$ [$A$ is the amount including interest and principal ($P$) both]

2. Amount $(A) = P\left(1 + \frac{r}{100}\right)^t$

3. When rate of interest is half-yearly

$$A = P\left(1 + \frac{(r/2)}{100}\right)^{2t}$$

4. When the rate of interest is quarterly

$$A = P\left(1 + \frac{r/4}{100}\right)^{4t}$$

Difference between CI and SI for two years

(also in second year) $= P\left(\frac{r}{100}\right)^2$

Difference between CI and SI for three years

$$= P\left(\frac{r}{100}\right)^2\left(\frac{r}{100} + 3\right)$$

**Depreciation :** It is known that the prices of some articles depriciates in their values over a time period. When the value in terms of currency decreases, we say that the value of the article is depreciating.

$$V_f = V_i\left(1 - \frac{r}{100}\right)^t$$

yoursmahboob.wordpress.com


$V_i$ = initial value of the article

$V_f$ = final (depreciated) value of article

$r$, is the rate of interest by which the price of article decreases over the time period '$t$'.

**Population :** It has been observed that the population of a particular locality/nation etc. increases or decreases successively over its previous value *i.e.*, it increases or decreases as compound interest for the money. Thus we use similar formulae for the calculation of population.

$$\text{(Total population) } P = P_0\left(1+\frac{r}{100}\right)^n,$$

when population increases

$$\text{(Total population) } P = P_0\left(1-\frac{r}{100}\right)^n,$$

when population decreases.

**Instalments :** When a borrower paid the sum in parts (*i.e.*, not in a single amount) then we say that he/she is paying in instalments. For example $A$ borrowed Rs. 100 from $B$ and he pays back it to $B$ in several parts *i.e.*, Rs. 20 in 5 times or Rs. 50 in 2 times etc. But the important point is that borrower has to also pay the interest for using the borrowed sum/or purchased article. In general the value of each instalment is kept constant even when the interest charged on each instalment vary for each instalment.

**For Simple Interest**

$$A = \left[x + \left(x + \frac{x \times r \times 1}{100}\right) + \left(x + \frac{x \times r \times 2}{100}\right) + \left(x + \frac{x \times r \times 3}{100}\right) + \ldots\right]$$

$A$ = Total amount paid

$x$ = Value of each instalment

Also,

$$\boxed{A = P + \frac{P \times n \times r}{100}}$$

$P$ is the principal

$n$ is the number of instalments

$r$ is the rate of interest

**For Compound Interest**

(loan amount)

$$P = \left[\frac{x}{\left(1+\frac{r}{100}\right)} + \frac{x}{\left(1+\frac{r}{100}\right)^2} + \frac{x}{\left(1+\frac{r}{100}\right)^3} + \ldots + \frac{x}{\left(1+\frac{r}{100}\right)^n}\right]$$

$x \to x$ is the value of each instalment.

$$\text{Total amount paid in instalments } (A) = P\left(1+\frac{r}{100}\right)^n$$

$n$ is the number of instalments.

Difference between CI and SI for $n^{\text{th}}$ year

$$= \frac{Pr}{100}\left[\left(1+\frac{r}{100}\right)^{n-1} - 1\right]$$

**For Compound Interest**

$$\frac{\text{increase in amount in } n^{\text{th}} \text{ year}}{\text{increase in amount in } (n+1)^{\text{th}} \text{ year}} = \frac{100}{(100+r)}$$

Similarly,

$$\frac{\text{decrease in amount in } n^{\text{th}} \text{ year}}{\text{decrease in amount in } (n+1)^{\text{th}} \text{ year}} = \frac{100}{(100-r)}$$

where $r$ is rate of interest.

**EXAMPLE 1.** *Find the simple interest on Rs. 1000 at 12% per annum for 5 years.*

**SOLUTION** $\text{SI} = \frac{Prt}{100} = \frac{1000 \times 12 \times 5}{100} = \text{Rs. } 600$

{Total amount = $P$ + SI = 1000 + 600 = Rs. 1600}

**EXAMPLE 2.** *Find the simple interest on Rs. 800 at 7% per annum and on Rs. 700 at 16% p.a. and on Rs. 500 at 4% p.a. for 2 years.*

**SOLUTION** $\text{SI} = \frac{P_1 r_1 t_1}{100} + \frac{P_2 r_2 t_2}{100} + \frac{P_3 r_3 t_3}{100}$

$= \frac{800 \times 7 \times 2}{100} + \frac{700 \times 16 \times 2}{100} + \frac{500 \times 4 \times 2}{100}$

$= 112 + 224 + 40$

$= \text{Rs. } 376$

**EXAMPLE 3.** *A sum of money ($P$) doubles in 10 years. In how many years it will be treble at the same rate of simple interest?*

**SOLUTION** $A = 2P$

$\therefore$ $\text{SI} = P$ $\quad$ (SI = 2$P$ − $P$)

$P = \frac{P \times r \times 10}{100}$

$\Rightarrow$ $r = 10\%$

So, the new amount = 3$P$

But the new SI = 2$P$ = (3$P$ − $P$)

$2P = \frac{P \times 10 \times t}{100}$ $\quad$ ($r$ = 10%)

$t$ = 20 years

**EXAMPLE 4.** *A sum of money in 3 years becomes 1344 and in 7 years it becomes Rs. 1536. What is the principal sum where simple rate of interest is to be charged ?*

*(a) 4000 (b) 1500 (c) 1200 (d) 2800*

**SOLUTION** It would be very time saving if we do it by unitary method.

1536 − 1344 = Rs. 192

yoursmahboob.wordpress.com



Rs. 192 is the interest for 4 years

So, Rs. 48 is the interest for 1 year

It means Rs. 144 is the interest for 3 years at actual principal.

$\therefore$ Principal = 1344 – 144 = Rs. 1200

**EXAMPLE 5.** *A certain sum of money amounts to Rs. 15900 at simple rate of interest at 6% p.a. in 1 year. What is the value of principal sum ?*

(a) 12000 (b) 18000
(c) 15000 (d) 14000

**SOLUTION** Best way is to go through option as $\frac{15000 \times 6 \times 1}{100} = 900$

So the total amount = 15900, hence (c) is correct.

**EXAMPLE 6.** *A sum of money becomes 3 times in 12 years. In how many years it will become 5 times at the same rate of simple interest?*

(a) 20 years (b) 16 years
(c) 24 years (d) 30 years

**SOLUTION** In this type of question consider only SI not the amount. So,

(in first case) SI = 2*P* for principal *P*

(in second case) SI = 4*P* for principal *P*.

Now since SI is directly proportional to the time at fixed rate of interest.

Therefore to make SI two times it will require 12 years

So to make SI four times it will require 24 years

Thus to make an amount 5 times of the principal requires 24 years at the given rate of interest as per question.

**EXAMPLE 7.** *What will be the amount when Rs. 10000 is deposited in a bank at 10% per annum compounded annually for 3 years?*

**SOLUTION** $A = P\left(1+\frac{r}{100}\right)^n = 10000\left(1+\frac{10}{100}\right)^3$

$= 10000 \times (1.1)^3$

= Rs. 13310

**EXAMPLE 8.** *A sum of amount at r% compound interest doubles in 3 years. In 9 years it will be k times of the original principal. What is the value of k?*

(a) 10 (b) 9 (c) 6 (d) 8

**SOLUTION** $A = P\left(1+\frac{r}{100}\right)^n$

1st case $2P = P\left(1+\frac{r}{100}\right)^3$

$\Rightarrow$ $2 = \left(1+\frac{r}{100}\right)^3$

2nd case $(2)^3 = \left[\left(1+\frac{r}{100}\right)^3\right]^3 = \left(1+\frac{r}{100}\right)^9$

$\Rightarrow$ $k = (2)^3 = 8$ times.

**EXAMPLE 9.** *Rs. 20000 is being compounded at 20% p.a. If the rate of interest is charged half yearly. What will be the amount after 2 years ?*

(a) 28292 (b) 27292
(c) 29282 (d) 22358

**SOLUTION** $20000\left(1+\frac{20/2}{100}\right)^{2\times 2} = 20000\left(1+\frac{10}{100}\right)^4$

$= 20000\,(1.1)^4$

$= 20000 \times 1.4641$

= Rs. 29282

**EXAMPLE 10.** *If the rate of interest is 10% p.a. and Rs. 12000 lent at the compound interest, half yearly. What is the equivalent simple rate of interest for first year?*

**SOLUTION** $A = P\left(1+\frac{r}{100}\right)^n = 12000\,(1.05)^2$

$= 12000 \times 1.1025$

= Rs. 13230

Again SI = 13230 – 12000 = 1230

$\therefore$ $1230 = \frac{12000 \times r \times 2}{2 \times 100}$

$\Rightarrow$ $r = 10.25\%$

**EXAMPLE 11.** *Rs. 1000 is being charged at 50% per annum. What is the interest for 3rd year at compound interest ?*

(a) 1122 (b) 1025 (c) 1125 (d) 625

**SOLUTION** Total amount for two years = $1000\,(1.5)^2 = 2250$

Now, interest for third year = $\frac{2250 \times 50 \times 1}{100} = 1125$

Hence (c) is correct.

**EXAMPLE 12.** *CI and SI for a certain sum at certain rate of interest are Rs. 220 and Rs. 200. What is the principal for these interests?*

(a) Rs. 2200 (b) Rs. 200
(c) Rs. 500 (d) Rs. 2000

**SOLUTION** 220 – 200 = 20

Rs. 20 is the interest on the interest of the first year, which is Rs. 100 = $\left(\frac{200}{2}\right)$

Thus the rate of interest = 20% $\left(20 = \frac{100 \times r \times 1}{100}\right)$

So the actual principal = *P* = 500

$\left(\text{since } 100 = \frac{P \times 20 \times 1}{100} \Rightarrow P = 500\right)$

Hence (c) is correct.

**EXAMPLE 13.** *The population of UP increases very rapidly @ 12% p.a. and 3 years ago its population was 1 million. What is present population?*

**SOLUTION** $A = 1000000\,(1.12)^3 = 1404928$

yoursmahboob.wordpress.com



**EXAMPLE 14.** *Jadeja purchased a Maruti car 3 years ago for Rs. 2 lakh. Its value depreciated each year @ 25% p.a. What is the present value of the car ?*

**SOLUTION** $200000\left(1-\frac{25}{100}\right)^3 = 200000 \times \left(\frac{3}{4}\right)^3$

$= 84{,}375$

**EXAMPLE 15.** *The difference between CI and SI for 3 years @ 20% p.a. is Rs. 152. What is the principal lent in each case ?*

(a) *1200* (b) *1155*
(c) *1187.5* (d) *none of these*

**SOLUTION** Difference between CI and SI for 3 years = Rs. 152

$$p\left(\frac{r}{100}\right)^2\left(\frac{r}{100}+3\right) = 152$$

$$P\left(\frac{1}{25}\right)\left(\frac{16}{5}\right) = 152$$

$$P = \frac{152 \times 25 \times 5}{16}$$

$$P = 9.5 \times 25 \times 5 = 1187.5$$

**EXAMPLE 16.** *A sum is being lent at 20% p.a. compound interest. What is the ratio of increase in amount of $4^{th}$ year to $5^{th}$ year?*

(a) *4 : 5* (b) *5 : 4*
(c) *5 : 6* (d) *can't be determined*

**SOLUTION** $$\frac{P\left(1+\frac{r}{100}\right)^4}{P\left(1+\frac{r}{100}\right)^5} = \frac{1}{\left(1+\frac{r}{100}\right)}$$

$$= \frac{100}{100+r} = \frac{100}{120} = \frac{5}{6}$$

**EXAMPLE 17.** *Rs. 12000 amounts to Rs. 20736 in 3 years at r% p.a. of compound interest. What is the value of r?*

(a) *10%* (b) *25%* (c) *12%* (d) *20%*

**SOLUTION**

$$A = P\left(1+\frac{r}{100}\right)^3$$

$$20736 = 12000\left(1+\frac{r}{100}\right)^3$$

$$\Rightarrow \frac{20736}{12000} = \left(1+\frac{r}{100}\right)^3$$

$$\Rightarrow \frac{1728}{1000} = \left(1+\frac{r}{100}\right)^3$$

$$\Rightarrow \left(\frac{12}{10}\right)^3 = \left(1+\frac{r}{100}\right)^3$$

$$\Rightarrow \left(1+\frac{2}{10}\right)^3 = \left(1+\frac{r}{100}\right)^3$$

$$\Rightarrow r = 20\%$$

**Alternatively :** The best way for this problem is to go through options.

$12000 \times 1.2 \Rightarrow 14400 \times 1.2 \Rightarrow 17280 \times 1.2 \Rightarrow 20736$

**EXAMPLE 18.** *A certain sum amounts to Rs. 14641 in 4 years @ 10% p.a. compounded annualy. What is the value of principal?*

(a) *Rs. 6000* (b) *Rs. 12000*
(c) *Rs. 10000* (d) *data insufficient*

**SOLUTION**

$$14641 = P\left(1+\frac{10}{100}\right)^4$$

$$14641 = P\left(\frac{11}{10}\right)^4$$

$$P = 14641 \times \left(\frac{10}{11}\right)^4$$

$$= 10000$$

**EXAMPLE 19.** *A sum of Rs. 10000 is borrowed at 8% p.a. compounded annualy which is paid back in 3 equal annual instalments. What is the amount of each instalments?*

**SOLUTION** $$10000 = x\left[\frac{25}{27}+\left(\frac{25}{27}\right)^2+\left(\frac{25}{27}\right)^3\right]$$

$$= x \times \frac{25}{27}\left[1+\frac{25}{27}+\frac{625}{729}\right]$$

$$= \frac{25x}{27}\left[\frac{2029}{729}\right]$$

$\Rightarrow$ $x$ = Rs. 3880.335

**Alternatively :**

$$10000\,(1.08)^3 = x\,[1 + (1.08) + (1.08)^2]$$

$\Rightarrow$ $x = 3880.335$

**EXAMPLE 20.** *A scooty is sold by an automobile agency for Rs. 19200 cash or for Rs. 4800 cash down payment together with five equal monthly instalments. If the rate of interest charged by the company is 12% per annum find each instalment.*

**SOLUTION** Balance of the price to be paid through instalments

= Rs. 14400

Rate of interest ($r$) = 12% p.a.

$$\therefore \left(14400+\frac{14400\times 12\times 5}{100\times 12}\right) = \left[x+\left(x+\frac{12x}{1200}\right)+\left(x+\frac{12x\times 2}{12\times 100}\right)+\ldots+\left(x+\frac{12x\times 4}{12\times 100}\right)\right]$$

$\Rightarrow x$ = Rs. 2964.70, where $x$ is the value of each instalment.

**NOTE** In the left hand side and right hand side given amounts are equal. Each amount is equal to the total amount payable after 5 months.

**Important :** For quick and smooth calculation to the problems of this chapter you can remember the following values :

yoursmahboob.wordpress.com



| Rate of Interest | For Rs. 100, amount | | | | |
|---|---|---|---|---|---|
| | after one year | after 2 years | after 3 years | after 4 years | after 5 years |
| 5% | 105 | 110.25 | 115.7625 | 121.550625 | 127.62815625 |
| 6% | 106 | 112.36 | 119.1016 | 126.247696 | 133.82255776 |
| 8% | 108 | 116.64 | 125.9712 | 136.048896 | 146.93280768 |
| 10% | 110 | 121.00 | 133.1000 | 146.4100 | 161.051 |
| 12% | 112 | 125.44 | 140.4928 | 157.351936 | 176.23416832 |
| 15% | 115 | 132.25 | 152.0875 | 174.900625 | 201.13571875 |
| 20% | 120 | 144.00 | 172.80 | 207.36 | 248.832 |
| 25% | 125 | 156.25 | 195.3125 | 244.140625 | 305.17578125 |
| 30% | 130 | 169.00 | 219.70 | 285.61 | 371.293 |
| 50% | 150 | 225.00 | 337.50 | 506.25 | 759.375 |

yoursmahboob.wordpress.com

# EXERCISE

## LEVEL 1

1. A man borrows Rs. 4000 and pays back after 5 years at 15% simple interest. The amount paid by the man is :
(a) Rs. 1800 (b) Rs. 4800
(c) Rs. 7500 (d) Rs. 7000

2. What is the time period for which Rs. 8000 amounts to Rs. 12000 at 20% p.a. of simple interest?
(a) 4 years (b) 2.5 years
(c) 3.25 years (d) 6 years

3. What is the rate of simple interest at which Rs. 14,000 gives interest of Rs. 1960 in two years?
(a) 4% (b) 5%
(c) 7% (d) 10%

4. What is the sum of amount which gives Rs. 6300 as interest @ 7% per annum of simple interest in $7\frac{1}{2}$ years?
(a) 36000 (b) 24000
(c) 63000 (d) 12000

5. If the rate of simple interest is 12% per annum, the amount that would fetch interest of Rs. 6000 per annum is :
(a) Rs. 7200 (b) Rs. 48000
(c) Rs. 50000 (d) Rs. 72000

6. A sum was put at simple interest at a certain rate for 2 years. Had it been put at 4% higher rate, it would have fetched Rs. 112 more. The sum is :
(a) 1120 (b) 1400
(c) 1200 (d) 8000

7. In what time will a sum of money double itself @ 20% per annum (p.a.) simple interest?
(a) 10 years (b) 5 years
(c) 2 years (d) 4 years

8. At $r$% per annum a sum doubles after 20 years. The rate of interest per annum is :
(a) 4% (b) 5%
(c) 8% (d) 10%

9. A sum of money trebles (*i.e.*, 3 times) in 15 years at $r$% of simple interest per annum. What is the value of $r$?
(a) 12% (b) $\frac{40}{3}$%
(c) $\frac{50}{3}$% (d) can't be determined

10. A sum of money doubles itself in 12 years. In how many years would it treble itself?
(a) 36 years (b) 18 years
(c) 24 years (d) 15 years

11. Out of a sum of Rs. 625, a part was lent at 5% SI and the other at 10% SI. If the interest on the first part after 2 years is equal to the interest on the second part after 4 years, then the second sum (in Rs.) is :
(a) 250 (b) 300
(c) 125 (d) 275

12. A sum of Rs. 2500 is lent out in two parts; one at 12% p.a. and another at 12.5% p.a. for one year. If the total annual income is Rs. 306, the money lent at 12% is :
(a) 1000 (b) 1200
(c) 1500 (d) 1300

13. Akul lent Rs. 6000 to Bakul for 2 years and Rs. 1500 to camlin for 4 years and received altogether from both Rs. 900 as simple interest. The rate of interest is :
(a) 4% (b) 8%
(c) 10% (d) 5%

14. A person takes a loan of Rs. 200 at 5% simple interest. He returns Rs. 100 at the end of one year. In order to clear his dues at the end of 2 years, he would pay :
(a) 125.50 (b) 110
(c) 115.50 (d) none of these

15. A lends a sum of money for 10 years at 5% SI. *B* lends double the amount for 5 years at the same rate of interest. Which of the following statements is true in this regard?
(a) *A* will get twice the amount of interest that *B* would get
(b) *B* will get twice the amount of interest that *A* would get
(c) *A* will get the same amount of interest that *B* would get
(d) *B* will get four times the amount of interest that *A* would get

16. Consider the following statements.
If a money is loaned at simple interest then the :
(i) money gets doubled in 5 years if the rate of interest is $16\frac{2}{3}$%.
(ii) money gets doubled in 5 years if the rate of interest is 20%.
(iii) money becomes four times in 10 years if it gets doubled in 5 years.
of these statements :
(a) (i) and (iii) are correct (b) (iii) alone is correct
(c) (ii) alone is correct (d) (ii) and (iii) are correct

17. Pratibha invests an amount of Rs. 15,860 in the names of her three daughters *A*, *B* and *C* in such a way that they get the same interest after 2, 3 and 4 years respectively. If the rate of simple interest is 5% p.a., then the ratio of the amounts invested among *A*, *B* and *C* will be :
(a) 5 : 10 : 12 (b) $\frac{1}{[illegible]}$ : 1 : 1
(c) 6 : 7 : 8 (d) [illegible] : 5 : 4

18. What annual payment will discharge a debt of Rs. 580 in 5 years, the rate being 8% p.a.?
(a) 120 (b) 100
(c) 80 (d) 78

yoursmahboob.wordpress.com



**19.** Find the amount of Rs. 2500 invested at 12% during the period from 4th February, 2005 to 18 April 2005 :
(a) Rs. 3000 (b) Rs. 3800
(c) Rs. 2560 (d) Rs. 2600

**20.** Find the amount of Rs. 1700 invested at 16% half yearly at simple interest for one year :
(a) 2100 (b) 2244
(c) 2200 (d) 2500

**21.** The compound interest on Rs. 1000 at 10% p.a. in 3 years is :
(a) 331 (b) 1331
(c) 133 (d) 300

**22.** The compound interest on Rs. 10000 at 20% p.a. in 4 years :
(a) 10736 (b) 736
(c) 20736 (d) 7280

**23.** The compound interest on Rs. 4000 at 25% p.a. in 3 years :
(a) 1235 (b) 5625
(c) 3812.5 (d) 3750.5

**24.** The compound interest on Rs. 5000 at 30% per annum for 4 years :
(a) 4280.5 (b) 6700
(c) 9280.5 (d) 3857.5

**25.** A sum of Rs. 400 would become Rs. 441 after 2 years at $r$% compound interest, find the value of '$r$' :
(a) 10% (b) 5%
(c) 15% (d) 20%

**26.** At compound interest, if a certain sum of money doubles in $n$ years, then the amount will be four fold in :
(a) $n^2$ years (b) $2n^2$ years
(c) $2n$ years (d) $4n$ years

**27.** Rs. 6000 amounts to Rs. 7986 in 3 years at CI. The rate of interest is :
(a) 20% (b) 10%
(c) 6% (d) 7.5%

**28.** The least number of complete years in which a sum of money put at 20% CI will be more than doubled is :
(a) 4 (b) 5
(c) 6 (d) 8

**29.** The CI on Rs. 5000 for 3 years at 8% for first year, 10% for second year and 12% for third year will be :
(a) Rs. 1750 (b) Rs. 1652.80
(c) Rs. 1575 (d) Rs. 1685.20

**30.** A sum of Rs. 2400 deposited at CI, doubled after 5 years. After 20 years it will become :
(a) Rs. 24000 (b) Rs. 38400
(c) Rs. 19200 (d) can't be determine

**31.** A sum of Rs. 550 was taken as a loan. This is to be paid back in two equal annual instalments. If the rate of interest be 20% compounded annually, then the value of each instalments is :
(a) 300 (b) 360
(c) 250 (d) none of these

**32.** The difference between CI and SI on a sum of money lent for 2 years at 10% is Rs. 40. The sum is :
(a) 1600 (b)
(c) 4000 (d) none of these

**33.** The difference between simple and compound interest on Rs. 6000 for 1 year at 20% per annum reckoned half yearly is :
(a) 120 (b) 60
(c) 180 (d) 72

**34.** A certain sum amounts to Rs. 8988.8 in two years and to Rs. 9528.128 in three years, at compound interest per annum. What is the principal and rate of interest?
(a) Rs. 12,000, 5% (b) Rs. 6,000, 8%
(c) Rs. 8,000, 6% (d) Rs. 10,000, 8.5%

**35.** The compound interest and the simple interest for two years on a certain sum of money at a certain rate of interest are Rs. 2257.58, Rs. 2100 respectively. Find the principal and rate percent :
(a) 6000, 7% (b) 7500, 8%
(c) 14000, 10% (d) 7000, 15%

**36.** The compound interest on a certain sum at a certain rate of interest for the second year and third year is Rs. 21780 and Rs. 23958 respectively. What is the rate of interest?
(a) 6% (b) 12%
(c) 10% (d) 15%

**37.** Amit borrowed Rs. 800 at 10% rate of interest. He repaid Rs. 400 at the end of first year. What is the amount required to pay at the end of second year to discharge his loan which was calculated at compound interest?
(a) 420 (b) 440
(c) 450 (d) 528

**38.** A sonata watch is sold for Rs. 440 cash or for Rs. 200 cash down payment together with Rs. 244 to be paid after one month. Find the rate of interest charged in the instalment scheme :
(a) 10% (b) 15%
(c) 20% (d) 25%

**39.** A cellphone is available for Rs. 600 or for 300 cash down payment together with Rs. 360 to be paid after two months. Find the rate of interest charged under this scheme :
(a) 20% (b) 50%
(c) 120% (d) none of these

**40.** Abhinav purchases a track suit for Rs. 2400 cash or for Rs. 1000 cash down payments and two monthly instalments of Rs. 800 each. Find the rate of interest :
(a) 75% (b) 120%
(c) 50% (d) none of these

**41.** Indicom cell-phone is available for Rs. 2500 cash or Rs. 500 cash down payments followed by 4 equal monthly instalments. If the rate of interest charged is 25% per annum, calculate the monthly instalment :
(a) 520 (b) 480
(c) 550 (d) none of these

**42.** An article is sold for Rs. 500 cash or for Rs. 150 cash down payments followed by 5 equal monthly instalments. If the rate of interest charged is 18% p.a., compute the monthly instalment :
(a) 63.07% (b) 37.06%
(c) 75.0% (d) 73.06%

**43.** A sum of Rs. 390200 is to be paid back in three equal annual instalments. How much is each instalment, if the rate of interest charged is 4% per annum compounded annually?
(a) Rs. 140608 (b) Rs. 120560
(c) Rs. 10000 (d) Rs. 18000

**44.** Purnima borrowed a sum of money and returned it in three equal quarterly instalments of Rs. 17576 each. Find the sum borrowed, if the rate of interest charged was 16% per annum compounded quarterly. Find also the total interest charged.
(a) 46900 and 4700 (b) 48775 and 3953
(c) 68320 and 1200 (d) none of these

yoursmahboob.wordpress.com



45. Sunidhi borrowed Rs. 10815, which is to be paid back in 3 equal half yearly instalments. If the interest is compounded half yearly at $\frac{40}{3}$% per annum, how much is each instalment?
(a) 2048 (b) 3150
(c) 4096 (d) 5052

46. Sapna borrowed some money on compound interest and returned it in three years in equal annual instalments. If the rate of interest is 15% per annum and annual instalment is Rs. 486680, find the sum borrowed :
(a) 1112220 (b) 1111200
(c) 1122000 (d) none of these

47. $P$ and $Q$ invest some amount under SI and CI repectively but for the same period at 6% per annum. Each gets a total amount of Rs. 65,000 at the end of 6 years. Which of the following is definitely true?
(i) $Q$'s initial principal is less than that of $P$
(ii) $Q$'s initial principal is equal to that of $P$
(iii) $P$'s percentage earning is less than that of $Q$
(a) (i) only (b) (ii) only
(c) (iii) only (d) (i) and (iii) only

48. In the above (*i.e.*, previous) problem, what is the ratio of $P$'s final amount to that of $Q$, if $P$ and $Q$ invest the same amounts?
(a) $(1.06)^6$ (b) $\frac{136}{100} \times \left(\frac{100}{106}\right)^6$
(c) $\frac{100}{136} \times \left(\frac{106}{100}\right)^6$ (d) none of these

49. Mr. Lala Ram has lent some money to Aaju at 6% p.a. and the Baaju at 8% p.a. At the end of the year he has gain the overall interest at 7% per annum. In what ratio has he lent the money to Aaju and Baaju?
(a) 2 : 3 (b) 1 : 1
(c) 5 : 6 (d) 4 : 3

50. The difference between simple and compound interest for the fourth year is Rs. 7280 at 20% p.a. What is the principal sum?
(a) 10000 (b) 50000
(c) 1 lakh (d) 40000

51. The simple interest on certain sum at 5% for 9 month is Rs. 10 greater than the simple interest on the same sum @ 3% for 14 months. What is the sum of interest in both the cases (*i.e.*, total sum of interest)?
(a) Rs. 130 (b) Rs. 290
(c) Rs. 120 (d) Rs. 330

52. Mr. Bajaj invested $\frac{1}{7}$ of his total investment at 4% and $\frac{1}{2}$ at 5% and rest at 6% for the one year and received total interest of Rs. 730. What is the total sum invested?
(a) Rs. 70000 (b) Rs. 14000
(c) Rs. 24000 (d) Rs. 38000

53. The rate of interest in two banks DNB and HBI are in the ratio of 7 : 8. If a person invested some amount in both the banks and received equal amounts from both the banks in two year. The ratio of amount invested in DNB and HBI respectively is :
(a) 15 : 1 (b) 8 : 7
(c) 7 : 8 (d) 108 : 107

54. The ratio of CI for 3 years and SI for 1 year for a fixed amount at a rate of $r$% is 3.64. What is the value of $r$?
(a) 10% (b) 15%
(c) 20% (d) none of these

55. A sum of money becomes 13/5 times of itself in 32 years at $r$% of SI. What is the value of $r$?
(a) 6% (b) 7%
(c) 5% (d) 18%

56. The difference between interest received by $A$ and $B$ is Rs. 18 on Rs. 1500 for 3 year. What is the difference in rate of interest?
(a) 1% (b) 2.5%
(c) 0.5% (d) 0.4%

## LEVEL 2

1. The compound interest on a certain sum for 2 years is Rs. 756 and SI (simple interest) is Rs. 720. If the sum is invested such that the SI is Rs. 900 and the number of years is equal to the rate per cent per annum, find the rate per cent :
(a) 4 (b) 5
(c) 6 (d) 1.0

2. Jalela and Dalela have to clear their respective loans by paying 3 equal annual instalments of Rs. 30000 each. Jalela pays @ 10% per annum of simple interest while Dalela pays 10% per annum compound interest. What is the difference in their payments?
(a) Rs. 300 (b) Rs. 425
(c) Rs. 245 (d) Rs. 333.33

3. Akbar lends twice the interest received from Birbal to Chanakya at the half of the interest at which he lent to Birbal. If Akbar lent Rs. $P$ @ $r$% per annum for 1 year to Birbal then the interest received by Akbar from Chanakya is :
(a) $\frac{Pr^2}{100}$ (b) $\left(\frac{Pr}{10}\right)^2$
(c) $P\left(\frac{r}{10}\right)^2$ (d) $P\left(\frac{r}{100}\right)^2$

4. Equal amounts of each Rs. 43892 is lend to two persons for 3 years. One @ 30% SI and second @ 30% CI annually. By how much per cent the CI is greater than the simple interest received in this 3 years duration?
(a) 23% (b) 33%
(c) 33.33% (d) none of these

5. Rs. 3500 was lent partly @ 4% and partly @ 6% SI. The total interest received after 3 years is 498. What is the amount lent @ 4% SI?
(a) Rs. 1300 (b) Rs. 1800
(c) Rs. 200 (d) Rs. 2200

6. The population of vultures in a particular locality is decreases by a certain rate of interest (compounded annually). If the current population of vultures be 29160 and the ratio of decrease in population for second year and 3rd year be 10 : 9. What was the population of vultures 3 years ago?
(a) 30000 (b) 35000
(c) 40000 (d) 50000

7. The ratio of the amount for two years under CI annually and for one year under SI is 6 : 5. When the rate of interest is same, then the value of rate of interest is :

yoursmahboob.wordpress.com





(a) 12.5% (b) 18%
(c) 20% (d) 16.66%

**8.** A bicycle can be purchased on cash payment of Rs. 1500. The same bicycle can also be purchased at the down payment (initial payment, at the time of purchasing) of Rs. 350 and rest can be paid in 3 equal installments of Rs. 400 for next 3 months. The rate of SI per annum charged by the dealer is :
(a) $23\frac{9}{17}\%$ (b) $17\frac{9}{23}\%$
(c) $13\frac{9}{17}\%$ (d) none of these

**9.** Data Ram lends equal sum of money at the same rate of interest to *A* and *B*. The money lends to *A* becomes twice of the original amount in just four years at simple interest. While Data Ram lends to *B* for the first two years at compound interest and for the rest two years at simple interest. If the difference between the amount of *A* and *B* after 4 years is Rs. 2750. What is the amount of money that Data Ram lends to each one?
(a) Rs. 40000 (b) Rs. 6000
(c) Rs. 8000 (d) Rs. 80000

**10.** Akram Ali left an amount of Rs. 340000 to be divided between his two sons aged 10 years and 12 years such that both of them would get an equal amount when each attain 18 years age. What is the share of elder brother if the whole amount was invested at 10% simple interest :
(a) 12000 (b) 16000
(c) 160000 (d) 180000

**11.** Satyam took loan from IDIDI Bank for his 2 years course of MBA at IMD. He took the loan of Rs. 6 lakh such that he would be charged at 8% per annum at CI during his course and at 10% CI after the completion of course. He returned half of the amount which he had to be paid on the completion of his studies and remaining after 2 years. What is the total amount returned by Satyam ?
(a) Rs. 7.73323 lakh (b) Rs. 7.58 lakh
(c) Rs. 7.336 lakh (d) none of these

**12.** We had 1000 goats at the beginning of year 2001 and the no. of goats each year increases by 10% by giving birth (compounded annually). At the end of each year we double the no. of goats by purchasing the same no. of goats as there is the no. of goats with us at the time. What is the no. of goats at the beginning of 2004?
(a) 10600 (b) 10648
(c) 8848 (d) 8226

**13.** Rs. 100000 was invested by Mohan in a fixed deposit @ 10% per annum at CI. However every year he has to pay 20% tax on the compound interest. How much money does Mohan has after 3 year?
(a) 128414 (b) 108000
(c) 126079.2 (d) none of these

**14.** A property dealer bought a rectangular plot (of land) in Noida 5 years ago at the rate of Rs. 1000 per $m^2$. The cost of plot is increases by 5% in every 6 years and the worth of a rupee falls down at a rate of 2% in every 5 years. What is the approximate value of the land per meter$^2$ 25 years hence?
(a) Rs. 995 (b) Rs. 1134
(c) Rs. 1500 (d) Rs. 1495

**15.** *A* and *B* enter into a venture in which the profit earned by *A* and *B* are in the ratio 28 : 15. *A* invest his share at the start of the year and *B* joins in after 9 months of the same year. What is the ratio of their initial investment respectively?
(a) 7 : 15 (b) 8 : 13
(c) 5 : 17 (d) 15 : 7

**16.** In the previous problem if *A* gets a profit of Rs. 4200 the amount invested by *B* is :
(a) 2250 (b) 2600
(c) 1350 (d) can't be determined

**17.** Arvind and Govind each invested Rs. 15000 for 3 years at the same rate of interest but Arvind's investment is compounded annually while Govind's investment is charged on simple interest. What amount did Arvind receive more than Govind?
(a) Rs. 680 (b) Rs. 3450
(c) data insufficient (d) none of these

**18.** Shyam Lal takes a loan of Rs. 10500 at 10% p.a. compounded annually which is to be repaid in two equal annual instalments. One at the end of one year and the other at the end of the second year. The value of each instalments is :
(a) 5987 (b) 6050
(c) 6352.5 (d) 5678.5

**19.** Hari Lal and Hari Prasad have equal amounts. Hari Lal invested all his amount at 10% compounded annually for 2 years and Hari Prasad invested 1/4 at 10% compound interest (annually) and rest at *r*% per annum at simple interest for the same 2 years period. The amount received by both at the end of 2 year is same. What is the value of *r*?
(a) 14% (b) 12.5%
(c) 10.5% (d) 11%

**20.** The annual sales of a company in the year 2000 was Rs. 1000 and in the year 2005 was Rs. 2490. Find the compounded annual growth rate (CAGR) of sales in the given period of the same company :
(a) 14.289% (b) 10%
(c) 15% (d) 20%

**21.** HDFC lends 1 million to HUDCO at 10% simple interest p.a. for 2 years and HUDCO lends the same amount to SAHARA STATES HOUSING corporation at 10% p.a. of compound interest for 2 years. What is the earning of HUDCO in this way?
(a) Rs. 133100 (b) Rs. 33100
(c) Rs. 131000 (d) no profit no loss

**22.** ICICI lent Rs. 1 lakh to captain Ram Singh @ 6% per annum of simple interest for 10 years period. Meanwhile ICICI offered a discount in rate of interest for armed forces. Thus the rate of interest ICICI decreased to 4%. In this way Ram Singh had to pay total amount 1.48 lakh.

After how many year Ram Singh got the discount in rate of interest?
(a) 3 years (b) 4 years
(c) 6 years (d) 5 years

**23.** Sanjay purchased a hotel worth Rs. 10 lakh and barkha purchased a car worth Rs. 16 lakh. The value of hotel every year increases by 20% of the previous value and the value of car every year depreciates by 25%. What is the difference between the price of hotel and car after 3 years?
(a) Rs. 925000 (b) Rs. 10,53,000
(c) remains constant (d) can't be determined

yoursmahboob.wordpress.com



# Answers

## LEVEL-1

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

## LEVEL-2

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

yoursmahboob.wordpress.com



# Hints & Solutions

## LEVEL 1

**1.** $4000 + (4000 \times 5 \times 0.15) = \text{Rs. } 7000$

**2.** $(12000 - 8000) = \dfrac{8000 \times t \times 20}{100}$

$\Rightarrow \quad t = \dfrac{5}{2}$ years

**3.** $1960 = \dfrac{14000 \times r \times 2}{100} \Rightarrow r = 7\%$

**4.** $6300 = \dfrac{P \times 7 \times 15}{100 \times 2}$

$\Rightarrow \quad P = \text{Rs. } 12000$

**5.** $6000 = \dfrac{P \times 12 \times 1}{100}$

$\Rightarrow \quad P = 50000$

**6.** In my opinion this question should be solved by unitary method instead of making complex solution

| Years | Rate of Interest | Interest |
|---|---|---|
| 2 | 4% | 112 |
| 2 | 1% | 28 |
| 1 | 1% | 14 |

It means the principal sum is Rs. 1400

**Alternatively:** $\dfrac{P}{100} \times 2[(r+4) - r] = 112$

$\Rightarrow \quad P = 1400$

**7.** $SI = 2P - P = P$ (Interest = Amount – Principal)

$P = \dfrac{P \times 20 \times t}{100} \Rightarrow t = 5$ years

**8.** $P = \dfrac{P \times r \times 20}{100}$ (Interest = Amount – Principal)

$\Rightarrow \quad r = 5\%$ p.a.

**9.** $2P = \dfrac{P \times 15 \times r}{100}$ $(2P = 3P - P)$

$r = \dfrac{40}{3}\%$ p.a.

**10.** $P = \dfrac{P \times r \times 12}{100} \Rightarrow r = \dfrac{100}{12}\%$ p.a.

Now, $2P = \dfrac{P \times 100 \times t}{12 \times 100} = 24$ years

**Shortcut (for SI)** Since SI in second case is double the SI in first case, so the time period will also be double since SI is directly proportional to the time period, provided that rate of interest be same and principal as well.

**11.** $\dfrac{P_1 \times 5 \times 2}{100} = \dfrac{P_2 \times 10 \times 4}{100}$

$\Rightarrow \quad P_1 : P_2 = 4 : 1$

Therefore second principal is Rs. $125 \left(= 625 \times \dfrac{1}{5}\right)$

**Alternative:** Go through options.

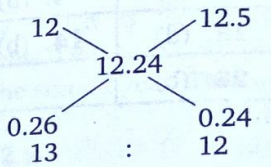
**12.** Best way is to go through option

So, $1300 \times 0.12 + 1200 \times 0.125 = 306$

Hence, (d) is the correct option.

**Alternatively:** Solve through alligation

Therefore the ratio of first principal to the second principal is 13 : 12.




$306 = \dfrac{2500 \times r \times 1}{100}$

$r = \dfrac{306}{25} = 12.24$

**13.** $\left(\dfrac{6000 \times 2 + 1500 \times 4}{100}\right) r = 900$

$\Rightarrow \quad r = 5\%$

**14.** Amount to be paid in first year $= \dfrac{200 \times 5 \times 1}{100} + 200 = 210$

Amount left as a principal for the second year

$= 210 - 100 = 110$

$\therefore$ Amount paid in second year $= 110 + \dfrac{110 \times 5 \times 1}{100} = 115.5$

**15.**

| A | B |
|---|---|
| $P_A = P$ | $P_B = 2P$ |
| $r_A = 5\%$ | $r_B = 5\%$ |
| $t = 10$ years | $t = 5$ years |
| Interest of $A = \dfrac{P \times 5 \times 10}{100} = \dfrac{P}{2}$ | Interest of $B = \dfrac{2P \times 5 \times 5}{100} = \dfrac{P}{2}$ |

Hence (c) is correct

**16.** **Statement (I)** $\dfrac{P \times 5 \times 50}{100 \times 3} \neq P$, hence wrong

**Statement (II)** $SI = \dfrac{P \times 5 \times 20}{100} = P$, hence correct

**Statement (III)** $P = \dfrac{P \times 5 \times r}{100} \Rightarrow r = 20\%$

Again $SI = \dfrac{P \times 10 \times 20}{100} = 2P$ hence wrong

**17.** $\dfrac{P_1 \times 2 \times 5}{100} = \dfrac{P_2 \times 3 \times 5}{100} = \dfrac{P_3 \times 4 \times 5}{100}$

$\Rightarrow \quad 10P_1 = 15P_2 = 20P_3$

$\Rightarrow \quad P_1 : P_2 : P_3 = 30 : 20 : 15 = \dfrac{1}{10} : \dfrac{1}{15} : \dfrac{1}{20}$

yoursmahboob.wordpress.com



18. $580 = \left[(x) + \left(x + \frac{x \times 1 \times 8}{100}\right) + \left(x + \frac{x \times 2 \times 8}{100}\right) + \left(x + \frac{x \times 3 \times 8}{100}\right) + \left(x + \frac{x \times 4 \times 8}{100}\right)\right]$

$$580 = 5x + \frac{8x}{10} = \frac{58x}{10}$$

$$\Rightarrow \quad x = 100$$

19. Time period = Feb 24 + March 31 + April 18

$$= 73 \text{ days} = \frac{1}{5} \text{ year}$$

$$\therefore \quad 2500 + \frac{2500 \times 12 \times 1}{100 \times 5} = \text{Rs. } 2560$$

20. $1700 + \frac{1700 \times 16 \times 2}{100} = \text{Rs. } 2244$

21. $A = P\left(1 + \frac{r}{100}\right)^n$

$$A = 1000\left(1 + \frac{10}{100}\right)^3$$

$$A = 1000 \times (1.1)^3$$

$$A = 1331$$

$$\therefore \quad \text{CI} = A - P = 1331 - 1000 = 331$$

22. $A = 10000 \times (1.2)^4$

$$A = 10000 \times 2.0736$$

$$A = 20736$$

$$\text{CI} = A - P$$

$$\text{CI} = 20736 - 10000 = 10736$$

23. $\text{CI} = [4000 \times (1.25)^3] - (4000)$

$$= 4000 \times 1.953125 - 4000$$

$$= 4000 \times 0.953125$$

$$= 3812.5$$

24. $\text{CI} = 5000 \times (1.3)^4 - 5000$

$$= 5000 \times 2.8561 - 5000$$

$$= 5000\ (1.8561)$$

$$= 9280.5$$

25. $441 = 400\left(1 + \frac{r}{100}\right)^2$

$$\Rightarrow \quad \frac{21}{20} = 1 + \frac{r}{100}$$

$$\Rightarrow \quad r = 5\%$$

26. Since, $A = 2P$, then

$$2P = P\left(1 + \frac{r}{100}\right)^n$$

$$\Rightarrow \quad 2 = \left(1 + \frac{r}{100}\right)^n$$

$$\Rightarrow \quad 4 = (2)^2 = \left[\left(1 + \frac{r}{100}\right)^n\right]^2 = \left[\left(1 + \frac{r}{100}\right)^{2n}\right]$$

$$\Rightarrow \quad \text{time period} = 2n \qquad \{\because (a^m)^n = a^{m.n}\}$$

(This question can be easily done by considering some appropriate values)

27. $7986 = 6000\left(1 + \frac{r}{100}\right)^3$

$$\frac{7986}{6000} = \left(1 + \frac{r}{100}\right)^3$$

$$\Rightarrow \quad \frac{1331}{1000} = \left(1 + \frac{r}{100}\right)^3$$

$$\Rightarrow \quad \frac{11}{10} = \left(1 + \frac{r}{100}\right)$$

$$\Rightarrow \quad r = 10\%$$

**Alternatively:** Go through options.

$$6000 \xrightarrow{+10\%} 6600 \xrightarrow{+10\%} 7260 \xrightarrow{+10\%} 7986$$

Hence, assumed option is correct.

28. Go through option

$$1 \times (1.2) = 1.2$$

$$1 \times (1.2)^2 = 1.44$$

$$1 \times (1.2)^3 = 1.728$$

$$1 \times (1.2)^4 = 2.0736$$

Hence minimum 4 years are required to double the sum.

29. $A = P\left(1 + \frac{R_1}{100}\right)\left(1 + \frac{R_2}{100}\right)\left(1 + \frac{R_3}{100}\right)\cdots$

$$A = 5000\ (1.08)\ (1.1)\ (1.12)$$

$$A = 6652.8$$

$$\text{CI} = 1652.8 = (6652.8 - 5000)$$

30. $2P = P\left(1 + \frac{r}{100}\right)^5$

$$\Rightarrow \quad 2 = \left(1 + \frac{r}{100}\right)^5$$

Now, $(2)^4 = \left(\left(1 + \frac{r}{100}\right)^5\right)^4 = \left(1 + \frac{r}{100}\right)^{20}$

$\Rightarrow$ The amount becomes 16 ($= 2^4$) times

$\therefore$ Hence (b) is correct, $\quad \because (2400 \times 16 = 38400)$

31. $550 = x\left[\left(\frac{1}{1.2}\right) + \left(\frac{1}{1.2}\right)^2\right]$

$$\Rightarrow \quad 550 = x\left[\frac{2.2}{1.44}\right]$$

$$\Rightarrow \quad x = \text{Rs. } 360$$

32. Difference between CI and SI for 2 years $= P\left(\frac{r}{100}\right)^2$

$$40 = P\left(\frac{10}{100}\right)^2 \Rightarrow P = 4000$$

**Alternatively:** Go through options

| | First year | Second year | |
|---|---|---|---|
| SI | 400 | 400 | 40 |
| CI | 400 | 440 | |

yoursmahboob.wordpress.com



**Alternatively:** Go back in the reverse process.
Rs. 40 at 10% implies that the principal for this interest was Rs. 400. Again by the same logic Rs. 400 as interest obtained at the principal of Rs. 4000 at 10%.

**33.** $6000\left(\frac{10}{100}\right)^2 = 60$

**34.**
$$\frac{P\left(1+\frac{r}{100}\right)^3}{P\left(1+\frac{r}{100}\right)^2} = \left(1+\frac{r}{100}\right)$$

$$\therefore \quad \frac{9528.128}{8988.8} = \left(1+\frac{r}{100}\right)$$

$$\Rightarrow \quad \left(1+\frac{84270}{1404500}\right) = \left(1+\frac{r}{100}\right)$$

$$\Rightarrow \quad \left(1+\frac{6}{100}\right) = \left(1+\frac{r}{100}\right)$$

$$\Rightarrow \quad r = 6\%$$

So,
$$8988.8 = P\left(1+\frac{6}{100}\right)^3$$

$$\Rightarrow \quad P = 8000$$

**Alternatively:** Best way is to go through options.

**35.** Difference between CI and SI for 2 years will be equal to the interest on SI for first year.

Hence, $6000 \times 0.07 \Rightarrow 420 \times 0.07 = 29.4 \neq 157.5$

and $7500 \times 0.08 \Rightarrow 600 \times 0.08 = 48 \neq 157.5$

and $14000 \times 0.1 \Rightarrow 1400 \times 0.1 = 140 \neq 157.5$

and $7000 \times 0.15 \Rightarrow 1050 \times 0.15 = 157.5 = 157.5$

Thus option (d) is correct.

**36.**
$$\frac{P\left(1+\frac{r}{100}\right)^3}{P\left(1+\frac{r}{100}\right)^2} = \left(1+\frac{r}{100}\right)$$

$$\frac{23958}{21780} = \left(1+\frac{r}{100}\right)$$

$$1+\frac{2178}{21780} = 1+\frac{r}{100}$$

$$\boxed{r = 10\%}$$

**Alternatively:** Remember the difference between compound interest of any two consecutive years will be same as the interest on the amount of total previous years.

So, $23958 - 21780 = 2178$

Now
$$r = \frac{2178}{21780} \times 100$$

$$r = 10\%$$

**37.** Amount to be paid at the end of 2 year

$$= \frac{800 \times 10 \times 2}{100} + 800 = 880$$

Amount left as principal for the second year

$$= 480 = (880 - 400)$$

Amount to be paid after 2nd year $= 480 + \frac{480 \times 10}{100}$

$$= \text{Rs. } 528$$

**38.** Principal for next month $= 440 - 200 = 240$

Amount paid after next month $= 244$

Therefore interest charged at Rs. 240 $= 4$

$$\therefore \quad 4 = \frac{240 \times r \times 1}{12 \times 100}$$

$$r = 20\% \text{ per annum}$$

**39.** Amount as a principal for first and second month $= 600 - 300 = \text{Rs. } 300$

Now, interest $= 360 - 300 = \text{Rs. } 60$

$$\therefore \quad 60 = \frac{300}{100} \times \frac{2}{12} \times r$$

$$r = 120\%$$

**40.** Amount as a principal for 2 month $= 2400 - 1000 = 1400$
At the rate of $r$% per annum after 2 months, Rs. 1400 will amount to

$$\text{Rs.}\left(1400 + \frac{1400 \times r \times 2}{100 \times 12}\right) \quad \text{...(i)}$$

Again total amount for the 2 instalments at the end of second month will be

$$\text{Rs}\left[800 + \left(800 + \frac{800 \times r \times 1}{100 \times 12}\right)\right] \quad \text{...(ii)}$$

from (i) and (ii), we get

$$1400 + \frac{2800r}{1200} = 1600 + \frac{800r}{1200}$$

$$\frac{2000r}{1200} = 200$$

$$\Rightarrow \quad r = 120\%$$

**41.** Balance price to be paid in instalments $= 1980$
At the rate of $r$% per annum after 4 months, Rs. 1980 will amount to Rs. $\left(1980 + \frac{1980 \times 4 \times 25}{12 \times 100}\right) = \text{Rs. } 2145$ ...(i)

Now, the total amount for the 4 instalments at the end of fourth month will be

$$\left[x + \left(x + \frac{25x \times 1}{12 \times 100}\right) + \left(x + \frac{25x \times 2}{12 \times 100}\right) + \left(x + \frac{25 \times 3x}{12 \times 100}\right)\right]$$

$$= 4x + \frac{25x}{1200}(1 + 2 + 3)$$

$$= \frac{33x}{8} \quad \text{...(ii)}$$

from (i) and (ii) $\frac{33x}{8} = 2145$

$$\boxed{x = 520}$$

**42.** Balance price to be paid in instalments $= 350$
At the rate of $r$% per annum after 5 months, Rs. 350 will amount to

$$\text{Rs.}\left(350 + \frac{350 \times 18 \times 5}{12 \times 100}\right) = \left(350 + \frac{1750 \times 18}{1200}\right) \quad \text{...(i)}$$

Again, total amount for the 5 instalments at the end of 5th month will be

yoursmahboob.wordpress.com



$$\text{Rs.}\left[x+\left(x+\frac{18x\times1}{1200}\right)+\left(x+\frac{18x\times2}{12\times100}\right)+\left(x+\frac{18x\times3}{12\times100}\right)+\left(x+\frac{18x\times4}{12\times100}\right)\right]$$

$$=\left[5x+\frac{18x}{1200}(1+2+3+4)\right]$$

$$=5x+\frac{180x}{1200}=\left(\frac{6180x}{1200}\right) \quad \ldots(ii)$$

from (i) and (ii), we get

$$\left(350+\frac{1750\times18}{1200}\right)=\frac{6180\,x}{1200}$$

$$\Rightarrow \quad x=73.058$$

43. Let each instalments be Rs. $x$

The amount to be paid instalments = 390200

The total value of all the three instalments is

$$\text{Rs.}\left[x\left(\frac{25}{26}\right)+x\left(\frac{25}{26}\right)^2+x\left(\frac{25}{26}\right)^3\right]$$

and this must be equal to Rs. 390200

Hence, $x\times\frac{25}{26}\left[1+\frac{25}{26}+\frac{625}{676}\right]=390200$

$$x=\text{Rs. }140608$$

44. Rate of interest = 16% annum

Actual rate of interest = 4% per quarter

Principal of all three instalments

$$=\left[17576\left(\left(\frac{25}{26}\right)+\left(\frac{25}{26}\right)^2+\left(\frac{25}{26}\right)^3\right)\right]$$

$$=\frac{17576\times25\times1951}{26\times676}$$

$$=48775$$

Total amount paid = Rs. 17576 × 3 = 52728

Interest charged = 52728 − 48775 = 3953

45. Rate of interest $=\frac{40/3}{2}\%=\frac{20}{3}\%$ half yearly

$$\therefore \quad 10815=x\left[\frac{15}{16}+\left(\frac{15}{16}\right)^2+\left(\frac{15}{16}\right)^3\right]$$

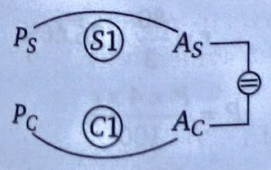
$$\Rightarrow \quad x=4096$$

46. $$P=486680\left[\frac{20}{23}+\left(\frac{20}{23}\right)^2+\left(\frac{20}{23}\right)^3\right]$$

$$\Rightarrow \quad P=\left[486680\times\frac{20}{23}\left(1+\frac{20}{23}+\frac{400}{529}\right)\right]$$

$$P=1111200$$

47.



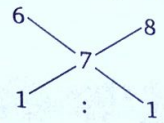

Obviously $P_S > P_C$, therefore percentage gain of $P_C$ is greater than $P_S$.

48. $$A_S=P+\frac{P\times6\times6}{100}=P\left(\frac{136}{100}\right)$$

$$A_C=P\left(1+\frac{6}{100}\right)^6=P\left(\frac{106}{100}\right)^6$$

$$\therefore \quad \frac{A_S}{A_C}=\frac{136}{100}\times\left(\frac{100}{106}\right)^6$$

49.




50. Difference between CI and SI for $n^{th}$ year

$$=\frac{Pr}{100}\left[\left(1+\frac{r}{100}\right)^{n-1}-1\right]$$

$$7280=\frac{P\times20}{100}[(1.2)^3-1]$$

$$\Rightarrow \quad P=50000$$

**Alternatively:**

| | Initially | I$^{st}$ year | II$^{nd}$ year | III$^{rd}$ year | IV$^{th}$ year |
|---|---|---|---|---|---|
| SI | 10000 | 12000 | 14000 | 16000 | 18000 |
| CI | 10000 | 12000 | 14400 | 17280 | 20736 |

CI for 4$^{th}$ year = 20736 − 17280 = 3456

SI for 4$^{th}$ year = 2000

Difference between CI and SI = 1456 for Rs. 10000

So, the difference of Rs. 7280 is for Rs. 50000

51. $$\frac{P\times5\times9}{100\times12}-\frac{P\times14\times3}{100\times12}=10$$

$$\Rightarrow \quad P=\text{Rs. }4000$$

Now, $\frac{4000}{100\times12}[5\times9+14\times3]=\text{Rs. }290$

52. Let the principal be $x$, then

$$\frac{\left(\frac{x}{7}\times4+\frac{x}{2}\times5+\frac{5x}{14}\times6\right)}{100}=730$$

$$\Rightarrow \quad x=14000$$

**Alternatively:** Go through suitable options.

Choose any middlemost option so that if the chosen option is not correct, then you can determine that whether you have to increase or decrease the value of the choices given.

53. $$\frac{P_1\times2\times7x}{100}=\frac{P_2\times2\times8x}{100}$$

$$\Rightarrow \quad \frac{P_1}{P_2}=\frac{8}{7}$$

54. $$\frac{P\left[\left(1+\frac{r}{100}\right)^3-1\right]}{\frac{pr}{100}}=\frac{\left(1+\frac{r}{100}\right)^3-1}{\frac{r}{100}}=3.64$$

Now go through options and verify

yoursmahboob.wordpress.com





$$\frac{\left(1+\frac{20}{100}\right)^3-1}{\frac{20}{100}}=\frac{(1.2)^3-1}{0.2}$$

$$=\frac{0.728}{0.2}=3.64$$

Hence (c) is correct.

**55.** $\frac{8P}{5}=\frac{8P}{5}$

Now, $\frac{8}{5}P=\frac{P\times r\times 32}{100}$

$\Rightarrow$ $r=5\%$

**56.** $\frac{1500\times 3}{100}(r_1-r_2)=18$

$\Rightarrow$ $r_1-r_2=0.4$

## LEVEL 2

**1.** CI for 2 years = Rs. 756
SI for 2 years = Rs. 720
It means the interest on the interest of the first year = Rs. 36 (= 756 – 720)
This implies that the rate of interest is 10%

as $\frac{36}{360}\times 100=10\%$

It means the principal for first year was Rs. 3600

$\because$ $\frac{P\times 10\times 1}{100}=360$

$\Rightarrow$ $P=3600$

Now, $\frac{P\times k\times k}{100}=\text{SI}$, where $r=t=k$

$\frac{3600\times k^2}{100}=900$

$\Rightarrow$ $k=5$

**2.** $30000\,(1+1.1+(1.1)^2)-30000\,(1+1.1+1.2)$

$\Rightarrow$ Rs. 300

$$30{,}000\left(1+\frac{10}{100}\right)^2-\frac{30{,}000\times 10\times 2}{100}$$

$\Rightarrow$ Rs. 300

**3.** Interest received from Birbal $=\frac{Pr}{100}$

Interest received from Chanakya $=\frac{\left(2\frac{Pr}{100}\right)\times\frac{r}{2}}{100}$

$$=P\left(\frac{r}{100}\right)^2$$

**4.** $100\,(1.3)^3=219.7$

$\Rightarrow$ CI = 119.7

and $\text{SI}=\frac{100\times 3\times 30}{100}=90$

$\therefore$ CI is greater than SI by Rs. 29.7 (119.7 – 90)

$\therefore$ % increase $=\frac{29.7}{90}\times 100=33.0\%$

**5.** The best way is to go through options

$$\frac{2200\times 4\times 3}{100}+\frac{1300\times 6\times 3}{100}=\text{Rs. }498$$

Hence the presumed option is correct.

**NOTE** When we consider Rs. 2200 for 4%, then the rest amount *i.e.*, Rs. 1300 = (3500 – 2200) will be considered automatically for 6%.

**Alternatively:** Average % rate $=\frac{166}{35}\%$

$$\left[\because 498=\frac{3500\times r\times 3}{100}\right]\Rightarrow r=\frac{166}{35}\%$$

$\therefore$

$$\begin{array}{ccc} \frac{35}{35}\times 4 & & 6\times\frac{35}{35} \\ & \frac{166}{35} & \\ \frac{44}{35} & & \frac{26}{35} \\ 22 & : & 13 \end{array}$$

Thus the ratio of principal at 4% and 6% will be in the ratio of 22 : 13 respectively.

**6.** $\frac{\text{Decreases in second year}}{\text{Decreases in third year}}=\frac{100}{100-r}=\frac{10}{9}$

$\Rightarrow$ $r=10\%$

Let the population of vultures 3 years ago be $P$, then

$$P\left(1-\frac{10}{100}\right)^3=29160$$

$\Rightarrow$ $P=40000$

**7.** On the second year (in terms of CI) is

$$\frac{P\left(1+\frac{r}{100}\right)^2}{\left(P+\frac{Pr}{100}\right)}=\frac{6}{5}\Rightarrow\left(1+\frac{r}{100}\right)=\frac{6}{5}$$

$\Rightarrow$ $r=20\%$

**8.** Balance price to be paid in instalments = Rs. 1150 ...(i)

$\because$ $(1500-350)=1150$

Now, the total amount for the next 3 instalments at the end of 3rd month will be

$$\left(1150+\frac{1150\times r\times 3}{12\times 100}\right)=$$

$$\left[400+\left(400+\frac{400\times r\times 1}{100\times 12}\right)+\left(400+\frac{400\times r\times 2}{100\times 12}\right)\right]$$

$$\left(\frac{46000+115r}{40}\right)=\left(1200+\frac{400\times 3r}{1200}\right)$$

$\Rightarrow$ $r=\frac{80}{3}=26.66\%$ ...(ii)

**9.** $A$: $P=\frac{P\times 4\times r}{100}$

$\Rightarrow$ $r=25\%$

$B$: $P\left(1+\frac{25}{100}\right)^2=\frac{25P}{16}$

yoursmahboob.wordpress.com



Again $\frac{25P}{16} \times \frac{2 \times 25}{100} = \frac{25P}{32}$

Therefore total amount of $A$ after 4 years $= 2P$

and total amount of $B$ after 4 years $= \frac{25P}{16} + \frac{25P}{32} = \frac{75P}{32}$

Therefore difference in amount $= \frac{75P}{32} - 2P = \frac{11P}{32} = 2750$

$\Rightarrow$ $P = 8000$

10. Go through options

$$1.8 + \frac{1.8 \times 6 \times 10}{100} = 1.6 + \frac{1.6 \times 8 \times 10}{100},$$

Hence (d) is correct.

**Alternatively:** $P_1 + \frac{P_1 \times 6 \times 10}{100} = P_2 + \frac{P_2 \times 8 \times 10}{100}$

$\Rightarrow$ $\frac{P_1}{P_2} = \frac{9}{8}$

11. Amount which is to be returned on completion of studies

$= 600000 \times (1.08)^2$

$= 699840$

But only half of 699840 is returned which is equal to Rs. 349920

$\therefore$ Amount which is returned after two year of completion of studies

$$= 349920\left(1 + \frac{10}{100}\right)^2$$

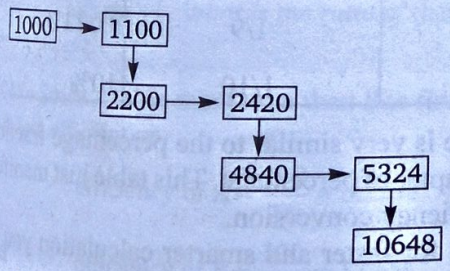
$= 423403.2$

Total amount returned

$= 349920 + 423403.2 = 773323.2$

$=$ Rs. 7.73323 lakh

12.




13. Note that, ultimately 8% interest is charged.

So the net value after 3 years $= 125971.2$

14. Total time $= 25 + 5 = 30$ years

Again no. of time periods for cost increment $= \frac{30}{6} = 5$

and no. of time periods for rupee depreciation $= \frac{30}{5} = 6$

Now, the net value of the plot $= 1000 \times (1.05)^5 \times (0.98)^6$

$\approx$ Rs. 1130

15. $\frac{A}{B} = \frac{12 \times x}{3 \times y} = \frac{28}{15}$

$\Rightarrow$ $\frac{A}{B} = \frac{7}{15}$

16. We can find the profit of $B$ but not investment.

17. We don't know the rate of interest.

18. $10500 = x\left[\frac{10}{11} + \left(\frac{10}{11}\right)^2\right]$

$\Rightarrow$ $x = 6050$

19. Let the amount of investment with each one be Rs. 400, then

Hari Lal Hari Prasad

$$[400\,(1.1)^2] = [100\,(1.1)^2] + \left[300 + \frac{300 \times r \times 2}{100}\right]$$

$\Rightarrow$ $r = 10.5\%$

20. Best way is to go through options

$1000 \times (1.2)^2 = 2488.32 \approx 2490$

21. Amount earned by HDFC $= 1000000 + \frac{1000000 \times 10 \times 2}{100}$

$= 1200000$

Amount earned by HUDCO $= 1000000\,(1.1)^3 = 1331000$

Net earning of HUDCO $= 1331000 - 1200000 = 131000$

22. Interest paid by Ram Singh $=$ Rs. 48000

Now go through option

$48000 = \frac{100000}{100}[6 \times 4 + 4 \times 6]$

$48000 = 48000$

Hence proved that option (b) is correct. It means Ram Singh availed the discount after 4 years of loaning.

23. Worth of hotel after 3 years $= 1000000\,(1.2)^3$

$= 1728000$

Worth of car after 3 years $= 1600000\left(\frac{3}{4}\right)^3$

$=$ Rs. 6,75,000

So, the difference in their worth (pertaining to hotel and car) is

$= 1728000 - 675000 = 10,53,000$

□□□