

MATHEMATICS



AFCAT

MATHEMATICS

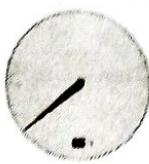
- | | |
|----|---------------------------------------|
| 1. | Work & Time |
| 2. | Time & Distance |
| 3. | Average |
| 4. | Percentage |
| 5. | Ratio & Proportion |
| 6. | Profit & Loss |
| 7. | Simple & Compound Interest |
| 8. | Decimal Fractions |

WORK & TIME

You can expect at least 2-3 questions from this chapter

Frequency of questions from this chapter is moderate.

This chapter is lengthy and will take some time to finish



TYPE I

When work of a single person needs to be computed.

Example: A, B, C can do a piece of work individually in 8, 12, 15 days respectively. A & B start working but A quits after working for 2 days. After this C joins B till completion of work. In how many days the work will be completed?

A can do work in 8 days. B can do work 12 days, C can do work in 15 days.

Now here, understand that

A can do work in 8 days. Which means in one day his $1/8^{\text{th}}$ work is done.

$$\frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \left(\frac{1}{8} \right) + \frac{1}{8} + \frac{1}{8}$$



ONE DAYS WORK

Total work in 8 days

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

$$\text{Now, one day work of } A + B = \frac{1}{8} + \frac{1}{12} = \frac{5}{24}$$

$$\text{Two day work of } A + B = \frac{5}{24} + \frac{5}{24} = \frac{10}{24}$$

After two days A quits.

(total work is always 1)

Thus, remaining work is $1 - \frac{10}{24} = \frac{14}{24}$

After A quits, C joins B to carry out the work

One day work of C + B = $\frac{1}{12} + \frac{1}{15} = \frac{9}{60}$

Number of days remaining to finish the work = $\frac{\frac{14}{24}}{\frac{9}{60}} = \frac{14 \times 60}{24 \times 9} = \frac{35}{9}$

Total time taken to finish the work = $2 + \frac{35}{9} = \frac{53}{9} = 5.8$ days

PRACTICE QUESTIONS



I. A can do a piece of work in 4 days. B can complete same work in 12 days. What is the number of days required to do the same work together.

- (a) 2 days (b) 3 days (c) 4 days (d) 5 days
ANS-(B)

II. A & B can do a piece of work in 10 h. B & C can do the same work in 15 h. A & C can do the work in 12 h. In how many hours will B do the work independently.

- (a) 12 h (b) 16 h (c) 20 h (d) 24 h
ANS-(D)

III. A and B undertake to do a piece of work for Rs 600. A alone can do it in 6 days while B alone can do it in 8 days. With the help of C, they finish it in 3 days. Find C's share

- (a) 300 (b) 225 (c) 75 (d) 90
ANS-(C)

IV. 45 men can complete a work in 16 days. Six days after they started working 30 more men joined them. How many days will they now take to complete the remaining work

- (a) 6 (b) 8 (c) 10 (d) 12
ANS-(A)

SOLUTION - V:

$$\text{A's one day work} = \frac{1}{15}$$

$$\text{A's 5 days work} = \frac{5}{15}$$

Since total work is 1, therefore work remaining $= 1 - \frac{5}{15} = \frac{10}{15}$

Let B's one day work be $\frac{1}{x}$

And we know that the remaining work was done by B in 20 days

$$\Rightarrow \left[\frac{\frac{10}{15}}{\frac{1}{x}} \right] = \frac{10}{15} \times \frac{x}{1} = 20 \text{ days}$$

$$\Rightarrow \frac{10x}{15} = 20$$

$$\Rightarrow 10x = 300 \Rightarrow x = 30$$

TYPE II

work done in hours & minutes.

Example: Two taps A & B fill up water tank. Tank can be filled up in 40 min if both taps are on.

If tap A alone fills the tank it takes 60 min. How much time will tap B take alone to fill the tank

$$\text{Tap A one min work} = \frac{1}{60}$$

$$(\text{Tap A total work} = \frac{60}{60} = 1)$$

$$\text{Tap A + B one min work} = \frac{1}{40}$$

$$(\text{Tap A + B total work} = \frac{40}{40} = 1)$$

$$\text{Tap B one min work} = \frac{1}{40} - \frac{1}{60} = \frac{1}{120}$$

$$\text{Therefore, tap B 120 min work} = \frac{120}{120} = 1$$

Tap B takes 120 min to complete full 1 work.



PRACTICE QUESTIONS

I. Pipe A can fill tank in 10 min and pipe B can empty tank in 15 min. If both are opened simultaneously how much time will it take to fill it up?

- (a) 20 min (b) 25 min (c) 30 min (d) 40 min
ANS-(C)

II. A mason can build a tank in 12 h. After working 6h he took the help of boy & finished the remaining work in just 5 hours. What is the time taken if boy does the whole work alone.

- (a) 30 h (b) 45 h (c) 60 h (d) 64 h
ANS-(C)

SOLUTION - IV:

One hour work of Pipe A of filling the water = $\frac{1}{4}$

1 hour work of Pipe B of removing the water = $\frac{1}{16}$

1 hour work of pipe A & B when they are turned on together = $\frac{1}{4} - \frac{1}{16} = \frac{3}{16}$
 $(-\frac{1}{16}$ because pipe B removes water)
 Therefore total hours when tank can be fully filled is $\frac{16}{3}$

TYPE III

Where men, work & days are given in comparison.

Example: If 15 men complete work in 16 days. 24 men complete the same work in how much time.



Trick

use this formula

$$\text{men} \times \text{work} \times \text{days} = \text{men} \times \text{work} \times \text{days}$$

$$15\text{men} \times 16\text{days} \times 1\text{work} = 24\text{men} \times \text{unknown days} \times 1\text{work}$$

$$\text{Unknown days} = \frac{15 \times 16}{24} = 10 \text{ days}$$

**PRACTICE QUESTIONS**

I. 20 workers working for 5 hours per day to complete work in 10 days. If 25 workers are employed to work 10 h per day. What is the time required to complete this work.

- (a) 4 days (b) 5 days (c) 6 days (d) 8 days

ANS-(A)

II. Certain number of men can do a piece of work in 40 days. If there were 45 men more, the work could have been finished in 25 days. Find the original number of men employed in the work

- (a) 45 men (b) 25 men (c) 75 men (d) 40 men

ANS-(C)

III. Certain number of men can do a piece of work in 40 days. If there were 8 more men, could be finished in 10 days less.

Find number of men

- (a) 30 (b) 25 h (c) 24 (d) 20

ANS-(C)

SOLUTION - I:

$$20 \times 5 \times 10 = 25 \times 10 \times \text{Days}$$

$$\Rightarrow \text{Days} = \frac{20 \times 5 \times 10}{25 \times 10} \Rightarrow 4 \text{ days}$$

SOLUTION - II:

$$M \text{ men} \times 40 \text{ days} \times 1 \text{ work} = (M + 8) \text{ men} \times 25 \text{ days} \times 1 \text{ work}$$

$$\Rightarrow 40M = 25M + 1000$$

$$\Rightarrow 15M = 1125 \Rightarrow M = 75$$

SOLUTION - III:

$$M \times 40 \text{ days} \times 1 \text{ work} = (M + 8) \text{ men} \times 30 \text{ days} \times 1 \text{ work}$$

$$\Rightarrow 40M = 30M + 240 \Rightarrow M = 24$$

TYPE IV

When there are both men & women.

Example: 3men & 4 boys do a piece of work in 8 days 6 men & 8 boys do the same work in ?

$$M \times D \times W = M \times D \times W$$

$$\{3M + 4B\} \times 8 \times 1 = \{6M + 8B\} \times D \times 1$$

$$\frac{\{3M + 4B\} \times 8}{\{6M + 8B\}} = \text{days}$$

$$\text{This can also be written as } \frac{\{3M + 4B\} \times 8}{\{3M + 4B\} \times 2} = \text{days} \Rightarrow \text{days} = 4$$



PRACTICE QUESTIONS

I. If 6 men & 8 boys can do a piece of work in 10 days. While 26 men & 48 boys can the same work in 2 days. What is the time taken by 15 men & 20 boys in doing the same type of work?

- (a) 4 days (b) 5 days (c) 6 days (d) 7 days
ANS-(A)

II. If one man or two women or three boys can do a piece of work in 55 days. Then one man, one women & one boy will do it in how many days.

- (a) 20 days (b) 30 days (c) 40 days (d) 50 days
ANS-(B)

III. 2 men and 3 boys can complete a work in 10 days, while 3 men and 2 boys can complete the work in 8 days. In how many days can 2 men and 1 boy complete the same work?

- (a) 4 days (b) 8 days

- (c) 12 $\frac{1}{2}$ days (d) 16 days

ANS-(C)

IV. 10 men and 15 women can together do a piece of work in 6 days. A man alone can complete the work in 100 days. In how many days can one woman complete the whole work?

- (a) 200 days

- (b) 225 days

- (c) 250 days

- (d) 150 days

ANS-(B)

SOLUTION - I:

$$(6M + 8B) \times 10 \times 1 = (26M + 48B) \times 2 \times 1$$

$$60M + 80B = 52M + 96B$$

$$\Rightarrow 8M = 16B$$

$$\Rightarrow M = 2B$$

Therefore 1 Man can do the work of 2 boys

We were told that 26 M and 48 boys take 2 Days.

Now, Since $M = 2B$,

$$\therefore 26 \text{ Men} = 52 \text{ Boys}$$

$$\text{Hence, } 52 \text{ Boys} + 48 \text{ Boys} = 100 \text{ Boys}$$

$\Rightarrow 100$ boys can do a work in 2 days

Therefore, by logic 50 Boys can do the work in 4 days

Therefore 1 Man ,1 Woman and 1 Boy together will complete a work in 30 days

SOLUTION - III:

$$(2M + 3B) \times 10 \text{ days} \times 1 \text{ work} =$$

$$(3M+2B) \times 8 \text{ days} \times 1 \text{ work}$$

$$\Rightarrow 20M + 30B = 24M + 16B$$

$$\Rightarrow 4M = 14B$$

$$\therefore 2M = 7B \Rightarrow M = 3.5 B$$

We are told that 2 Men and 3 Boys take 10 days. Now, Since, $1 M = 3.5 B$

Therefore, $2 \text{ Men} = 7 \text{ boys}$

[Hence, In the next equation, we will replace 2 men with 7 boys]

$$2 \text{ Men} + 3 \text{ Boys} \text{ take 10 days}$$

$$\Rightarrow 7 \text{ Boys} + 3 \text{ Boys} \text{ take 10 days}$$

$$\Rightarrow 10 \text{ Boys take 10 days}$$

Now we are asked to find the time taken by 2 Men and 1 Boy

$$\Rightarrow 10B \times 10D \times W = (2M + 1B) \times D \times W$$

$$\Rightarrow 10 \text{ Boys} \times 10 \text{ days} \times 1 \text{ work} =$$

$$(7 \text{ Boys} + 1 \text{ Boy}) \times Days \times 1 \text{ Work}$$

$$\Rightarrow 10 \times 10 \times 1 = 8 \times Days \times 1$$

$$\Rightarrow Days = \frac{100}{8} = 12.5$$

SOLUTION - II:

$$1 \text{ man one day's work} = \frac{1}{55}$$

$$1 \text{ women one day's work} = \frac{1}{110}$$

$$1 \text{ Boy one day's work} = \frac{1}{165}$$

When 1 Man, 1 Women & 1 Boy work

$$\text{together} = \frac{1}{55} + \frac{1}{110} + \frac{1}{165} = \frac{6+3+2}{330}$$

$$\Rightarrow \frac{11}{330} = \frac{1}{30}$$

SOLUTION - IV:

$$(10M + 15W) \times 6 \text{ days} \times 1 \text{ work} = 1 M \times 100 \text{ days} \times 1 \text{ work}$$

$$\Rightarrow 60M + 90W = 100M$$

$$\Rightarrow 40M = 90W$$

$$\Rightarrow M = 2.25W$$

We are told that 10 Men and 15 Women can do a work in 6 days.

$$\text{Now, } M = 2.25W$$

$$\Rightarrow (10M + 15W) \times 6 \text{ days} \times 1 \text{ work} = 1 M \times 100 \text{ days} \times 1 \text{ work}$$

$$\Rightarrow (22.5 + 15W) \times 6 \text{ days} \times 1 \text{ work} = 1 W \times \text{Days} \times 1 \text{ work}$$

$$\Rightarrow 37.5 \times 6 \times 1 = 1 \times \text{Days} \times 1$$

$$\Rightarrow \text{Days} = 225$$

TYPE V

When money is included as wage or salary for work done

Example: 18 men can earn ₹ 360 in 5 days. How much money will 15 men earn in 9 days.



TRICK use formula

$$\frac{M \times D}{₹} = \frac{M \times D}{₹}$$

$$\frac{18M \times 5D}{360\text{Rs}} = \frac{15M \times 9D}{\text{unknown ₹}}$$

$$\text{Unknown ₹} = \frac{15 \times 9 \times 360}{18 \times 5} = 540$$



PRACTICE QUESTIONS

I. If 18 men earn ₹ 1440 in 5 days. How many men can earn ₹ 1920 in 8 days.

- (a) 10 (b) 12 (c) 15 (d) 18

ANS-(C)

II. The mess charges for 35 students for 24 days is rs 6300. In how many days will the mess charges be ₹ 3375 for 25 students.

- (a) 12 (b) 15 (c) 18 (d) 21

ANS-(C)

SOLUTION - I:

$$\frac{18 \times 5}{1440} = \frac{\text{Men} \times 8}{1920}$$

$$\Rightarrow \text{men} = \frac{1920 \times 18 \times 5}{1440 \times 8} \Rightarrow \text{Men} = 15$$

SOLUTION - II:

$$\frac{35 \times 24}{6300} = \frac{\text{Men} \times 25}{3375}$$

$$\Rightarrow \text{men} = \frac{3375 \times 35 \times 24}{6300 \times 25} \Rightarrow \text{Men} = 18$$

TYPE VI

When efficiency of two people are compared

Example: X can do a work in 16 days. In how many days will the work be completed by Y, if efficiency of Y is 60% more than that of X.



Here, the trick is to make the comparison

$$\text{If } X = 100\% \quad Y = 100 + 60 \Rightarrow 160\%$$

$$M \times W \times D = M \times W \times D$$

$$100 \times 1 \times 16 = 160 \times 1 \times D \Rightarrow \frac{100 \times 1 \times 16}{160 \times 1} = D \Rightarrow D = 10 \text{ days}$$



PRACTICE QUESTIONS

I. A & B have been assigned a work of completing a book of 1575 pages in 25 days working 15 hours per day. A is 20% more efficient than B. Page contains an average of 275 words then how many words can A type in an hour.

- (a) 600 (b) 620 (c) 630 (d) 650
ANS-(C)

II. A can complete a certain job in 12 days. B is 60% more efficient than A. In how many days can B complete the same job?

- (a) 6 (b) 6.25 (c) 7 (d) 7.5
ANS-(D)

SOLUTION - I:

A is 20% more efficient than B.

Therefore, $1A = 1.2B$

$$(20\% = \frac{20}{100} = 0.2)$$

Total number of words in book =

$$1575 \times 275 = 433125$$

Total number of hours to write book =

$$25 \times 15 = 375$$

Therefore, Total words written per hour

$$= \frac{433125}{375} = 1155$$

\Rightarrow 1155 words are written when A & B work together

$A + B = 1155$ or since, $A = 1.2B$, we can say that $1.2B + 1B = 1155$

$$\Rightarrow 2.2B = 1155$$

$$B = 525. \text{ Hence, } A = 1.2 \times 525 = 630$$

SOLUTION - II:

B is 60% more efficient than A

Therefore, $1B = 1.6A$

$$(60\% = \frac{60}{100} = 0.6)$$

$$A \times 12 \times 1 \text{ WORK} = B \times \text{DAYS} \times 1 \text{ WORK}$$

$$A \times 12 = B \times \text{DAYS}$$

$$A \times 12 = 1.6A \text{ DAYS}$$

$$\text{DAYS} = \frac{12}{1.6} = 7.5 \text{ Days}$$

TYPE - VII

Example: A, B and C finish a work in 10, 15 and 12 days respectively. What is the time taken to finish the work if they all work together?



Here, the trick is to use the following formula

$$\frac{abc}{ab + bc + ca}$$

$$\text{Therefore, we have } \frac{10 \times 15 \times 12}{(10 \times 15) + (15 \times 12) + (12 \times 10)} = \frac{1800}{(150) + (180) + (120)} = \frac{1800}{450} = 4$$

A, B and C will together finish the work in 4 days

Example:

A and B together can do a piece of work in 8 days, B and C together can do the same work in 6 days. C and A together can do the same work in 10 days. Find out number of days taken, If they all work together.



Here, the trick is to use the following formula

$$\frac{2abc}{ab + bc + ca}$$

$$\frac{ab + bc + ca}{2abc}$$

Therefore, we have $\frac{2 \times 8 \times 6 \times 10}{(8 \times 6) + (6 \times 10) + (10 \times 8)} = \frac{960}{(48) + (60) + (80)} = \frac{960}{185} = 5 \frac{5}{47}$
A, B and C will together finish the work in $5 \frac{5}{47}$ days

Example:
A, B and C can do a work separately in 16, 32 and 48 days respectively. After working together for long time B finally left 8 days before the completion of work and C left 6 days before completion of work. In what time will the work be finished?



Here, the trick is to use the following formula

$$\frac{x - \text{Days}}{A} + \frac{x - \text{days}}{B} + \frac{x - \text{days}}{C} = 1$$

Therefore, In this case A did not leave the work , B left 8 days and C left 6 days before completion of work

$$\frac{x-0}{16} + \frac{x-8}{32} + \frac{x-6}{48} = \frac{6x+3x-24+2x-12}{96} = \frac{11x-36}{96} = 1$$

$$11x - 36 = 96 \Rightarrow x = 12 \text{ days}$$



PRACTICE QUESTIONS

I. A and B can do a given piece of work in 8 days, B and C can do the same work in 12 days. A, B and C can complete the same work in 6 days. Find out the time taken by A and C to complete the work

- (a) 10 (b) 12 (c) 15 (d) 8
ANS-(D)

II. A, B and C can do a work separately in 10, 12 and 15 days respectively. A left the work before the work was completed and B left 2 days after A left. In what time will the work be finished

- (a) 7 (b) 5 (c) 8 (d) 2
ANS-(A)

SOLUTION - I:

$$\text{One day work of } A+B = \frac{1}{8} \quad \text{One day work of } B+C = \frac{1}{12} \quad \text{One day work of } A+B+C = \frac{1}{6}$$

$$\text{Let us say that one day work of } C+A = \frac{1}{x}$$

$$(\text{One day work of } A+B) + (\text{One day work of } B+C) + (\text{One day work of } C+A) = 2 \times \text{One day work of } (A+B+C)$$

$$\Rightarrow \frac{1}{8} + \frac{1}{12} + \frac{1}{x} = \frac{1}{6} \quad \Rightarrow \frac{3+2}{24} + \frac{1}{x} = \frac{1}{6} \quad \Rightarrow \frac{1}{x} = \frac{1}{6} - \frac{5}{24} \quad \Rightarrow \frac{1}{x} = \frac{1}{8} \quad \therefore x = 8$$

Therefore, A & C will take 8 days to finish the work together.

SOLUTION - II:

$$\text{As per the trick explained above, we get } \frac{x-\text{Days}}{A} + \frac{x-\text{days}}{B} + \frac{x-\text{days}}{C} = 1$$

A left the work 5 days before the work was completed. B left it 2 days after A left.

Therefore, we can say that B left 3 days before the work was completed.

$$\Rightarrow \frac{x-5}{10} + \frac{x-3}{12} + \frac{x-0}{15} = 1 \quad \Rightarrow \frac{x-5}{10} + \frac{x-3}{12} + \frac{x}{15} = 1 \quad \Rightarrow \frac{6(x-5)+5(x-3)+4x}{60} = 1$$

$$\Rightarrow 6x - 30 + 5x - 15 + 4x = 60 \quad \Rightarrow 15x = 105$$

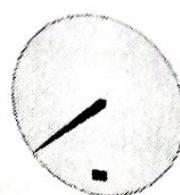
$\Rightarrow x = 7$ Therefore, work can be completed in 7 days.

TIME AND DISTANCE

You can expect at least 2-3
Question from this chapter

Frequency of questions from
this chapter is moderate

This chapter is again lengthy
with various types & subtypes



Before beginning the chapter lets understand now that there is just one fundamental formula which you should use in every question of time and distance.

$$\text{SPEED} = \frac{\text{DISTANCE}}{\text{TIME}}$$

TYPE 1 (A)

When total time is given and person travels at different speed for same distance.

Example: RAM goes from place A to place B at a speed of 4km/h and returns at the speed of 3km/h. he takes 7 hours in totality. Find the distance travelled.



TRICK

Use this trick to find distance

$$\frac{\text{Speed 1} \times \text{Speed 2}}{\text{Speed 1} + \text{Speed 2}} \times \text{total Time}$$

Here speed 1 will be 4km/h and speed 2 will be 3km/h. Total time will be 7 hours

$$\text{Distance} = \frac{4 \times 3}{4+3} \times 7 \Rightarrow \frac{12}{7} \times 7 = 12\text{km}$$

TYPE I (B)

When a person travels at different speed in different time for same distance.

Example: Ram walks from his house to school at 2.5 km/h and arrives 12 min late. When he comes back from school to home at speed of 4km/h he reaches 15 min earlier. Find distance



TRICK

Use this trick to find distance

$$\frac{\text{Speed 1} \times \text{Speed 2}}{\text{Speed 1} - \text{Speed 2}} \times \text{Time}$$

Speed 1 here refers to the greater speed while speed 2 refers to the smaller speed.

Time here will vary for every Question as explained below

Conditions	Example	Execution of time
When one reaches late at some speed and reaches early at other speed	Example – he reached 12 min late at speed x and 15 minutes early at speed y	$12 + 15 = 27 \text{ min}$ When converted to hours we get $\frac{27}{60} \text{ h}$
When one reaches late at some speed and reaches late at another speed	Example – he reaches 15 min late at speed x and 12 min late at speed y	$15 - 12 = 3 \text{ min}$ When converted to hours we get $\frac{3}{60} \text{ h}$
When one reaches early for one speed and early at another speed	Example – he reaches 15 min early at speed x and 12 min early at speed y	$15 - 12 = 3 \text{ min}$ When converted to hours we get $\frac{3}{60} \text{ h}$

Therefore solving above question through trick we get

$$\text{Distance} = \frac{4 \times 2.5}{4 - 2.5} \times \frac{27}{60} \Rightarrow \frac{10}{1.5} \times \frac{27}{60} \Rightarrow 3 \text{ km}$$

PRACTICE QUESTION



I. Father & his son starts at point P with speed of 12 km/h & 18 km/h respectively to reach point Q. Son reaches 2 hour early than his father. Find distance PQ

- (a) 90 km (b) 72 km (c) 36 km (d) 18 km

ANS- (B)

II. Ram travels at 3 km/h to reach playground 15 min late. Had he travelled at 4 km/h he would have reached 15 min earlier. Find distance

- (a) 4.5 km (b) 6 km (c) 7.2 km (d) 12 km

ANS-(B)

III. Walking at a speed of 5 km/h a man reaches his office 6 minutes late. Walking at 6 km/h he reaches there 2 minutes early. Find the distance from his home to office

- (a) 99 km (b) 7 km (c) 4 km (d) 6 km

ANS- (C)

IV. A travels certain distance at 24 km/h . While coming back he travels the same distance at 30 km/h . He takes one hour less than the usual time when travelled at 30 km/h speed. Find the distance

- (a) 120 km (b) 160 km (c) 172 km (d) 132 km

ANS-(A)

SOLUTION - I:

$$\text{Distance} = \frac{\text{Speed 1} \times \text{speed 2}}{\text{speed 1} + \text{Speed 2}} \times \text{total Time}$$

$$\Rightarrow \frac{12 \times 18}{18-12} \times 2 \Rightarrow 72\text{ km}$$

SOLUTION - III:

$$\text{Distance} = \frac{\text{Speed 1} \times \text{speed 2}}{\text{speed 1} + \text{Speed 2}} \times \text{total Time}$$

$$\Rightarrow \frac{5 \times 6}{6-5} \times \frac{8}{60} \Rightarrow 4\text{ km}$$

SOLUTION - II:

$$\text{Distance} = \frac{\text{Speed 1} \times \text{speed 2}}{\text{speed 1} + \text{Speed 2}} \times \text{total Time}$$

$$\Rightarrow \frac{3 \times 4}{4-3} \times \frac{30}{60} \Rightarrow 6\text{ km}$$

SOLUTION - IV:

$$\text{Distance} = \frac{\text{Speed 1} \times \text{speed 2}}{\text{speed 1} + \text{Speed 2}} \times \text{total Time}$$

$$\Rightarrow \frac{24 \times 30}{18-12} \times 1 \Rightarrow 120\text{ km}$$

SOLUTION - III:

Train while passing first bridge

$$\text{Speed} = \frac{\text{DISTANCE}}{\text{TIME}}$$

$$\Rightarrow \text{Speed of train} + \text{speed of bridge} = \frac{\text{Length of train} + 500\text{m}}{60}$$

$$\Rightarrow \text{Speed of train} + 0 = \frac{100}{\text{Length of train} + 100\text{m}}$$

Speed of the bridge of course is zero.

Train while passing second bridge.

$$\text{Speed} = \frac{\text{DISTANCE}}{\text{TIME}}$$

$$\Rightarrow \text{Speed} = \frac{60}{\text{Length of train} + 100\text{m}}$$

Equating both the equations above we get =

$$\frac{\text{Length of train} + 500\text{m}}{100} = \frac{\text{Length of train} + 100\text{m}}{60}$$

$$\Rightarrow 6 \times L + 500\text{m} = 10 \times L + 100\text{m}$$

$$\Rightarrow 4L = 400\text{m}$$

⇒ Length of train is equal to 100m

SOLUTION - IV:

Train while passing first man

$$\text{Speed} = \frac{\text{DISTANCE}}{\text{TIME}} \Rightarrow \text{Time} = \frac{\text{DISTANCE}}{\text{SPEED}}$$

$$\Rightarrow \frac{10}{60} = \frac{\text{Length of train} - \text{Length of man}}{\text{Speed of train} - 3}$$

$$\Rightarrow \frac{10}{60} = \frac{L}{\frac{S-3}{(S-3) \times 10}}$$

$$\Rightarrow L = \frac{60}{(S-3)}$$

Length of man is of course is zero or negligible when compared to train

[Why minus ? Because both men are travelling in same direction. You will understand the concept well in Type 4(a) & 4(b) Questions.]

Train while passing second man

$$\text{Speed} = \frac{\text{DISTANCE}}{\text{TIME}} \Rightarrow \text{Time} = \frac{\text{DISTANCE}}{\text{SPEED}}$$

$$\Rightarrow \frac{11}{60} = \frac{\text{Length of train} - \text{Length of man}}{\text{Speed of train} - 5}$$

$$\Rightarrow \frac{11}{60} = \frac{L}{\frac{S-5}{(S-5) \times 11}}$$

$$\Rightarrow L = \frac{60}{(S-5)}$$

Equating both the equations above we get

$$= \frac{(S-3) \times 10}{60} = \frac{(S-5) \times 11}{60}$$

$$\Rightarrow 10 \times S - 30 = 11 \times S - 55$$

$$\Rightarrow S = 25 \quad \Rightarrow \text{Speed of train is equal to } 25\text{km/h}$$

TYPE III

Sometimes units are different for speed , time, distance.

Understand this clearly.

SPEED = $\frac{\text{DISTANCE}}{\text{TIME}}$, Values can be put in equation only when they are of the same units

SPEED = Km/h

TIME = h

DISTANCE = km

→ these are same units

SPEED = m/s

TIME = s

DISTANCE = m

→ these are same units

What if time is given in minutes? It's simple!
 Divide minutes by 60 to convert into hours.
 For e.g. 30 min = $\{30 / 60\}$ or $\{1/2\}$, therefore 30 minutes can also be written as half hour ($1/2$ hrs)

What if time is given in seconds & speed is in km/h? It's simple!
 Convert speed of Km/h to m/s by multiplying with $5/18$
 e.g. 9km/h can also be written as 2.5m/s $\{9 \times 5/18\}$

Example: train running at a speed of 72 km/h goes past a pole in 15 seconds. What is the length of the train?

Here, we observe that SPEED is in km/h and TIME is in seconds. Thus we convert km/h to m/s by multiplying $5/18$

$$72 \times 5/18 = 20 \text{ m/s.}$$

$$S = D/T \quad \Rightarrow 20 = D/15 \quad \Rightarrow \text{DISTANCE} = 300\text{m}$$



PRACTICE QUESTIONS

I. Bike travels at the rate of 20km/h. what is the distance travelled in 45 min.

- (a) 15km (b) 20km (c) 18km (d) 15.75km

ANS-(A)

II. Train 200m long passes platform of 200m length in 15 seconds. What is the speed of train?

- (a) 36km/h (b) 96km/h (c) 48km/h (d) 72km/h

ANS-(B)

III. Train running at a speed of 60km/h cross a pole in 9 seconds. Find the length of train

- (a) 150m (b) 145m (c) 130m (d) 155m

ANS-(A)

IV. A Train 360m long is running at a speed of 45km/h. In what time will it pass a Bridge 140m long?

- (b) 36 s (b) 26 s (c) 40 s (d) 72 s

ANS-(C)

SOLUTION - I:

$$\text{SPEED} = \frac{\text{DISTANCE}}{\text{TIME}}$$

$$\Rightarrow 20 \text{ km/h} = \frac{\text{DISTANCE}}{45 \text{ min}}$$

- ⇒ Here Speed is in km/h while time is in minutes
- ⇒ We will convert time of min to hrs because the answer in options is expected in km
- ⇒ $45 \text{ min} = 45/60 \text{ hours}$
- ⇒ $45/60$ can also be written as $\frac{3}{4}$

$$\text{Distance} = 20 \times \frac{3}{4}$$

$$\Rightarrow 15 \text{ km}$$

SOLUTION - III:

- ⇒ Here Speed is in km/h
- ⇒ We will convert it into m/s because the answer in options is expected in m
- ⇒ Therefore, we will multiply 60 with $\frac{5}{18}$.

Now we get speed as $\frac{100}{6} \text{ m/s}$

$$\text{SPEED} = \frac{\text{DISTANCE}}{\text{TIME}}$$

$$\Rightarrow \frac{100}{6} = \frac{D}{9}$$

$$\Rightarrow D = 150 \text{ m}$$

SOLUTION - IV:

- ⇒ Here Speed is in km/h
- ⇒ We will convert it into m/s because the answer in options is expected in seconds
- ⇒ Therefore, we will multiply 45 with $\frac{5}{18}$.

Now we get speed as $\frac{25}{2} \text{ m/s}$

$$\text{SPEED} = \frac{\text{DISTANCE}}{\text{TIME}}$$

$$\Rightarrow \frac{25}{2} = \frac{140+360}{\text{Time}}$$

$$\Rightarrow \text{Time} = 40 \text{ sec}$$

SOLUTION - II:

$$\text{SPEED} = \frac{\text{DISTANCE}}{\text{TIME}}$$

$$\Rightarrow \text{SPEED} = \frac{200+200}{15}$$

$$\text{SPEED} = \frac{\text{DISTANCE}}{\text{TIME}}$$

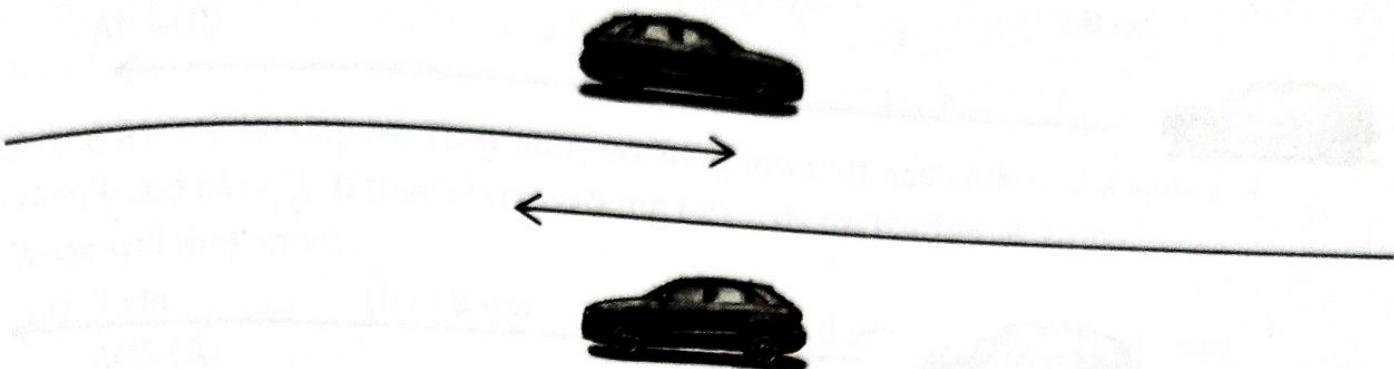
$$\Rightarrow \text{SPEED} = 400/15 \Rightarrow 80/3$$

- ⇒ Here Speed is in m/s
- ⇒ We will convert it into km/h because the answer in options is expected in km
- ⇒ Therefore, we will multiply $80/3$ into $18/5$

$$\text{SPEED} = 80/3 \times 18/5 = 96 \text{ km/h}$$

TYPE IV (A)

Objects coming towards each other or moving in opposite direction



Example: Two trains are coming towards each other. They are 200 m long & their velocities are 20 km/h & 30 km/h respectively. What is the time elapsed, when they first met until cleared each other?



TRICK when "objects are coming towards each other"

Add all distances, add all speeds given, add all time given

This is given in meters

$$\text{Now, } S = D / T$$

$$\Rightarrow 20 + 30 = \frac{200+200}{T}$$

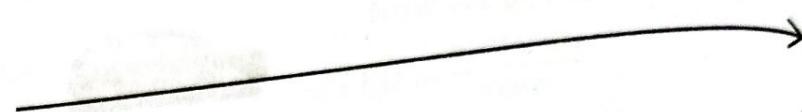
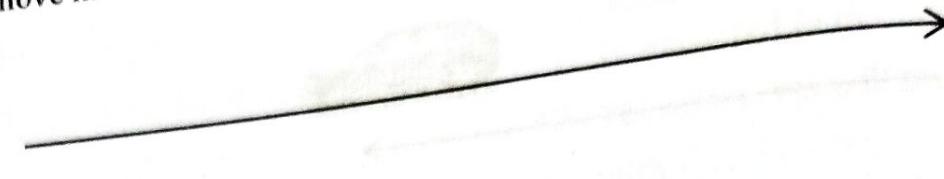
These are in Km/h while distance is in meter

$$T = \frac{400m}{50km/h} \Rightarrow T = \frac{\frac{400}{1}}{\frac{50 \times 5}{18}} \Rightarrow T = \frac{400 \times 18}{250 \times 1} \Rightarrow 28.8 \text{ sec}$$

Thus we will convert km/h to m/s by multiplying $\frac{5}{18}$

TYPE IV (B)

When objects move in same direction



TRICK

Here the trick is "minus" exactly opposite of type iv (a)

Example: Two train travel in same direction at 50 km/h & 32 km/h respectively. A man in slower train observes that 15 seconds time elapses before faster train completely passed him. What is the length of faster train

$$\Rightarrow S = \frac{D}{T} \quad \Rightarrow 50 - 32 = \frac{D}{15} \quad \Rightarrow \frac{18 \text{ Km/h}}{1} = \frac{D}{15 \text{ sec}}$$

$$\Rightarrow \frac{18}{1} \times \frac{5}{18} = \frac{D}{15} \quad \Rightarrow 5 \times 15 = D$$

Therefore, D = 75

Here speed is in km/h & time is in seconds.

Thus we will convert km/h



PRACTICE QUESTION

- I. Two trains travelling in opposite direction. Their speed is 75 km/h & 50 km/h, their length is 100 m & 150 m respectively. What is the time taken to cross each other
- (a) 7.4 sec (b) 7.2 sec (c) 7 sec (d) 6.8 sec
- ANS-(B)

- II. A train 110m long running with speed of 60km/h, what is the time in which it will pass a man who starts from engine running at a speed of 6km/h in direction opposite to that of train
- (a) 5 sec (b) 6 sec (c) 10 sec (d) 15 sec
- ANS-(B)

III. Two trains of equal length takes 10 sec & 15 sec respectively to cross a telephone pole. If the length of each train is 120 m. What is the time taken to cross each other when they travel in opposite direction

- (b) 7.4sec (b) 7sec

ANS-(C)

- (c) 12sec (d) 9.8sec

IV. A and B are 20km apart. They start walking towards each other at a speed of 4km/h and 6km/h. If they start walking towards each other at 7am. When will they meet

- (a) 9 am (b) 10 am

ANS-(A)

- (c) 10:30 am (d) 10:45 am

SOLUTION - I:

$$\text{SPEED} = \frac{\text{DISTANCE}}{\text{TIME}}$$

$$\Rightarrow 75 + 50 = \frac{150+100}{\text{TIME}}$$

$$\Rightarrow 125 \text{ km/h} = \frac{250 \text{ m}}{\text{TIME}}$$

⇒ Here Speed is in km/h while distance is in meters

⇒ We will convert the speed of km/h to m/s because the answer in options is expected in seconds

$$\Rightarrow 125 \times \frac{5}{18} = \frac{250}{\text{TIME}}$$

$$\Rightarrow \text{Time} = \frac{250 \times 18}{125 \times 5}$$

$$\Rightarrow \text{Time} = 7.2 \text{ seconds}$$

answer in options is in seconds

$$\Rightarrow 66 \times \frac{5}{18} = \frac{110}{\text{TIME}}$$

$$\Rightarrow \text{Time} = 110 \times \frac{3}{55}$$

$$\Rightarrow \text{Time} = 6 \text{ seconds}$$

SOLUTION - III:

Speed of first train

$$\text{SPEED} = \frac{\text{DISTANCE}}{\text{TIME}} \Rightarrow \text{Speed} = \frac{120}{10}$$

$$\Rightarrow \text{Speed} = 12 \text{ m/s}$$

Speed of second train

$$\text{SPEED} = \frac{\text{DISTANCE}}{\text{TIME}} \Rightarrow \text{Speed} = \frac{120}{15}$$

$$\Rightarrow \text{Speed} = 8 \text{ m/s}$$

Now we know speed and distance of both the trains.

Hence crossing time = $\frac{\text{DISTANCE}}{\text{SPEED}}$

$$\Rightarrow \text{Time} = \frac{120+120}{12+8} \Rightarrow \text{Time} = 12 \text{ sec}$$

SOLUTION - II:

$$\text{SPEED} = \frac{\text{DISTANCE}}{\text{TIME}}$$

$$\Rightarrow 60 + 6 \text{ km} = \frac{110 \text{ m}}{\text{TIME}}$$

Here Speed is in km/h while distance is in meters

We will convert the speed of km/h to m/s because the

SOLUTION - IV:

Lets say they met each other after x hours.

In that case, A would have walked for $4x$ km and B would have walked for $6x$ km

We know that $4x + 6x = 20 \text{ Km}$

On solving $x = 2$

Therefore, they met each other after 2 hours

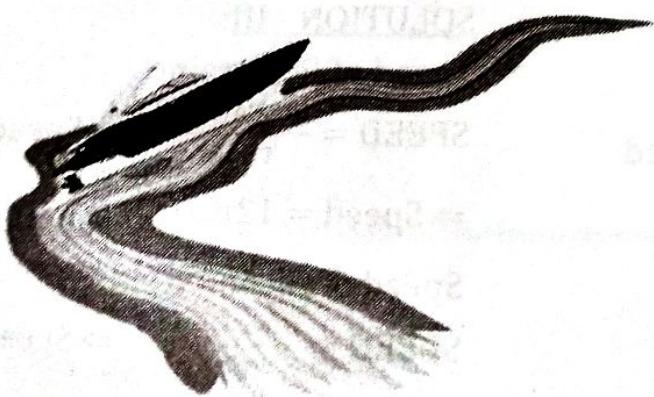
$\Rightarrow 7 : 00 \text{ am} + 2 \text{ hrs} = 9 : 00 \text{ am}$

TYPE V**Upstream & downstream**

Now, if you don't understand the concept of upstream and downstream you wont be able to solve these.

Therefore, we will understand these terms and their significance. To avoid any confusion ahead you must understand that water flow is also referred to as current or stream.

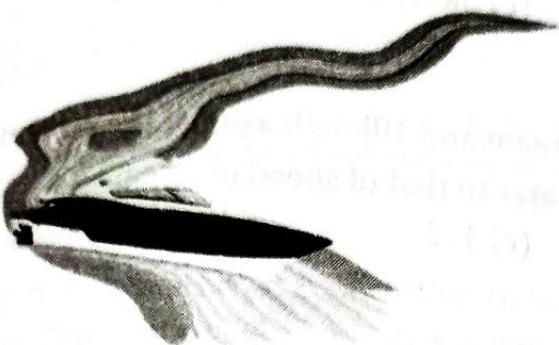
UP STREAM is to "Go against the water flow"



Speed will be slow as force of water is acting against force of boat . In upstream we use speed of boat as " $U - V$ "

U refers to speed of boat & V refers to the speed of water

DOWNSTREAM is when going with the flow of river. Here speed will be more as speed of water will add to the speed of boat



In downstream we use speed of boat as " $U + V$ ". u refers to speed of boat & v refers to the speed of water

Example: A sailor sails a distance of 48 km along the flow of river in 8 hours. It takes 12 hours to return the same distance , the speed of flow of river is

$$\text{SPEED} = \frac{\text{DISTANCE}}{\text{TIME}},$$

Adding both the equation

$$\Rightarrow u + v + u - v = 6 + 4$$

$$\Rightarrow 2u = 10, \quad u = 5$$

Put the value of u in any equation above, therefore value of $u = \dots$

Hence, speed of flow of water is 1km/h

PRACTICE QUESTIONS



I. Motor boat takes 2 hours to travel a distance of 9km down the current & it takes 6 hours to travel the same distance against the current. What is the speed of boat in water?

- II. Speed of boat in still water is 11 km/h . It can travel 12 km upstream and return downstream to starting point in $2\text{ h } 45\text{ min}$. What is the speed of stream?
- (a) 5 km/h (b) 4 km/h (c) 3 km/h (d) 2 km/h
- ANS-(A)

- III. Motor boat runs 20 km/h along the stream and 10 km/h against the stream. Find the ratio of speed of the boat in still water to that of speed of stream?
- (a) $3:1$ (b) $2:1$ (c) $1:2$ (d) $1:3$
- ANS-(A)

- IV. Ravi rows in still water with a speed of 4.5 km/h to go to a certain place and come back. Find his average speed for the whole journey, if the river is flowing at the speed of 1.5 km/h ?
- (a) 5 km/h (b) 4 km/h (c) 3 km/h (d) 2 km/h
- ANS-(B)

SOLUTION - I:

SPEED of boat when travelling in the direction of water, SPEED = $\frac{9}{2} \Rightarrow u + v = \frac{9}{2}$

SPEED of boat when travelling against the direction of water,

$$\text{SPEED} = \frac{9}{6} \Rightarrow u - v = \frac{9}{6}$$

Adding both the equations,

$$u + v + u - v = \frac{9}{2} + \frac{9}{6}$$

$$\Rightarrow 2u = 6 \Rightarrow u = 3$$

SOLUTION - II:

SPEED of boat = 11 km/h ,

Therefore $u = 11$

While upstream, SPEED = $\frac{\text{DISTANCE}}{\text{TIME}}$,

$$11 - v = \frac{12}{\text{Time}} \text{ during upstream}$$

While downstream, SPEED = $\frac{\text{DISTANCE}}{\text{TIME}}$,

$$11 + v = \frac{12}{\text{Time}} \text{ during downstream}$$

$$\text{Time of upstream} + \text{downstream} = \frac{12}{11-v} + \frac{12}{11+v}$$

⇒ Here Time given is 2 hours 45 minutes. Since 2 hours is equal to 120 minutes, total time is 165 minutes

⇒ 165 minutes can be written as $\frac{165}{60}$ hours

⇒ Further, $\frac{165}{60}$ can be written as

$$\frac{11}{4} = \frac{264}{121-v^2} \Rightarrow 121 - v^2 = 96 \\ \Rightarrow v^2 = 25 \Rightarrow v = 5$$

SOLUTION - III:

While downstream, SPEED =

$$u + v = 20 + 10 = 30,$$

While upstream, SPEED =

$$u - v = 20 - 10 = 10,$$

Therefore, Ratio is equal to $30:10$ or $3:1$

SOLUTION - IV:

Average speed of upstream &
downstream = $\left(\frac{(u+v) \times (u-v)}{u} \right)$

Therefore, average speed =

$$\left(\frac{(4.5+1.5) \times (4.5-1.5)}{4.5} \right) = \frac{6 \times 3}{4.5} = 4$$

TYPE V (i)

When upstream and downstream speeds are given along with their distances

Example: A boat takes 6 hours to cover 36 km downstream and 8 hours to cover 32 km upstream. Then the speed of the boat in still water is?



TRICK

$$\text{speed of Boat} = \frac{1}{2} \left(\frac{36}{6} + \frac{32}{8} \right) = 5$$

$$\text{Speed of stream} = \frac{1}{2} \left(\frac{36}{6} - \frac{32}{8} \right) = 1$$



PRACTICE QUESTIONS

I. If a man rows 6 km downstream in 3 hours and 2 km upstream in 2 hours then how long in hours will he take to cover 9 km in stationary water?

- (a) 3 (b) 2 (c) 6 (d) 1
ANS-(C)

II. A boat goes 4 km against the current of the stream in 1 hour and goes 1 km along the current in 10 minutes. How long will it take to go 15 km in stationary water?

- (a) 5h (b) 4h (c) 3h (d) 2h
ANS-(C)

III. Ashok can row upstream at 8kmph & downstream at 12kmph. What is the speed of the stream?

- (a) 3 (b) 2 (c) 6 (d) 1
ANS-(B)

IV. Nisha can swim downstream at 6kmph & upstream at 2kmph. What's her speed in still water?

- (a) 5h (b) 4h (c) 3h (d) 2h
ANS-(B)

SOLUTION - I:

$$\text{Speed of Boat} = \frac{1}{2} \left(\frac{6}{3} + \frac{2}{2} \right) = 1.5 \text{ km/h}$$

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} \Rightarrow 1.5 = \frac{9}{\text{Time}} \Rightarrow$$

$$\text{Time} = 6 \text{ h}$$

SOLUTION - II:

$$\text{Speed of Boat} = \frac{1}{2} \left(\frac{4}{1} + \frac{1}{10/60} \right) =$$

$$5 \text{ km/h}$$

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} \Rightarrow 5 = \frac{15}{\text{Time}} \Rightarrow$$

$$\text{Time} = 3 \text{ h}$$

SOLUTION - III:

$$\text{Speed of Stream} = \frac{1}{2} (12 - 8) =$$

$$2 \text{ km/h}$$

Note: Here we were not given time for upstream and downstream speeds & hence we did not divided them by any number.

SOLUTION - IV:

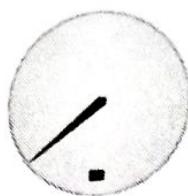
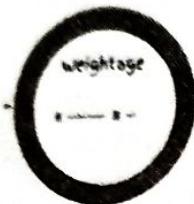
$$\text{Speed of Water} = \frac{1}{2} (6 + 2) = 4 \text{ km/h}$$

AVERAGE

You can expect at least 2-3
Question from this chapter

Frequency of questions from
this chapter is moderate

This chapter is again lengthy
with various types & subtypes



TYPE I

where average rates are given.

Example: A truck made a trip of 200 km , covering first 100 km at the rate of 50 km/h & second 100 km at 40 km/h . what was the average speed of truck.



TRICK

use formula $\frac{2uv}{u+v}$

First 100km speed = 50km/h = u

$$\text{average speed} = \frac{2 \times 50 \times 40}{50 + 40} = \frac{4000}{90} = 44.4 \text{ km/h}$$

second 100km speed = 40km/h = v



PRACTICE QUESTIONS

PRACTICE QUESTIONS
A person travels first 50 km in his car at the rate of 10km/h .He travels next 50 km at the rate of 20km/h. find out the average speed

ii. A body covers distance at the rate of x km/h & another equal distance at the rate of y km/h. Then average speed in km/h is

- ANS-(C)

III. A man travels to a certain place in his cycle at the rate of 10km/h. He travels back same distance at the rate of 15km/h. Find out the average speed
 (a) 12 km/h (b) 13 km/h (c) 13.33 km/h

- (b) 12.5 (c) 13 (d) 12 (e) 15.5
ANS-(C)

IV. A truck covers distance of 300 km. He travels first 100 km at the rate of 40 km/h, second at 30km/h and third 100km at the rate of 60 km km/h. Then average speed in km/h is

- (b) 45 (b) 48 (c) 40 (d) 52.5
ANS-(C)

SOLUTION - I:

first 50km speed = 10km/h = u

$$\text{second 50km speed} = 20\text{km/h} = v$$

$$\text{average speed} = \frac{2 \times 20 \times 10}{20 + 10} = \frac{400}{30} = 13.3 \text{ km/h}$$

13.3km/h

SOLUTION - II:

first A km speed = x

second A km speed = v

$$\text{average speed} = \frac{2 \times x \times y}{x + y} = \frac{2xy}{x+y}$$

SOLUTION - III.

first distance speed = 10km/h

second equal distance speed = 15km/h

$$\text{average speed} = \frac{2 \times 10 \times 15}{10 + 15} = \frac{300}{25} = 12 \text{ km/h}$$

SOLUTION - IV:

first 100 km distance speed = 40 km/h

second equal distance speed = 30 km/h

Third 100 km distance speed = 60 km/h

$$\text{average speed} = \frac{3 \times x \times y \times z}{xy + yz + zx} =$$

$$\frac{3 \times 40 \times 30 \times 60}{40 \times 30 + 60 \times 40 + 60 \times 30}$$

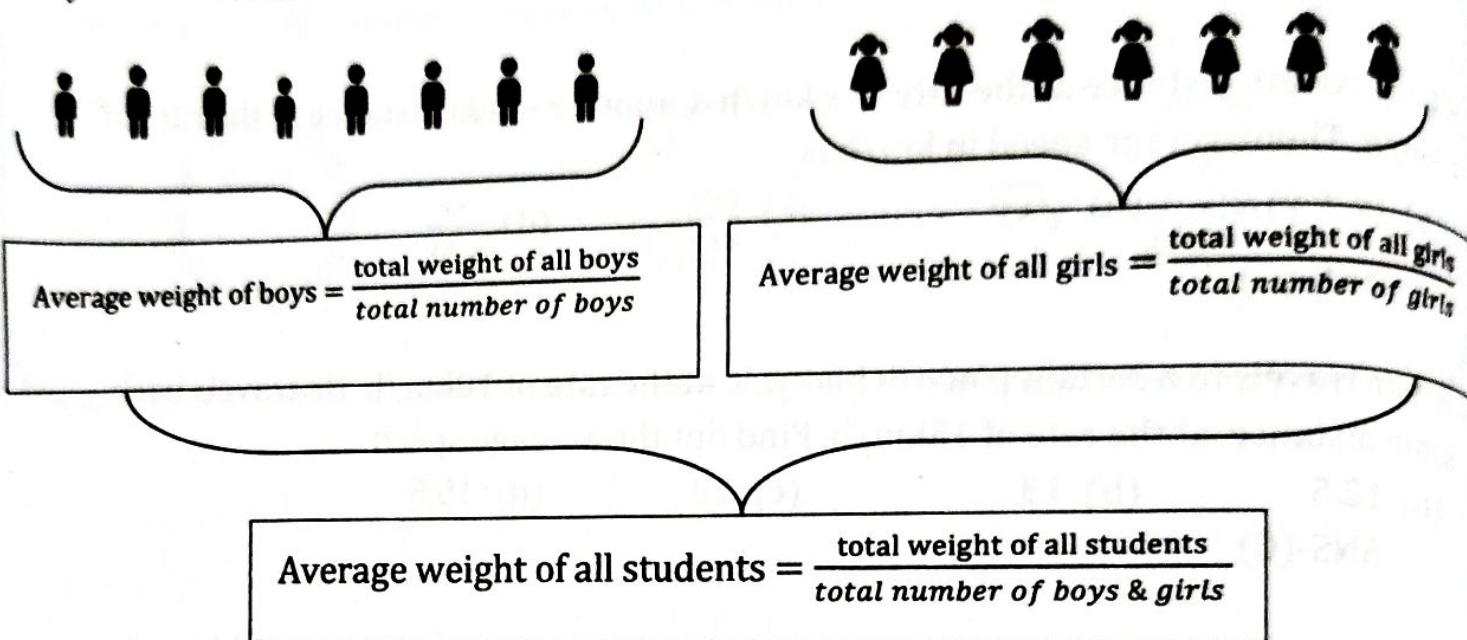
$$\Rightarrow \frac{216000}{540} = 40 \text{ km/h}$$

TYPE II

Where average weight of one part is given & average weight of other part needs to be calculated.

Example: average weight of class of 15 boys & 10 girls 38.4 kg. if average weight of boys is 40 kg. what is average of weight of girls.

Try to understand this



$$\text{Here, Average weight of all students} = \frac{\text{total weight of all students}}{\text{total number of boys & girls}}$$

$$38.4 = \frac{\text{total weight of all students}}{25}$$

$$\Rightarrow \text{Total weight of all students} = 960$$

$$\text{Now, Average weight of boys} = \frac{\text{total weight of all boys}}{\text{number of boys}}$$

$$\text{Total weight of all boys} = 40 \times 15 = 600$$

Total weight of all students can also be written as,

$$\text{Total weight of boys} + \text{Total weight of girls} = 960$$

$$\text{Thus, total weight of girls} = 960 - 600 = 360$$

$$\text{Therefore, average weight of all girls} = \frac{\text{total weight of all girls}}{\text{number of girls}} \Rightarrow 360/10 = 36$$

PRACTICE QUESTIONS

I. Mean (average) weight of 150 students in class is 60 kgs. The mean weight of boys from class is 70 kgs while that of girls is 55 kgs. What is the number of girls in class.
 (a) 105 (b) 100 (c) 95 (d) 60
ANS-(B)

II. Out of 250 observations, first 100 observations have mean (average) 5 & the average of remaining 150 observations is $25/3$. what is the average of whole group.
 (a) 6 (b) 8 (c) 7 (d) 9
ANS-(C)

III. There are 90 students in a class. 30 boys whose average age is 12 years and 60 girls whose average age is 10 years. Find the average age of all the students (in years)
 (a) 11 (b) 10.66 (c) 9 (d) 10.8
ANS-(B)

II. Out of 100 observations, first 45 observations have mean (average) 5 & the average of Remaining 55 observations is 4 . What is the average of whole group.
 (a) 4.5 (b) 4.45 (c) 4.8 (d) 4.1
ANS-(B)

SOLUTION - I:

$$\text{Here, Average weight of all students} = \frac{\text{total weight of all students}}{\text{total number of boys & girls}}$$

$$60 = \frac{\text{total weight of all students}}{150} \Rightarrow \text{Total weight of all the students} = 9000 \text{ Kgs}$$

$$\text{Average weight of boys} = \frac{\text{total weight of all boys}}{\text{total number of boys}}$$

$$\text{Average weight of girls} = \frac{\text{total weight of all girls}}{\text{total number of girls}}$$

Let total boys be B

Since total boys are B, total girls will be $150 - B$

$$70 = \text{Total weight of all boys} / B$$

$$\text{Total weight of all Boys} = 70 B$$

$$\text{Total weight of all Boys} + \text{Total weight of all Girls} = \text{Total weight of everyone in class}$$

$$9000 = 70 B + 8250 - 55 B \Rightarrow 15 B = 750 \Rightarrow B = 50$$

Since total boys are 50 and strength of class is 150, Total number of girls are 100

$$55 = \text{total weight of girls} / (150 - B)$$

$$\text{Total weight of all girls} = 8250 - 55 B$$

SOLUTION - II:

$$\begin{aligned} \text{Average of First 100 observation} &= \text{total of first 100 observation}/100 \\ 5 &= \text{Total of first 100 observation}/100 \Rightarrow \text{Total of 1st 100 observation} = 500 \\ \text{Average of First 150 observation} &= \text{total of next 150 observation}/150 \\ 25/3 &= \text{Total of next 150 observation} \Rightarrow \text{Total of next 100 observation} = 1250 \\ \text{Total of 250 observation} &= 500 + 1250 \\ \text{Average of whole group} &= 1750/250 \Rightarrow 7 \end{aligned}$$

SOLUTION - III:

$$\text{Here, Average age of all students} = \frac{\text{total weight of all students}}{\text{total number of boys & girls}}$$

$$\text{Total weight of all the students} = 960$$

$$\text{Average weight of all students} = \frac{960}{90} = 10.66$$

SOLUTION - IV:

$$\text{Average of all observations} = \frac{45 \times 5 + 55 \times 4}{100} = 4.45$$

TYPE III

where all numbers in an observation are given similar effect.

Example: Average age of 10 students in a class is 13 years. If we add 3 years to each and everyone in the class, then what will be the new average.



TRICK New average will be $\{a + N\}$

Here "a" refers to the average while "N" refers to the new number added

Similarly, When new number is multiplied with all the existing numbers, then new average = $\{a \times N\}$

When new number is subtracted with all the existing numbers, then new average = $\{a - N\}$

When new number is divided with all the existing numbers, then new average = $\{a/N\}$

Since, In the given question new number "3" is added to everyone's age. Therefore, new average = 13 years + 3 years = 16 years

PRACTICE QUESTIONS

I. There are 15 students in a class. Total weight of all the students in a class is 420 kgs. If 2kg weight is reduced from every student's weight, what will be the new average?

- (a) 13 (b) 15 (c) 26 (d) 28

ANS-(C)

II. Mean age of 25 students in tuition is 16 years. If the age of every student is doubled, then what will be the new average?

- (a) 50 (b) 30 (c) 32 (d) 48

ANS-(C)

III. Average marks obtained by the class is 44. There are 20 girls and 10 boys in the class. Teacher found that 1 question carrying 3 marks was incorrect and hence everyone in the class was awarded 3 more grace marks in lieu of the wrong question. What is the new average?

- (a) 33 (b) 44 (c) 27 (d) 47

ANS-(D)

IV. Mean weight of all the puppies of a dog is 12 kgs. If weight of each puppy is reduced by 3 times, then what will be their new average?

- (a) 3 (b) 4 (c) 9 (d) 6

ANS-(B)

SOLUTION - I:

average weight = $\frac{420}{15} = 28$ kg. Now, a = 28 & N = 2 kgs.

Therefore, New average = $28-2 = 26$ kgs

SOLUTION - II:

a=16 years N = 2 (it is said that age is doubled or multiplied by 2)

∴ New average = $16 \times 2 = 32$

SOLUTION - III:

a = 44 marks. N = 3 Marks (3 marks will be added to everyone's score)

∴ New average = $44+3 = 47$

SOLUTION - IV:

a = 12 kgs N = 3 (weight of each puppy is divided by 3) ∴ New average = $\frac{12}{3} = 4$ kg

TYPE IV

Finding unit of specific observation.

Example: The average age of 30 students is 10 years. If the teacher's age is included, the average age becomes 11 years. What is the teacher's age?



TRICK

Teachers age = Number of observations in beginning \times change in average + New average

$$\text{Teachers age} = 30 \times 1 + 11 = 41$$



PRACTICE QUESTIONS

I. The average weight of 25 students is 30 kgs. If one student excluded, the average weight of remaining students becomes 29 kgs. What is the weight of excluded student?

(a) 54

(b) 45

(c) 46

(d) 48

ANS-(A)

II. In a cricket team, the average age of 11 players and the coach is 18 years. If the age of the coach is not considered, then the average decreases by 1 year. Find out the age of the coach?

(a) 33

(b) 28

(c) 27

(d) 29

ANS-(D)

III. The average run scored by a batsman in 20 innings is 32. After 21st innings, the runs average becomes 34. How much runs does the batsman score in his 21st innings?

(a) 63

(b) 74

(c) 79

(d) 69

ANS-(B)

SOLUTION - I:

$$\text{Weight of excluded student} = 25 \times 1 + 29 = 54 \text{ kgs}$$

$30 - 19 = 1$

{Difference in average =

SOLUTION - II:

$$\text{Age of the coach} = 12 \times 1 + 17 = 29$$

$18 - 17 = 1$

{Difference in average =

SOLUTION - III:

$$\text{Runs to score in } 21^{\text{st}} \text{ innings} = 20 \times 2 + 34 = 74$$

$34 - 32 = 2$

{Difference in average =

Few Basic Formulae

- Average of 1st "n" natural numbers = $\frac{n+1}{2}$
- Average of 1st "n" whole numbers = $\frac{n-1}{2}$
- Average of 1st "n" even numbers = $n + 1$
- Average of 1st "n" odd numbers = n

TYPE V

Different distances and different speeds.

Example: A person covers 18 km at 10 km/hr, 16km at 8 km/hr and 30km at 6 km/hr. Then find average speed in covering the whole distance?



TRICK

Average speed in such cases =
$$\frac{\text{Total distance}}{\frac{1\text{st distance}}{1\text{st speed}} + \frac{2\text{nd distance}}{2\text{nd speed}} + \frac{3\text{rd distance}}{3\text{rd speed}}}$$

$$\Rightarrow \frac{18+16+30}{\frac{18}{10} + \frac{16}{8} + \frac{30}{6}} = \frac{80}{11}$$



PRACTICE QUESTIONS

I. A person covers 3 different 20km, 15km, 10km distances by car at a speed of 5km/h, 3km/h and 2km/h respectively. What is average speed during the whole journey?

- (a) 54/14 (b) 45/14 (c) 46/14 (d) 48/14

ANS-(B)

II. A person covers 25% of journey with speed of 10km/h, 45% of journey with speed of 5km/h, and remaining 30% distance

by car at a speed of 15km/h. What is average speed during the whole journey ?

- (a) 3.3 (b) 2.8 (c) 7.2 (d) 7.4

ANS-(D)

SOLUTION - I:

Average speed =

Total distance

$$\frac{\text{1st distance}}{\text{1st speed}} + \frac{\text{2nd distance}}{\text{2nd speed}} + \frac{\text{3rd distance}}{\text{3rd speed}}$$

$$\frac{20+15+10}{5+3+2} = \frac{45}{14}$$

SOLUTION - II:

Average speed =

Total distance

$$\frac{\text{1st distance}}{\text{1st speed}} + \frac{\text{2nd distance}}{\text{2nd speed}} + \frac{\text{3rd distance}}{\text{3rd speed}}$$

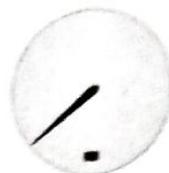
$$\frac{25+45+30}{10+5+15} = \frac{100}{13.5} = 7.4$$

PERCENTAGE

You can expect at least 2-3
Question from this chapter

Frequency of questions from
this chapter is moderate

This chapter is again lengthy
with various types & subtypes



Half of the percentage questions are solved if you just focus on understanding the question. Before that let's understand the basics:

5% can be written as $\frac{5}{100}$
or 0.05

15% can be written as $\frac{15}{100}$
or 0.15

20% can be written as $\frac{20}{100}$
or 0.20

25% can be written as $\frac{25}{100}$
or 0.25 or $\frac{1}{4}$

50% can be written as $\frac{50}{100}$
or 0.5 or $\frac{1}{2}$

75% can be written as $\frac{75}{100}$
or 0.75 or $\frac{3}{4}$

100% can be written as $\frac{100}{100}$
or 1

150% can be written as $\frac{150}{100}$
or 1.5

200% can be written as $\frac{200}{100}$
or 2

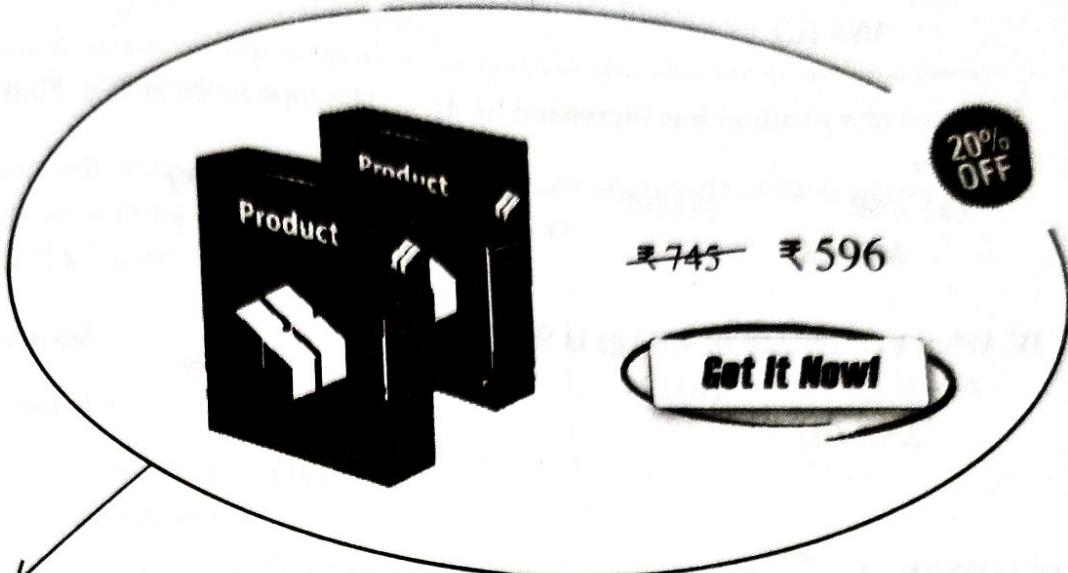
300% can be written as $\frac{300}{100}$
or 3

& so on.....

TYPE I

Direct Questions

Example: On a 20% discount sale, an article costs ₹ 596. What is its original price?



This is what the question is trying to convey
So, how do we find out the original price?



TRICK we already know that 20% discount is given on a product and at 80%, it costs ₹596

Hence, the simplest way to find the original cost is computing 80% of 4 options given

- | | |
|-----------------------------|------------------------------|
| (a) $720 \times 80\% = 576$ | (b) $735 \times 80\% = 58.8$ |
| (b) $745 \times 80\% = 596$ | (d) $775 \times 80\% = 620$ |

Hence, the original cost of product is ₹ 745



PRACTICE QUESTIONS

I. Price of cookie jar was 300, it later increased by 40%. What is the new price of cookie jar?

- | | | | |
|---------|---------|---------|---------|
| (a) 325 | (b) 400 | (c) 420 | (d) 450 |
| ANS-(C) | | | |

II. Rahul's salary was 12000 earlier, with certain percentage of increase in his salary, the new salary is 14400?

- (a) 25% (b) 14% (c) 20% (d) 15%

ANS-(C)

III. Price of a product has increased by 40%. The new price is 490. Find the initial price

- (a) 250 (b) 350 (c) 340 (d) 390

ANS-(B)

IV. What percentage of 4.5 kgs is 90 grams

- (a) 5% (b) 2% (c) 9% (d) 8%

ANS-(B)

SOLUTION - I:
There is a 40% increase in the price of jar. Therefore now the jar costs 140% of 300

$$\frac{140}{100} \times 300 = 420$$

SOLUTION - II:

Rahul's new salary is 14000.

Total increase in his salary is $(14400 - 12000) = 2400$

$$\text{Percentage increase in his salary} = \frac{2400}{12000} \times 100 = 20$$

Why have we divided 2400 by 12000 and why not by 14000 ?

If this kind of doubts ever arise in your mind then use this method to see the small picture.

Let's assume salary was 10 and it got increased by 20%.

Therefore new salary will be 12.

Total increase in his salary is $(12 - 10) = 2$

$$\Rightarrow \text{Percentage increase} = \frac{2}{10} \times 100 = 20\%$$

[Had we computed $\frac{2}{12} \times 100$ we would have got 16.6%]

SOLUTION - III:

There is 40% increase in price. At 140%, the new price will increase to 490
Clearly, option (B) satisfies the situation. $[350 \times \frac{140}{100} = 490]$

SOLUTION - IV:
 $4.5 \text{ kg} = 4500 \text{ gm}$ $\Rightarrow 90 \text{ gm of } 4.5 \text{ kg will be } \frac{90}{4500} \times 100 = 2\%$

TYPE II

Percentage profit/ loss on sale

Example: A person sold products for ₹ 3600 & got profit of 20%. Had he sold the article for ₹ 3150. How much profit would he have got?
 Let's say at price "₹ x" it brings him no profit/loss.

$$x + 20\% \text{ of } x = 3600$$

$$x + \frac{20}{100} \times x = 3600$$

$$120x = 360000, \Rightarrow x = 3000$$

At 3000, there is no profit no loss

If he sells product as ₹ 3150, there is a profit of 150

$$(3000 \times \frac{x}{100}) = 150 \Rightarrow x = 5$$

$$3000 + (3000 \times 5\%) = 3150 \quad \xrightarrow{\text{5 % profit or } \{ ₹150 \text{ profit } \}}$$



PRACTICE QUESTIONS

I. If the price of sugar rises from Rs 6 per kg to Rs 7.50 per kg, a person cannot afford to increase in his expenditure on sugar. His original consumption was 7.5 kgs now he will have to reduce his consumption of sugar by

- (a) 1.5kg (b) 2kg (c) 4kg (d) 5kg

ANS-(A)

II. Due to increase in price per kg of sugar by 25%, a housewife decreased the quantity so that total expenditure remains same. Find the percentage decrease in quantity

- (a) 25% (b) 14% (c) 20% (d) 15%

ANS-(C)

III. Due to increase in the price of sugar by 30% a man can buy 6kg less for Rs.520.

Then find out the original price per kg?

ANS-(B)

IV. Due to a decrease in the price of sugar by 20% a man can buy 4Kg more for Rs80

then find the original price per Kg

ANS-(A)

SOLUTION - I:

SOLUTION - I:		OLD	NEW
Price		6 Rs	7.5 Rs
Quantity		7.5 kg	x
Total expenditure (Price \times Qty)		45	45

Hence, $x = 6$

SOLUTION - II:

	OLD	NEW
Price	100 (assumed)	125 (25% increase)
Quantity	125 (assumed)	x
Total expenditure (Price \times Qty)	12500	12500

Hence, $x = 100$

$$\text{Percentage decrease} = \frac{25}{125} \times 100 = 20\%$$

SOLUTION - III:

	OLD	NEW
Price	100 (assume)	130 (30% increase)
Quantity	130 (assume)	x
Total expenditure (Price \times Qty)	13000	13000

Hence, $x = 100$

Now he gets 30 kgs less ($130 - 100$), However the question says that he should have got 6 kgs less. Therefore we will convert 30 to 6 by dividing it by 5

Same way all other terms needs to be divided by 5 as well

Quantity	$\frac{130}{5} = 26$
Total expenditure (Price \times Qty)	$26 \times 20 = 520$ (actual, as given in question)

Therefore actual price = 20

SOLUTION - IV:

	OLD	NEW
Price	100 (assume)	80 (20% decrease)
Quantity	80 (assume)	x
Total expenditure	8000	8000

Hence, $x = 100$

Now he gets 20 kgs more ($100 - 80$), however the question says that he should have got 4 kgs more. Therefore we will convert 20 to 4 by dividing it by 5

Same way all other terms needs to be divided by 5 as well

Quantity	$\frac{80}{5} = 16$
Total expenditure (Price \times Qty)	$16 \times 5 = 80$ (actual, as given in question)

Therefore actual price = 5

TYPE III

Increase and decrease percentage

Example: a person's salary has increased from ₹7200 to ₹8100. What is the percentage increase in salary?

TRICK



$$\frac{\text{increased TO-increased FROM}}{\text{increased FROM}} \Rightarrow \frac{8100-7200}{7200} \times 100 = 12.5\%$$



PRACTICE QUESTIONS

I. A person sold an article for Rs 3600 and got a profit of 20%. Had he sold the article for Rs 3150. How much profit would he have got?

- (a) 5% (b) 4% (c) 6% (d) 10%

ANS-(A)

II. Price of a product increased to Rs 1800. Original price of the product was Rs 1500.

Find the percentage increase in the cost of the product

- (a) 25% (b) 14% (c) 20% (d) 15%

ANS-(C)

III. A person sold his cycle at a loss of 10%. He sold it at Rs 9000. Had he sold it at Rs 11000 he would have got some profit.

Find the percentage of profit if he sells at Rs 12000

- (a) 25 (b) 20 (c) 34 (d) 40

ANS-(B)

IV. A village population decreased from 24000 to 23040. Find the percentage decrease

- (a) 4 (b) 2 (c) 9 (d) 6

ANS-(A)

SOLUTION - I:

Let the actual price be x . When x is sold at a profit of 20%, he gets 3600

In short, $x + 20\% \text{ of } x = 3600$

$$\Rightarrow x + x \times \frac{20}{100} = 3600$$

$$\Rightarrow 120x = 360000$$

$$\Rightarrow x = 3000$$

Actual cost (worth) of the product was 3000

Percentage increase =

increased TO-increased FROM

increased FROM

$$\Rightarrow \frac{3150 - 3000}{3000} \times 100 = 5\%$$

SOLUTION - II:

Percentage increase =

increased TO-increased FROM

increased FROM

$$\Rightarrow \frac{1800 - 1500}{1500} \times 100 = 20\%$$

SOLUTION - III:

Let the actual price be x . When x is sold at a loss of 10%, he gets 9000

In short, $x - 10\% \text{ of } x = 9000$

$$\Rightarrow x - x \times \frac{10}{100} = 9000$$

$$\Rightarrow 90x = 900000$$

$$\Rightarrow x = 10000$$

Actual cost (worth) of the product was 10000

$$\Rightarrow \frac{12000 - 10000}{10000} \times 100 = 20\%$$

SOLUTION - IV:
 Percentage decrease =
Increased TO - Increased FROM
 $\Rightarrow \frac{\text{Increased FROM}}{24000 - 23040} \times 100 = 4\%$

TYPE IV

Successive percentage is given

Example: what is 5% of 50% of 500

$$\frac{5}{100} \times \frac{50}{100} \times \frac{500}{1} = 12.5$$



PRACTICE QUESTIONS

1. What is 20% of 30% of 40 ?

- (a) 2.2 (b) 2 (c) 2.4 (d) 4
ANS (C)

II. What is 10% of 30% of 60% of 500 ?

- (a) 9 (b) 5 (c) 25 (d) 90
ANS (A)

III. Price of product is ₹ 25. After two successive cuts by same percentage price of the product becomes 20.25 , you are required to identify the discount percentage.

- (a) 9 (b) 10 (c) 11 (d) 90
ANS (B)

IV. Price of product is ₹ 48. After three successive cuts by same percentage price of the product becomes 12. Identify the discount percentage.

- (a) 5 (b) 10 (c) 30 (d) 50
ANS (D)

SOLUTION - I:

$$\frac{20}{100} \times \frac{30}{100} \times \frac{40}{1} = 2.4$$

SOLUTION - II:

$$\frac{10}{100} \times \frac{30}{100} \times \frac{60}{100} \times \frac{500}{1} = 9$$

SOLUTION - III:

10% of 25 will be 2.5.

Further 10% of $(25 - 2.5)$ will be
20.25

Alternatively, $\frac{25}{1} - (\frac{10}{100} \times \frac{25}{1}) = 22.5$
Next, $\frac{22.5}{1} - (\frac{10}{100} \times \frac{22.5}{1}) = 20.25$

SOLUTION - IV:

50% of 48 will be 24.

Further 50% of $(48 - 24)$ will be 12

Alternatively, $\frac{48}{1} - (\frac{50}{100} \times \frac{48}{1}) = 24$

Next, $\frac{24}{1} - (\frac{50}{100} \times \frac{24}{1}) = 12$

TYPE V

In case of comparable percentages

A's income is 20% higher than B's income. B's income is 25% less than C's income.

What % less is A's income from C's income.



TRICK

you don't know A's B's or C's income

Let's take C's income as 100.

Now, B's income is 25% less than C's income. Therefore B's income is 75

A's income is 20% higher than B. Therefore A's income is $75 + \left(\frac{20}{100} \times 75 \right) = 90$

Now, Question says what percentage of A's income is

$$\frac{100-90}{100} \times 100 = 10\%$$

less than C's income

If they said what percentage of B's income is

$$\frac{90-75}{90} \times 100 = 16.6\%$$

less than A's income

PRACTICE QUESTIONS



I. If salary of X is 20% more than salary of y , By how much percentage is salary of y less than X.

(a) 25 (b) 20 (c) $50/3$ (d) $60/3$
ANS (C)

II. No of worker in employment scheme is increased by 15, which resulted into increase of 20%. What were the initial number of workers?

(a) 60 (b) 75 (c) 80 (d) 90
ANS (B)

III. Water pipe is cut into two pieces. Longer piece is 70% length of the pipe . How much percentage is longer piece longer than shorter piece.

(a) 140% (b) $\frac{400}{3}\%$ (c) 400% (d) 90%
ANS (B)

IV. Water pipe is cut into two pieces. Longer piece is 60% length of the pipe . How much percentage is longer piece longer than shorter piece.

(a) 50% (b) $\frac{400}{3}\%$ (c) 40% (d) 90%
ANS (A)

SOLUTION - I:

Let salary of y be 100, Therefore salary of x is 120

$$\Rightarrow \frac{20}{120} \times 100 = \frac{50}{3}$$

SOLUTION - II:

Increase in percentage = 20%

Let's say total was x , then the 20% increase of x is equal to 15

$$\Rightarrow \frac{20}{100} \times x = 15 \Rightarrow x = 75$$

SOLUTION - III:

Lets say pipes length is 10 m

Longer part is 70% , thus it is 7 m , consequently shorter pipe is 3 cm

Longer piece is 4 cm longer

than the shorter piece

In percentage format, it can be written as $\frac{4}{3} \times 100 = \frac{400}{3}$

SOLUTION - IV:

Lets say pipes length is 10 m

Longer part is 60% , thus it is 6 m , consequently shorter pipe is 4 cm

Longer piece is 2 cm longer

than the shorter piece

In percentage format, it can be written as $\frac{2}{4} \times 100 = 50\%$

TYPE VI

Indirect percentage questions

Example: Man loses 20% of his money. After spending 25% of the remained he had ₹480 left. What is the amount of money he had originally.

Let's say he had "₹ x" originally.

$$x - \frac{20x}{100} = \frac{80x}{100}$$

$$\frac{80x}{100} - 25\% \text{ of remaining} = 480$$

→ He lost 20%

$$\frac{80x}{100} \cdot \left(\frac{25}{100} \times \frac{80x}{100} \right) = 480$$

$$\frac{8x}{10} \cdot \frac{2x}{10} = 480$$

$$6x = 4800 \Rightarrow x = 800$$

Thus, we had ₹ 800 originally.

$$₹ 800 - 20\% \text{ of } ₹ 800 \text{ lost (160)} = 640 \text{ remaining}$$

$$₹ 640 - 25\% \text{ of } ₹ 640 \text{ spent (160)} = 480 \text{ left}$$

PRACTICE QUESTIONS



- I. 38L of milk was poured in tub. Tub is still 5% empty. How much more milk needs to be poured to fill 100%
- (a) 1 (b) 2 (c) 3 (d) 4
ANS (B)
- II. When 75 is added to 75% of a number, the answer is the number. Find 40% of that number.
- (a) 120 (b) 210 (c) 300 (d) 340
ANS (A)
- III. Milk contains 5% water. What quantity of pure milk should be added to 10 litres of milk to reduce this to 2%.
- (a) 5 (b) 10 (c) 15 (d) 20
ANS (B)
- IV. The weight of the container alone is 25% of the total container filled with liquid. When some of the liquid is removed, the weight of the container and the remaining liquid is 50% of the original total weight. What fractional part of the liquid has been removed?
- (a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{2}{3}$ (d) $\frac{3}{4}$
ANS (B)

SOLUTION - I:

38 Litre of milk is poured in tub and it is still 5% empty. In short the tub is filled 95% with 38 ltr of milk. Let totally filled tub be 100% of x
95% of $x = 38$ ltr

$$\frac{95}{100} \times x = 38$$

$$\Rightarrow x = 40$$

Therefore, tub needs to be filled by 2 more ltr in order to fill it 100%

SOLUTION - II:

$$\begin{aligned} &\text{Let total number be } x \\ &\text{As per the question } 75 + 75\% \text{ of } x = x \\ &\Rightarrow 75 + \left(\frac{75}{100} \times x \right) = x \\ &\Rightarrow 7500 + 75x = 100x \\ &\Rightarrow 25x = 7500 \\ &\Rightarrow x = 300 \end{aligned}$$

SOLUTION - III:

Total milk is 10 ltr, of this 9.5 ltr is pure milk while 0.5 ltr is water.

Percentage of water in milk =

$$\frac{0.5}{10} \times 100 = 5\%$$

If more pure milk is added to the solution, total solution will be $(10 + x)$ ltrs such that percentage of water now in the total solution will be 2%

$$\frac{0.5}{10+x} \times 100 = 2 \quad \Rightarrow x = 15$$

SOLUTION - IV:

Let the Weight of total container filled with liquid be 100 ltr. Therefore,

Weight of empty container is 25 ltr.

Eventually total liquid in container = 75 ltr (100-25)

Let's say x ltr is removed.

As per question $100 - x = 50\%$ of 100

$$\Rightarrow 100 - x = 50 \quad \text{Hence, } x = 50$$

Fraction of liquid removed =

$$\frac{\text{liquid removed}}{\text{total liquid}} = \frac{50}{75} = \frac{2}{3}$$

TYPE VII

Miscellaneous

Example: In an examination, a candidate must secure 40% marks to pass. A candidate, who gets 220 marks fails by 20 marks. What are the maximum marks for the examination?

Candidate scored 220 marks. Had he scored 20 more marks (220+20), he would have passed the exam.

Therefore, passing marks = 240

As per the question, 40% are the passing marks. Let total paper be x marks

40% of x = 240

$$\Rightarrow \frac{40}{100} \times x = 240 \quad \Rightarrow x = 600$$



PRACTICE QUESTIONS

I. In an election, there were only two candidates. One of the candidates secured 40% of votes and is defeated by the other candidate by 298 votes. The total number of votes polled is.

- (a) 1220 (b) 1490 (c) 3210 (d) 2140
ANS (B)

II. In an election between two candidates, the candidate getting 60% of the votes polled, is elected by a majority of 140 votes. The number of votes polled by the winning candidate is.

- (a) 420 (b) 210 (c) 300 (d) 340

ANS (A)

III. 8% of the votes in an election did not cast their votes. In this election, there only two candidates. The winner by obtaining 48% of the total votes defeated his contestant by 11 votes. The total number of votes casted in the election was.

- (a) 205 (b) 275 (c) 215 (d) 290

ANS (B)

IV. Mohan had a certain amount with him. He spent 20% of that to buy an article and 5% of the Remaining on Transport, then he gifted Rs 120. If he is left with Rs 1400, the amount he spent on transport is

- (a) 80 (b) 30 (c) 70 (d) 40

ANS (A)

SOLUTION - I:

One candidate secured 40% of the votes, eventually second one secured 60%. Difference between both their votes is 298 votes

$$\text{Therefore } 20\% \text{ of votes} = 298$$

$$\Rightarrow \text{votes} = 1490$$

SOLUTION - II:

Winning candidate secured 60% vote.
Eventually other party secured 40%.
Difference between both their votes is 140

$$\text{Therefore, } 20\% \text{ of votes} = 140$$

$$\Rightarrow \text{Total votes} = 700$$

$$\Rightarrow \text{Votes secured by winning candidate} = 60\% \text{ of } 700$$

$$\Rightarrow 420$$

SOLUTION - III:

8% of voters didn't cast votes.

Therefore, total vote casted were 92%, out of them winning candidate secured 48% eventually non-winning candidate secured 44%. Difference between both their votes is 11

$$\text{Therefore, } 4\% \text{ of votes casted} = 11$$

$$\Rightarrow \text{Total votes casted} = 275$$

SOLUTION - IV:

Let's say mohan has x Rs with him. He spent 20% and therefore is left with 80% of x or $0.8x$

Further, he spent 5% of the remaining money (5% of remaining $0.8x$ is $0.04x$)

Therefore, he is now left with $0.76x$

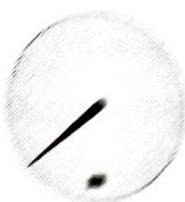
According to the question, $0.76x - 120 = 1400 \Rightarrow x = 2000$

RATIO & PROPORTIONS

You can expect at least 2-3 questions from this chapter

Frequency of questions from this chapter is moderate

This chapter is again lengthy with various types & subtypes



Before we begin with the chapter, let us understand the basics of Ratio & Proportion. The word ratio is denoted with :.

When we say, $A:B = 2:3$, we mean that when you divide $\frac{A}{B}$, you will get $\frac{2}{3}$.

- This can also be written as $\frac{A}{B} = \frac{2}{3}$
- This does not mean $A = 2$ & $B = 3$

Even, $\frac{4}{6} = \frac{2}{3}$, when 4 & 6 are divided by 2 & $\frac{36}{54} = \frac{2}{3}$, when 36 & 54 are divided by 18

Ratio does not have unit. Ratio just shows relationship between two numbers. It depicts that how many times one number is bigger/smaller than other.

e.g. $\frac{5}{10} = \frac{1}{2}$. This means 10 is two times 5.

e.g. $\frac{10}{100} = \frac{1}{10}$. This means 100 is ten times 10.

TYPE I

Example: $\frac{A}{B} = \frac{2}{3}, \frac{B}{C} = \frac{5}{7}, \frac{C}{D} = \frac{3}{10}$, What is the ratio between $\frac{A}{D}$



Trick

Multiply All The Three i.e $\frac{A}{B} \times \frac{B}{C} \times \frac{C}{D}$

$$\Rightarrow \frac{A}{B} \times \frac{B}{C} \times \frac{C}{D} = \frac{2}{3} \times \frac{5}{7} \times \frac{3}{10} \quad \Rightarrow \frac{A}{B} \times \frac{B}{C} \times \frac{C}{D} = \frac{2}{3} \times \frac{5}{7} \times \frac{3}{10} \quad \Rightarrow \frac{A}{D} = \frac{1}{7}$$

Let's Go through another type of questions asked

Example: $\frac{A}{B} = \frac{2}{3}, \frac{B}{C} = \frac{2}{4}$, What is the ratio between A:B:C?



Trick

Use this methodology.

$$\begin{array}{l} A : B : C \\ 2 : 3 \\ \downarrow \quad \downarrow \quad \downarrow \\ 2 : 4 \\ \hline 4 : 6 : 12 \end{array}$$

$$\begin{array}{l} A : B : C \\ x : y \\ \downarrow \quad \downarrow \quad \downarrow \\ z : w \\ \hline x \times z : y \times z : y \times w \end{array}$$

If A:B is $x:y$
& B:C is $z:w$

Then, A:B:C will be $(x \times z) : (y \times z) : (y \times w)$

Alternate way is to proportionate the value of common term

We Have A:B & B:C
 2:3 2:4

On, Observing the proportionate term of "B", we see that on one hand it is "3" & on the other it is "2".

Hence, we will make it equal by multiplying both the ratios with suitable numbers
We will multiply first ratio with "2" and we get A:B

$$4:6$$

Multiplying second ratio with "3", we get B:C

$$6:12$$

Now, the proportionate term of B is same in both the ratios.

Therefore we can say that the ratio of A:B:C = 4:6:12

PRACTICE QUESTIONS



If $a, b, c, d \& e$ are in continued proportion, then $\frac{a}{e}$ is equal to

- (a) $\frac{a^3}{b^3}$ (b) $\frac{a^4}{b^4}$ (c) $\frac{b^3}{a^3}$ (d) $\frac{b^4}{a^4}$

ANS (B)

If the ratio of A to B is $x : 8$ & the ratio of B to C is $12 : z$, if ratio of A to C is $2 : 1$, then what is the ratio of $x : z$

- (a) 2:3 (b) 3:2 (c) 4:3 (d) 3:4

ANS (C)

If $x : y = 1 : 3, y : z = 5 : k, z : t = 2 : 5$ & $t : x = 3 : 4$, then what is the value of k ?

- (a) $1/2$ (b) $1/3$ (c) 2 (d) 3

ANS (A)

If $A : B = 5 : 2, B : C = 2 : 3, C : D = 5 : 3$. Find the ratio of $A : B : C : D$?

- (a) 25:10:15:9 (b) 10:5:3:2 (c) 15:5:3:2 (d) 25:10:15:3

ANS (A)

SOLUTION - I:

Since, they are in continued proportion,

$$\frac{b}{c} = \frac{c}{d} = \frac{d}{e}$$

$$\frac{b}{c} \times \frac{c}{d} \times \frac{d}{e} = \frac{a}{b} \times \frac{b}{c} \times \frac{c}{d} \times \frac{d}{e} \Rightarrow \frac{a}{e} = \frac{a^4}{b^4}$$

SOLUTION - III:

Multiplying them all

$$\Rightarrow \frac{x}{y} \times \frac{y}{z} \times \frac{z}{t} \times \frac{t}{x} = \frac{1}{3} \times \frac{5}{k} \times \frac{2}{5} \times \frac{3}{4}$$

$$\Rightarrow \text{on solving we get } k = \frac{1}{2}$$

SOLUTION - II:

$$\frac{A}{B} = \frac{x}{8} \quad \& \quad \frac{B}{C} = \frac{12}{z}$$

Multiplying both the equations above we

$$\frac{A}{B} \times \frac{B}{C} = \frac{x}{8} \times \frac{12}{z} \Rightarrow \frac{A}{C} = \frac{3}{2} \times \frac{x}{z}$$

Question says that $\frac{A}{C} = \frac{2}{1}$ (Given)

$$\frac{3}{2} \times \frac{x}{z} = \frac{2}{1} \Rightarrow \frac{x}{z} = \frac{4}{3}$$

SOLUTION - IV:

$A : B = 5 : 2$ & $B : C = 2 : 3$. Here, "B" proportionate is same in both the ratios. Therefore, we can say $A : B : C = 5 : 2 : 3$

Now, $C : D = 5 : 3$. Proportionate of "C" is different in the ratio above.

Thus to make them comparable we will multiply ratios with suitable numbers. Multiplying the first ratio with "5",

we get A:B:C = 25:10:15

Multiplying the seconds ratio with "3",

C:D = 15:9

Now, "C" proportionate is same in both
the above ratios.

Therefore, we can say A:B:C
25:10:15:9

TYPE II

Direct questions

Example: In school ratio of boys to girls is 7 : 5. There are 2400 students in school. Now
many girls are there in school

$$\Rightarrow \text{Number of Girls} = \frac{5}{7+5} \times 2400 = 1000$$

$$\Rightarrow \text{Number of Boys} = \frac{7}{7+5} \times 2400 = 1400$$



PRACTICE QUESTIONS

I. If rs 8400 is divided among A, B, C in ratio $\frac{1}{5} : \frac{1}{6} : \frac{1}{10}$ { multiply numerator by 30 to get
ratio in proper numbers $(\frac{30}{5} : \frac{30}{6} : \frac{30}{10})$ } Thus ratio $\frac{1}{5} : \frac{1}{6} : \frac{1}{10}$ can also be written as
{6 : 5 : 3.} What is the share of A?

- (a) 1800 (b) 3000 (c) 3600 (d) 4000

ANS (C)

II. If rs 2600 is divided into 3 persons A, B, C in ratio $1/2, 1/3, 1/4$. How much does A
get (multiply numerator by 12 to get ration in proper numbers 6:4:3)

- (a) 600 (b) 800 (c) 1000 (d) 1200

ANS (D)

III. Seats for mathematics, Physics & Biology in a school are 5:7:8. There is a proportion
increase these seats by 40%, 50% and 75% respectively. What will be the new ratio?

- (a) 2:3:5 (b) 2:4:5 (c) 2:4:6 (d) 2:3:4

ANS (D)

IV. Three numbers are in the ratio of 3:2:5 and the sum of their squares are 1862. The
smallest of these numbers are

- (a) 14 (b) 18 (c) 10 (d) 12

ANS (A)

SOLUTION - I:

Share of A, $8400 \times \frac{6}{6+5+3} = 3600$

SOLUTION - II:

Share of A, $2600 \times \frac{6}{13} = 1200$

SOLUTION - III:

Ratio of Mathematics : Physics : Biology

5:7:8

Let's say seats in Mathematics are 50,

Physics are 70 and Biology is 80

Mathematics seats are increased by

9%, then New Mathematics seats are

$$50 \times \frac{140}{100} = 70$$

If Physics seats are increased by 50%,
 then New mathematics seats are $70 \times \frac{150}{100} = 105$

If Biology seats are increased by 75%,
 then New Biology seats are $80 \times \frac{175}{100} = 140$

70:105:140 can also be written as 2:3:4

SOLUTION - IV:

Let's say the numbers are $3x, 2x$ and $5x$

$$(3x)^2 + (2x)^2 + (5x)^2 = 1862$$

$$\Rightarrow 9x^2 + 4x^2 + 25x^2 = 1862$$

$$\Rightarrow 38x^2 = 1862$$

$$\Rightarrow x^2 = 49$$

$$\Rightarrow x = 7$$

The smallest number is $2x$ which is
 $2 \times 7 = 14$

TYPE III

Example: Age of X is 6 times that of Y, after 4 years X is four times elder to Y. What is the present age of Y.

Age is six times that of Y. lets say if Y is 6 years old. X is 36 years old.

Therefore, $X = 6Y$

After 4 years X is 4 times elder to Y

$$(X + 4) = 4(Y + 4) \Rightarrow X + 4 = 4Y + 16$$

$$6Y + 4 = 4Y + 16 \Rightarrow 2Y = 12 \Rightarrow Y = 6$$



PRACTICE QUESTIONS

Two numbers are in the ratio 2:3 . if 9 is added to each number, they will be in the ratio of 3:4 . what is the product of two numbers.

- (a) 360 (b) 480 (c) 486 (d) 512

ANS (C)

II. Two numbers are in the ratio 3:5, if 9 is subtracted from each number, then they are in the ratio of 12:23. What is the second number.

- (a) 44 (b) 55 (c) 66 (d) 77

ANS (B)

III. The ratio between the ages of A & B is 2:5. After 8 years, their ages will be in the ratio 1:2, what is the difference between their present ages?

- (a) 20 (b) 22 (c) 24 (d) 25

ANS (C)

IV. Sum of the ages of father and son is 75 years. If the product of their ages before 5 years was 750. Then what is the present age of the father.

- (a) 60 (b) 55 (c) 52 (d) 50

ANS (B)

V. 10 years ago ram was 5 times as old as shyam but 20 years later from now he will only be twice as old as shyam. How many years old is shyam.

- (a) 20 (b) 30 (c) 40 (d) 50

ANS (A)

SOLUTION - I:

$$\text{According to the question } \frac{2x+9}{3x+9} = \frac{3}{4}$$

$$\Rightarrow 8x + 36 = 9x + 27 \quad \Rightarrow x = 9$$

Thus, the numbers are $2x$ & $3x$ or 18 and 27

$$18 \times 27 = 486$$

SOLUTION - II:

$$\text{According to the question } \frac{3x-9}{5x-9} = \frac{12}{23}$$

$$\Rightarrow 69x - 207 = 60x - 108$$

$$\Rightarrow x = 11$$

Thus, the second numbers are 55

SOLUTION - III:

$$\text{According to the question } \frac{2x+8}{5x+8} = \frac{1}{2}$$

$$\Rightarrow 4x + 16 = 5x + 8$$

$$\Rightarrow x = 8$$

Thus, their present ages are 16 & 40

SOLUTION - IV:

$$\text{If father's age} = x, \text{then son's age} = 75 - x$$

$$\text{Their ages 5 years ago} = x - 5 \text{ and } 70 - x$$

$$5 \text{ years before, the product of their ages} = 750$$

$$\therefore (x - 5)(70 - x) = 750 \quad \Rightarrow x = 55.$$

SOLUTION - V:

$$(Ram - 10) = 5 (\text{shyam} - 10)$$

$$\Rightarrow 5 \text{ Shyam} - \text{Ram} = 40$$

$$\Rightarrow \text{Ram} = 5 \text{ shyam} - 40$$

$$(\text{Ram} + 20) = 2 (\text{shyam} + 20)$$

$$\Rightarrow \text{Ram} - 2 \text{ shyam} = 20$$

Substituting value of ram

$$\Rightarrow 5 \text{ shyam} - 40 - 2 \text{ shyam} = 20$$

$\Rightarrow 3 \text{ shyam} = 60$, shyam is 20 years old

TYPE IV

Example: If $x:y = 7:5$ what is $\frac{5x-2y}{3x+2y}$.



In Such Cases Substitute x & y With the Proportional Value Given

$$\text{TRICK} \\ \frac{5 \times 7 - 2 \times 5}{3 \times 7 + 2 \times 5} = \frac{25}{31}$$

Therefore, $\frac{5x-2y}{3x+2y} = \frac{25}{31}$, this means $\{\frac{5x-2y}{3x+2y}\}$ is in the ratio of $\frac{25}{31}$.

**PRACTICE QUESTIONS**

Two numbers are in the ratio 2:3. if 9 is added to each number, they will be in the ratio of

3:4. what is the product of two numbers.

- (a) 360 (b) 480 (c) 486 (d) 512

ANS (C)

Two numbers are in the ratio 3:5, if 9 is subtracted from each number, then they are in the ratio of 12:23. What is the second number.

- (a) 44 (b) 55 (c) 66 (d) 77

ANS (B)

The ratio between the ages of A & B is 2:5. After 8 years, their ages will be in the ratio

1:2. what is the difference between their present ages?

- (a) 20 (b) 22 (c) 24 (d) 25

ANS (C)

Sum of the ages of father and son is 75 years. if the product of their ages before 5 years

was 750. Then what is the present age of the father.

- (a) 60 (b) 55 (c) 52 (d) 50

ANS (B)

SOLUTION - I:

According to the question $\frac{2x+9}{3x+6} = \frac{3}{4}$

$$\Rightarrow \text{Upon solving, } 8x + 36 = 9x + 27$$

$$\Rightarrow x = 9$$

Therefore, two numbers $2x$ & $3x$ are 18 and 27

$$\Rightarrow 2A + 16 = \frac{5A}{2} + 8$$

$$\Rightarrow 2A + 16 = \frac{5A + 16}{2}$$

$$\Rightarrow 4A + 32 = 5A + 16$$

$$\Rightarrow A = 16$$

Therefore, their present ages are 16 & 48

SOLUTION - II:

According to the question $\frac{3x-9}{5x-6} = \frac{12}{25}$

$$\Rightarrow \text{Upon solving, } 69x - 207 = 60x - 108$$

$$\Rightarrow 9x = 99$$

$$\Rightarrow x = 11$$

Therefore, two numbers $3x$ & $5x$ are 33 and 55

SOLUTION - III:

$$\frac{s}{s} = \frac{2}{5} \quad (B = \frac{5s}{2})$$

After 8 years the new ratio becomes 1:2

$$\text{Hence, } \frac{A+s}{B+s} = \frac{1}{2}$$

$$\Rightarrow 2A + 16 = B + 8$$

Substituting the equation of B, we get

SOLUTION - IV:

Taking option (A), Fathers age is 60.

Therefore, Sons age is automatically 15
 $60 + 15 = 75$ First Condition is satisfied

$55 \times 10 = 550$ Second condition isn't satisfied

Taking option B, Fathers present age is 55. Therefore, Sons age will be 20

$$55 + 20 = 75$$

Also, 5 years ago multiplication of their ages was 750

$50 \times 15 = 750$. Hence, option (B) satisfies both the conditions

TYPE V

Example: P% of x is equal to Q% of yt. What is the ratio of x to y

P% of x = Q% of y $\times t$

$$\frac{P}{100} \times x = \frac{Q}{100} \times y \times t$$

$$\Rightarrow \frac{x}{y} = \frac{Qt}{P}$$

Example: A bag contains Rs 112 in form of Rs 1, 50 paise & 10 paise coins in the ratio of 3:8:10. What is the number of 50 paise coins.

Rs 1 : 50 paise : 10 paise \longrightarrow these are different units (i.e Rs & Paise)

3	: 8	: 10
Rs 3 (300 paise)	RS 4 (400 paise)	Rs 1

\longrightarrow these are same units after converting

Thus now we can say that a bag contains Rs. 112 in the ratio of 3:4:1
Amount of 50 paise coins in RS = $\frac{4}{8} \times 112 = 56$.

50 paise coins amount to Rs 56

Rs = 56 one rupees coin

Rs = 112 fifty paise coins



PRACTICE QUESTIONS

Ratio of x to y is 25 times ratio of y to x . What is the ratio of x to y

- (a) 1:5 (b) 5:1 (c) 25:1 (d) 1:25

ANS (B)

$b\%$ of a is equal to $c\%$ of ed . What is the ratio of a to d

- (a) $\frac{ce}{b}$ (b) $\frac{cb}{e}$ (c) $\frac{eb}{c}$ (d) None of these

ANS (A)

I. A Bag contains Rs 114 in the form of Rs 1, 50 paise and 10 paise coins in the ratio of 3:4:10. What is the number of 50 paise coins?

- (a) 48 (b) 81 (c) 76 (d) 80

ANS (C)

II. There are 480 coins in half rupees, quarter rupees and 10 paise coins. Their values are proportional to 5:3:1. The number of fifty paise coins are

fifty paise coins are

- (a) 115 (b) 150 (c) 125 (d) 180

ANS (B)

SOLUTION - I:

$$= 25 \times \frac{y}{x} \Rightarrow \left(\frac{x}{y}\right)^2 = \frac{25}{1}$$

$$\text{Therefore, } \frac{x}{y} = \frac{5}{1}$$

SOLUTION - II:

$$\frac{b}{100} \times a = \frac{c}{100} \times ed$$

$$\Rightarrow \frac{a}{d} = \frac{ce}{b}$$

SOLUTION - III:

Rs 114 are in the ratio of $3x$, $4x$ & $10x$

$$\Rightarrow (3x \times 1) + (4x \times 0.50) + (10x \times 0.10)$$

$$= 114$$

$$\Rightarrow 3x + 2x + 1x = 114$$

$$\Rightarrow x = 19$$

Number of 50 paise coins are $4x$, which is equal to $4 \times 19 = 76$

SOLUTION - IV:

This Question is tricky because it is said that the "values" are proportional to 5:3:1 unlike previous questions where the ratio was given in relation to coins. Thus as per this question 10 fifty paise coins will make Rs 5

12 twenty five paise coins will make Rs 3

Similarly, 10 ten paise coins will make 1

Therefore, now we can say that the coins are in ratio of 10:12:10

$$\Rightarrow 10x + 12x + 10x = 480$$

$$\Rightarrow x = 15$$

Number of 50 paise coins are 10x, which is equal to $10 \times 15 = 150$

TYPE VI

A milkman brought 15 kl of milk and mixed it with 3 kl of water. If the price per kg of mixture becomes Rs 22, what is the cost price of milk per kl?

We know that we have 15 kl of milk, let the cost of per kg of milk be x Rs/kl.

Now assuming that water is free and there is no cost of water.

After adding 3kl of water in 15 kl of milk, now we have total 18 kl of mixed liquid, which costs Rs 22/kl

$$\Rightarrow \frac{15 \times x + 3 \times 0}{18} = 22$$

$$\Rightarrow x = 26.4$$

**PRACTICE QUESTIONS**

I. In a 80 ltr solution containing milk and water in the ratio of 2:3. How much milk should be added to the solution so that the new ratio becomes 4:1?

- (a) 360 (b) 480 (c) 160 (d) 120
ANS (C)

II. In a 60 ltr mixture of milk and water, the ratio of milk and water is 7:5. How much water needs to be added to the mixture so that the ratio of milk and water becomes 5:7

- (a) 44 (b) 24 (c) 36 (d) 17
ANS (B)

- III. 20 ltr of a mixture contains milk and water in the ratio of 3:1. How much more milk needs to be added to get a mixture containing milk and water in the ratio of 4:1?
 (a) 4 ltr (b) 3 ltr (c) 5 ltr (d) 2 ltr
 ANS (C)

- IV. 729 ml of mixture contains milk and water in the ratio of 7:2. How much more water is to be added to get a new mixture containing milk and water in the ratio 7:3.
 (a) 81 ml (b) 36 ml (c) 52 ml (d) 62 ml
 ANS (A)

SOLUTION - I:

80 ltr contains milk and water in the ratio of 2:3

$$\Rightarrow \text{Quantity of Milk} = \frac{2}{5} \times 80 = 32 \text{ ltr}$$

$$\Rightarrow \text{Quantity of Water} = \frac{3}{5} \times 80 = 48 \text{ ltr}$$

As given in the question that more milk is added to the solution to get new ratio

$$\Rightarrow \frac{32+x}{48} = \frac{4}{1}$$

$$\Rightarrow 32+x = 192$$

$$\Rightarrow x = 160$$

SOLUTION - II:

60 ltr contains milk and water in the ratio of 7:5

$$\Rightarrow \text{Quantity of Milk} = \frac{7}{12} \times 60 = 35 \text{ ltr}$$

$$\Rightarrow \text{Quantity of Water} = \frac{5}{12} \times 60 = 25 \text{ ltr}$$

As given in the question that more water is added to the solution to get new ratio

$$\Rightarrow \frac{35}{25+x} = \frac{5}{7}$$

$$\Rightarrow 245 = 125 + 5x$$

$$\Rightarrow x = 24$$

SOLUTION - III:

20 ltr contains milk and water in the ratio of 3:1

$$\Rightarrow \text{Quantity of Milk} = \frac{3}{4} \times 20 = 15 \text{ ltr}$$

$$\Rightarrow \text{Quantity of Water} = \frac{1}{4} \times 20 = 5 \text{ ltr}$$

As given in the question that more milk is added to the solution to get new ratio

$$\Rightarrow \frac{15+x}{5} = \frac{4}{1}$$

$$\Rightarrow 15+x = 20$$

$$\Rightarrow x = 5$$

SOLUTION - IV:

729 ltr contains milk and water in the ratio of 7:2

$$\Rightarrow \text{Quantity of Milk} = \frac{7}{9} \times 729 = 567 \text{ ltr}$$

$$\Rightarrow \text{Quantity of Water} = \frac{2}{9} \times 729 = 162 \text{ ltr}$$

As given in the question that more water is added to the solution to get new ratio

$$\Rightarrow \frac{567}{162+x} = \frac{7}{3}$$

$$\Rightarrow 1134 + 7x = 1701$$

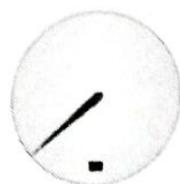
$$\Rightarrow x = 81$$

PROFIT & LOSS

You can expect at least 2-3
Question from this chapter

Frequency of questions from
this chapter is moderate

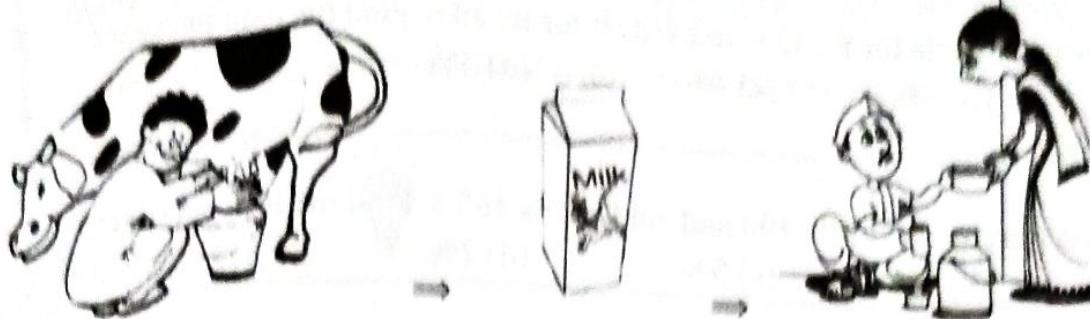
This chapter is again lengthy
with various types & subtypes



Profit and Loss is a very basic math that everyone uses in real life. To seamlessly solve every question concerned to this chapter one must understand various terms related to Profit and Loss.

Let us understand them one by one.

- **Cost Price** : From a seller point of view Cost Price is the cost at which he has procured a product. From the buyer Point of view Cost Price is the price at which buyer has purchased the product.
- **Selling Price** : From a seller point of view Selling price is price at which he sells the product. From the buyer point of view Selling Price is the price at which buyer may resell the product.
- **Marked Price** : Marked price is a price at which seller is making the product available for sale
- **Discount/Rebate** : It refers to the concession that the seller gives.



Lets say Raju a milk seller, procured 1 ltr milk from a village at Rs 20 (1st picture). He packed it in milk container and labelled the price in Can at Rs 30/ltr (2nd picture). Lastly, He sold Milk to a lady at 10% discount. (3rd picture)

Now, for Raju

Cost Price = Rs 20 Marked Price = Rs 30 Selling Price = Rs 27 (30-3, as he sells at 10% discount)

Has Raju been in a Profit or Loss ?

Well of course Profit of Rs 7 (He sold milk for Rs 27 - He procured it at Rs 20)

Now, How will you determine the profit percentage ?

$$\text{Profit Percentage} = \frac{7}{20} \times 100 = 35\% \text{ Profit}$$

TYPE - I

Basic Questions on computing Profit/Loss percentage

Example : An article is purchased for Rs 450 and sold for Rs 500. Find the gain percent?

$$\text{Profit} = 500 - 450 = \text{Rs } 50$$

$$\text{Profit Percentage} = \frac{50}{450} \times 100 = 11.1\%$$



PRACTICE QUESTIONS

I. If the cost Price is 25% of selling price then what is the profit percentage?

- (a) 300 (b) 400 (c) 2400 (d) 180

ANS (A)

II. By selling 5 Pens, a person gets profit equal to selling Price of 2 Pens. What is the profit percentage ?

- (a) 66.6% (b) 88.8% (c) 40% (d) 28%

ANS (D)

III. A man buys an article for Rs 27.5 and sells it for Rs 28.6 Find his gain percent?

- (a) 5% (b) 4% (c) 2% (d) 3%

ANS (D)

IV. If a radio is purchased for Rs 490 and sold for Rs.465.5 Find the loss percent?

- (a) 4% (b) 8% (c) 5% (d) 2%

ANS (A)

Solution - I:

Let's assume the selling price is Rs 100.

Therefore, being 25% of selling Price,

Cost price = 25

Profit = $100 - 25 = \text{Rs } 75$

Profit percentage = $\frac{75}{25} \times 100 = 300$

Solution - II:

Let us assume selling price of Pen is Rs 10

Pen sold = $5 \times 10 = 50$

As given profit = $2 \times 10 = 20$

Eventually, Cost Price of 5 Pen =
 $50 - 20 \Rightarrow 30$

Profit percentage = $\frac{20}{30} \times 100 = 66.6\%$

Solution - III:

Profit = $28.6 - 27.5 \Rightarrow 1.1$

Profit percentage = $\frac{1.1}{27.5} \times 100 = 4\%$

Solution - IV:

Loss = $490 - 465.5 = 24.5$

Loss percentage = $\frac{24.5}{490} \times 100 = 5\%$

TYPE - II

Finding Cost price & Selling price

Example : A man purchases two TV sets for 21500. He sold one at a loss of 12% and other at a loss of 16%. If the selling price of each TV is same, their cost price are respectively.



Trick

Cost Price of Article sold at $x\%$ Profit = $\frac{100 + y}{200 + x + y} \times \text{Amount spent}$
(If both are sold at profit)

Cost Price of Article sold at $x\%$ Loss = $\frac{100 - y}{200 - x - y} \times \text{Amount spent}$
(If both are sold at loss)

Therefore, Cost Price of Article sold at 12% Loss = $\frac{100 - 16}{200 - 12 - 16} \times 21500$
 $\Rightarrow \frac{84}{72} \times 21500 = 10,500$

Eventually, cost price of article sold at 16% loss = $21500 - 10500 = 11000$

Note: For this trick to work Selling price of articles needs to be the same



PRACTICE QUESTIONS

- I. A trader brought two watches for Rs 2300. He sold one at a profit of 10% and other at a profit of 20%. If selling price of each watch is same. Find their respective cost price.
 (a) 1200, 1100 (b) 1300, 1500 (c) 900, 1200 (d) 1800, 2100
 ANS (A)

- II. A man buys a cycle for Rs 1400 and sells it at a loss of 15%. What is the selling price of the cycle?
 (a) 2190 (b) 1280 (c) 1190 (d) 2800
 ANS (C)

- III. A trader brought two horses for Rs 19500. He sold one at a loss of 20% and other at a profit of 15%. If the selling price of each horse is the same, then their cost price of horse sold at loss is
 (a) 11500 (b) 10900 (c) 11600 (d) 14400
 ANS (A)

- IV. By selling a chair for Rs 350 instead of Rs 400, loss percentage is increased by 5%.
 The cost price of the chair is?
 (a) 900 (b) 1200 (c) 1000 (d) 1800
 ANS (C)

Solution:

Cost Price of Article sold at 10% Profit
 $= \frac{100 + 20}{200 + 10 + 20} \times 2300$
 $\Rightarrow \frac{120}{230} \times 2300 = 1200$

Eventually, cost price of other article =
 1100

Solution:

At 100% price of cycle is Rs 1400
 At 85% price of cycle will be $\frac{85}{100} \times 1400$
 \Rightarrow Rs 1190

Solution:

Cost Price of Article sold at 20% Loss =
 $\frac{100 + 15}{200 + 15 - 20} \times 19500$
 $\Rightarrow \frac{115}{195} \times 19500 = 11500$

Solution:

Let x be the cost price
 According to the question, $\frac{50}{x} \times 100 = 5$
 $\Rightarrow x = 100$

TYPE - III

Overall Net Profit/Loss

Example : A dealer brought two T.V sets for Rs 7400 each. The first one is sold at 10% profit whereas the second one at a loss of 10%. Then find out loss or gain in the transaction.



Trick

$$\text{Overall Profit/Loss percentage} = \frac{100(P-L) - 2PL}{(100+P) + (100-L)}$$

$$\text{Therefore, Overall Profit/Loss percentage} = \frac{100(10-10) - 2 \times 10 \times 10}{(100+10) + (100-10)}$$

$$\Rightarrow \frac{-200}{200} = -1\%$$

Hence, there is an overall loss of 1%

Note: This trick will work only when the articles are brought at the same price.



PRACTICE QUESTIONS

I. A women sold her two old ornaments at the same price, that is Rs 35000 each. She sold one at a profit of 75% and other at a loss of 30%. What is her overall net profit/loss?

- (a) 1% profit (b) 2% loss (c) 1.5% profit (d) No profit/loss

ANS (A)

II. A dealer sold two T.V sets for Rs 7400 each. On one he gained 10% profit while on the other, he lost 10%. Find overall profit/loss ?

- (a) 2% (b) 1% (c) 4% (d) No profit/loss

ANS (D)

III. A dealer sold two T.V sets for Rs 990 each. On one he gained 10% while on the other he lost 15%. Find overall profit/loss

- (a) 5% Profit (b) 4.1% loss (c) 1% Loss (d) 3% loss

ANS (D)

- IV. A dealer sold two T.V sets. He sells one at Rs 990 while other at Rs 720. On one he gained 10% while on the other he lost 10%. Find overall profit/loss
- (a) Rs 10 (b) Rs 15 (c) Rs 8 (d) Rs 12
ANS (A)

Solution - I:
Overall Profit/Loss percentage =

$$\frac{100(10-10) - 2 \times 10 \times 10}{100(10+10) + (100-10)}$$

$$\Rightarrow \frac{-200}{200} = -1\%$$

Hence, there is an overall loss of 1%

Solution - II:
Overall Profit/Loss percentage =

$$\frac{100(75-30) - 2 \times 75 \times 30}{100(75+30) + (100-30)} \Rightarrow 0$$

Hence, Overall, there is no profit or loss

Solution - III:
Overall Profit/Loss percentage =

$$\frac{100(10-15) - 2 \times 10 \times 15}{100(10+10) + (100-15)} \Rightarrow \frac{-800}{195} = -4.1\%$$

Hence, there is an overall loss of 1%

Solution - IV:

According to the question,

⇒ He gained 10% when sold for Rs 990

⇒ Let cost of T.V sold at profit be x

$$\therefore \frac{110}{100} \times x = 990 \Rightarrow x = 900$$

$$\text{Profit} = 990 - 900 = \text{Rs } 90$$

⇒ He lost 10% when sold for Rs 720

⇒ Let cost of T.V sold at loss be y

$$\therefore \frac{90}{100} \times y = 720 \Rightarrow y = 800$$

$$\text{Loss} = 800 - 720 = 80$$

$$\text{Overall Profit/Loss} = 90 - 80 \Rightarrow \text{Rs } 10$$

TYPE - IV

False weight

Example : A dishonest seller sells his goods at cost price, but he uses a weight of 960 gm for 1kg weight, then the percentage of gain is?

Let us first understand what false weight is & how a seller is benefitted from false weight.

Suppose a product costs Rs 1000 per kg. Hence, 1 grams = 1 Rs

If a seller uses false weight that looks like 1 kg (1000 grams), but its actual weight is 960 gm

Then actually seller is selling only 960 gm of product while he's getting Rs 1000.
Therefore, he makes a profit of Rs 40

Profit in weight due to false weight = $1000 - 960 = 40$ gm

Profit Percentage = $\frac{40}{960} \times 100 = 4.16$

PRACTICE QUESTIONS



I. A grocer sells rice at a profit of 10% and uses a weight which is 20% less. Find his total percentage gain?

- (a) 37.5 (b) 40 (c) 25 (d) 42

ANS (A)

II. A shopkeeper marks his good at 20% above the cost price and also allows a discount of 20% but uses false weight of 800gms instead of 1kg. What is overall profit percentage?

- (a) 15% (b) 20% (c) 30% (d) 28%

ANS (D)

III. A shopkeeper cheats to the extent of 10% while buying as well as selling, by using false weights. His total gain is?

- (a) 15% (b) 24% (c) 21% (d) 30%

ANS (D)

IV. A shopkeeper cheats to the extent of 10% while buying and 20% while selling, by using false weights. His total gain is?

- (a) 24% (b) 38% (c) 15% (d) 12%

ANS (A)

Solution - I:

1st thing is that seller sells at a profit of 10%

Let us consider he sells a product of Rs 1000/kg at a 10% profit.

Therefore, he gains Rs 100

Over that amount he gains additional profit by using false weight,

that is the weight looks like 1000 gm but in actual is only 800 gm

∴ Profit percentage due to this =

$$\frac{200}{800} \times 100 = 25\%$$

Eventually he had Two profits, that is

10% & 25%

When there are successive profits, then

$$\text{Total Percentage gain} = x + y + \frac{xy}{100}$$

$$\Rightarrow 10 + 25 + \frac{10 \times 25}{100}$$

$$\Rightarrow 35 + 2.5$$

$$\Rightarrow \text{Total percentage gain } 37.5 \%$$

Solution - II:
Let's say cost of a product is Rs 100/kg.
He marks it 20% above the cost, that is 120.
Now on 120, he gives a discount of 20%. Therefore final price = $120 - 24 = 96$

However, in actual he has used false weight of 800 gm instead of 1000 gm.
Hence, he actually sold product costing Rs 80 at Rs 96

$$\text{Profit} = 16$$

$$\text{Profit percentage} = \frac{16}{80} \times 100 = 20\%$$

Solution - III:
According to the question, Seller earns successive profits

One at 10% while buying and other at 10% while selling
Total Percentage gain = $x + y + \frac{xy}{100}$
 $\Rightarrow 10 + 10 + \frac{10 \times 10}{100}$
 $\Rightarrow 21$
 \Rightarrow Total percentage gain 21 %

Solution - IV:
According to the question, Seller earns successive profits
One at 10% while buying and other at 20% while selling
Total Percentage gain = $x + y + \frac{xy}{100}$
 $\Rightarrow 10 + 20 + \frac{10 \times 20}{100}$
 $\Rightarrow 32$
 \Rightarrow Total percentage gain 32

TYPE - V

Discount, additional discount and percentage discount

Example : Difference between a discount of 30% on Rs 2000 and two successive discounts of 25% and 5% on the same amount is?

$$\Rightarrow \frac{30}{100} \times 2000 = 600$$



Trick for computing successive discount

$$\Rightarrow x + y - \frac{xy}{100}$$

$$\text{Hence, } 25 + 5 - \frac{25 \times 5}{100} = 28.75$$

$$\Rightarrow \frac{28.75}{100} \times 2000 = 575$$

$$\text{Difference in discount} = 600 - 575 \Rightarrow \text{Rs 25}$$

PRACTICE QUESTIONS



I. Successive discount of 30% and 20% are equivalent to a single discount of?

- (a) 35% (b) 44% (c) 48% (d) 50%

ANS (A)

II. Single discount equivalent to the successive discount of 10%, 20% and 25% is ?

- (a) 66.6% (b) 88.8% (c) 40% (d) 28%

ANS (D)

III. A man buys T.V set which lists for Rs 5000 at 10% discount. He gets additional 2% discount for paying with cash. How much does he actually pay?

- (a) 5% (b) 4% (c) 2% (d) 3%

ANS (D)

IV. A cloth store offers Buy 3 Get 1 free. Calculate net percentage discount?

- (a) 33% (b) 30% (c) 25% (d) 20%

ANS (A)

Solution - I:

Equivalent single discount =

$$x + y - \frac{x \times y}{100}$$

$$\text{Hence, } 30 + 20 - \frac{30 \times 20}{100} = 44\%$$

Solution - II:

Since we have three discounts, we will compute two first

Equivalent single discount =

$$x + y - \frac{x \times y}{100}$$

$$\text{Hence, } 10 + 20 - \frac{10 \times 20}{100} = 28\%$$

Now, again taking the third discount

Equivalent single discount =

$$x + y - \frac{x \times y}{100}$$

$$\text{Hence, } 28 + 25 - \frac{28 \times 25}{100} = 46\%$$

Solution - III:

Cost of T.V = 5000

After 10% discount, cost = 4500

Additional 2% discount for paying with cash

$$\Rightarrow \frac{2}{100} \times 4500 = 90$$

$$\text{Final Price} = 4500 - 90 \Rightarrow \text{Rs } 4410$$

Solution - IV:

Discount = 1 & Products given = 4

$$\text{Percentage discount} = \frac{1}{4} \times 100 = 25\%$$

TYPE - VI

Desired Profit/Loss
Example : A man were to sell his chair for Rs 720, he would lose 25%. To gain 25% he would sell it for?



Trick
Current Profit/Loss = 25% loss & Desired Profit = 25%
⇒ Selling Price to have desired profit = Amount $\times \frac{(100 + \text{Desired profit})}{(100 + \text{current Profit})}$
⇒ Hence we get, $720 \times \frac{(100 + 25)}{(100 - 25)} = \text{Rs } 1200$



PRACTICE QUESTIONS

- I. On selling article for Rs 240, a trader loses 4%. In order to gain 10%, he must sell the article for?
 (a) 275 (b) 250 (c) 280 (d) 300
 ANS (A)

- II. By selling an article for Rs 600, a man gains 20%. At what price should he have sold it to gain 15%?
 (a) 656 (b) 575 (c) 450% (d) 520
 ANS (B)

- III. By selling an article for Rs 720, a man loses 20%. At what price should he have sold it to lose 15%?
 (a) 765 (b) 750 (c) 675 (d) 740
 ANS (A)

- IV. By selling 80 ball pens for Rs 140, a man loses 30%. How many ball pens should he sell for Rs 104 to make a profit of 30%?
 (a) 24 (b) 32 (c) 36 (d) 42
 ANS (A)

Solution:

Selling price for desired profit =

$$240 \times \frac{(100 + 10)}{(100 - 4)} = \text{Rs } 275$$

Solution:

Selling price for desired profit =

$$600 \times \frac{(100 + 15)}{(100 + 20)} = \text{Rs } 575$$

Solution:

Selling price for desired loss =

$$720 \times \frac{(100 - 15)}{(100 - 20)} = \text{Rs } 765$$

Solution:

Selling price for desired profit =

$$140 \times \frac{(100 + 30)}{(100 - 30)} = \text{Rs } 260$$

$$\begin{aligned} \text{Number of ball pens to sell} &= \frac{80}{260} \times 104 \\ &= 32 \end{aligned}$$

Alternatively : Desired Selling price
for 80 ball pens = Rs 260

\Rightarrow cost of 1 ball pen = 3.25

Number of ball pens to get by spending
Rs 104 = $\frac{104}{3.25} = 32 \text{ pens}$

SIMPLE AND COMPOUNDED INTEREST

You can expect at least 2-3
Question from this chapter

Frequency of questions from
this chapter is moderate

This chapter is again lengthy
with various types & subtypes



Before we begin with the chapter, let us understand the basic of Simple and compound interest.



What do you do when you have lots of savings with you ?

You may purchase things, invest and could do a lot more but very often what you do is that you deposit it in Bank. The money that you initially deposit is called "Principal"

You deposit money in bank for a specific tenure, after the end of the tenure, you get your initial money back along with some extra cash called "interest". This interest is calculated in two broad ways:

- ✓ Simple Interest
- ✓ Compound Interest

Let's understand it with an example.

Maya deposited 1000 Rs in a bank at Simple interest of 6% while Brian deposited 1000 Rs in a bank at 6% p.a compound interest for a year which was compounded half yearly.

Below are their respective calculations:

$$(i) \text{ Simple interest} = 1000 \times 6\% = \\ 60 \text{ Rs}$$

So after one year, Maya gets 1060 Rs

$$(ii) \text{ Compound Interest for 1st half year} \\ \Rightarrow 1000 \times 6\% \times \frac{1}{2} = 30 \text{ Rs}$$

Compound Interest at the end of 2nd half year

$$\Rightarrow 1060 \times 6\% \times \frac{1}{2} = 31.8 \text{ Rs}$$

So after a year, Brian gets 1061.8 Rs

Therefore, You will receive more money when you deposit at a compound interest. It is also called recurring interest. You may have heard of Recurring Deposit (R.D)

Type I

Direct questions

These are the direct formulas that you need to use when direct questions are asked

Simple interest =

$$\frac{\text{Principal amount deposited} \times \text{rate} \times \text{time period for which the money is invested}}{100}$$

Amount received after getting interest = principal (initial money invested) + simple interest

Amount. If the interest implied on principal sum was "Simple Interest", we use this formula for calculating amount received after depositing money

$$A = P \left\{ 1 + \frac{R \times n}{100} \right\}$$

If the interest on principal sum was "Compound Interest", then Amount direct formula in case of compound interest

$$A = p \left\{ 1 + \frac{R}{100} \right\}^n$$

- Now, If it is given in question that interest is compounded annually then "n" = 1
- However, if it is given that interest is compounded half yearly, then "n" = 2. It is because there are two half years in a year.
- Similarly, if it is given that interest is compounded monthly, then "n" = 12. It is because there are 12 months in any given year.

- Same way, if it is given that interest is compounded quarterly, then "n" = 4, as there are four quarters in a year.
- Lastly, if it is given that interest is compounded daily, then "n" = 360. It is because there are 360 days in a year.



PRACTICE QUESTIONS

I. Principal on which a simple interest of ₹ 55 will be obtained after 9 months at the rate of $11\frac{1}{3}\%$ per annum is

- (a) 1000 (b) 1500 (c) 2000 (d) 2500

Ans (C)

II. What is the compound interest on ₹ 1600 at 25% per annum of 2 years compounded annually?

- (a) 700 (b) 750 (c) 800 (d) 900

Ans (D)

III. The sum which amounts to ₹ 364.8 in 8 years at 3.5 % simple interest per annum is.

- (a) 285 (b) 280 (c) 275 (d) 270

Ans (A)

IV. A person borrowed ₹ 7500 at 16% p.a compound interest .how much does he have to pay at the end of 2nd year to clear the loan

- (a) 9900 (b) 10092 (c) 11000 (d) 11052

Ans (B)

Solution - I:

$$\text{Simple interest} = \frac{P \times R \times T}{100}$$

$$\Rightarrow 55 = \frac{\text{principal} \times 11 \times 9}{100} \times 3 \times 12$$

$$\Rightarrow \text{Principal amount} = 2000$$

Solution - II:

$$\text{Amount} = \text{Principal} \left(1 + \frac{\text{Rate}}{100} \right)^n$$

$$\Rightarrow \text{amount} = 1600 \left(1 + \frac{25}{100} \right)^2$$

$$\Rightarrow \text{amount} = 1600 \left(\frac{5}{4} \times \frac{5}{4} \right)$$

$$\Rightarrow 1500$$

$$\text{Interest received in 2 years} = 2500 - 1600 \Rightarrow 900$$

Solution - III:

Total amount after receiving interest

$$= P + \frac{P \times R \times T}{100}$$

$$\Rightarrow 364.8 = \text{principal amount} +$$

$$\frac{\text{principal} \times 3.5 \times 8}{100}$$

$$\Rightarrow 36480 = 128 \text{ principal}$$

$$\Rightarrow \text{principal} = 285$$

Solution - IV:

$$\text{Amount} = \text{Principal} \left(1 + \frac{\text{Rate}}{100} \right)^n$$

$$\Rightarrow \text{Amount} = 7500 \left(1 + \frac{16}{100} \right)^2 \approx 10092$$

Type II

Example: A sum of money becomes 3 times in 5 years. In how many years will the same sum become 6 times at the same rate of simple interest



Trick

use the formula, Expected time for conversion = $\frac{m-1}{n-1} \times \text{Time given}$

Here, "m" = increase in expected times

$$\Rightarrow \frac{6-1}{3-1} \times 5 \Rightarrow \frac{25}{2} \Rightarrow 12.5$$



PRACTICE QUESTIONS

I. What is the least number of complete years in which a sum of money at 20% compound interest will be more than doubled?

- (a) 7 (b) 6 (c) 5 (d) 4

Ans (D)

II. A sum of money lent on simple interest triples itself in 15 years & 6 month. In how many year still it be doubled

- (a) 6y & 3m (b) 7y & 9 m (c) 8y & 3m (d) 7y & 4m

Ans (B)

III. At what rate per cent per annum simple interest, will a sum of money triples itself in 25 years

- (a) 8% (b) 9% (c) 10% (d) 12%

Ans (A)

Solution - I:

Let's say the amount is Rs 100. Hence, as per the question what is the time frame for the amount to get doubled i.e 200
 For 1st year he will get an interest of Rs 20. Now, the total sum becomes Rs 120
 Hence, we can easily say that it requires at least 4+ years to make the sum more than Rs 200

Solution - II:

$$\text{Time} = \frac{2-1}{3-1} \times 15.5 \Rightarrow 7.75 \text{ years} \Rightarrow 7 \text{ years and } 9 \text{ months} \quad [0.75 \times 12 = 9 \text{ months}]$$

Solution - III:

When sum of money triples itself, Simple interest will be 2 times the principal

$$\text{Amount} = \text{principal} + \text{simple interest}$$

$$3P = P + 2P$$

$$\text{Simple interest} = \frac{P \times R \times T}{100} \Rightarrow 2P = \frac{P \times R \times 25}{100} \Rightarrow r = 8$$

- When it is said that sum of money doubles itself (for certain interest & certain time period), Simple interest & principal amount will be the same
 Since, $A = P + (S.I)$, and if $S.I = P$, then $A = P + P \therefore A = 2P$

- When sum of money becomes 4 times, (for certain interest rate & certain time period)

$S.I$ will be 3 times the principal

- When sum of money becomes 5 times, (for certain interest rate & certain time period)

$S.I$ will be 4 times the principal

- When sum of money becomes 6 times, (for certain interest rate & certain time period)

$S.I$ will be 5 times the principal

Solution - II:

If we take first part as "x", and second part be "y"

S.I on x at 12% for 1 years + S.I on y

at 10% for 1 years = 130

$$\frac{x \times 12 \times 1}{100} + \frac{y \times 10 \times 1}{100} = 130 \Rightarrow$$

$$12x + 10y = 13000$$

It is said that if the interest rate is interchanged, then S.I comes to 134

\therefore S.I on x at 10% for 1 years + S.I on y

at 12% for 1 years = 130

$$\frac{x \times 10 \times 1}{100} + \frac{y \times 12 \times 1}{100} = 134$$

$$\Rightarrow 10x + 12y = 13400$$

Now we have two equations,

$$12x + 10y = 13000$$

$$\& 10x + 12y = 13400$$

On solving both equations $x = 500$ & $y = 700$

Solution - III:

$$\text{Overall interest rate} = \frac{P_1 \times R_1 + P_2 \times R_2}{P_1 + P_2}$$

$$\Rightarrow \frac{2400 \times 5 + 600 \times 6}{2400 + 600} \Rightarrow 5.2\%$$

Interest rate on the whole sum is 5.2%

Solution - IV:

$$\text{Overall interest rate} = \frac{P_1 \times R_1 + P_2 \times R_2}{P_1 + P_2}$$

Overall interest rate =

$$\frac{\text{principal sum } 1 \times \text{Rate } 1 + \text{Principal sum } 2 \times \text{Rate } 2}{\text{Principal sum } 1 + \text{Principal sum } 2}$$

$$\Rightarrow \frac{150000 \times 10 + 150000 \times 12}{150000 + 150000} \Rightarrow 11\%$$

Interest rate on the whole sum is 11%

Type V

Difference between Simple Interest & Compound Interest

Example: Difference between simple interest & compound interest compounded yearly on a certain Sum of money for 2 years at 4% per annum is rs 1. The sum is ?



Trick when you are asked for difference between simple interest and compound interest for 2 years, use this

- Compound interest for 2 years - simple interest for 2 years = $\frac{P(R)^2}{(100)^2}$
- Similarly, Compound interest for 2 years - simple interest for 2 years
 $= \frac{P(R)^2 \times (300+R)}{(100)^3}$

Note:- This trick will work only when Compound interest must have been compounded annually

Coming to the question,

$$1 = \frac{P \times 4^2}{100^2} \Rightarrow P = 625, \text{ therefore, the principal amount is 625}$$

PRACTICE QUESTIONS



I. Two equal sum of money were invested at an annual rate of 10%. One at a S.I for 2 years while other at Compound interest for 2 years compounded annually. If the difference between Simple interest & Compound interest for two years is Rs. 100, what were the sum invested?

- (a) 12000 (b) 10000 (c) 80000 (d) 60000

Ans (B)

II. The difference between the CI and SI on 10,000 for 2 years is Rs 25. What will be the rate of interest?

- (a) 5% (b) 4% (c) 3% (d) 8%

Ans (A)

III. The difference between the compound interest and simple interest on a certain sum for 2 years at 6% per annum is Rs 90. Find the sum?

- (a) 20000 (b) 24000 (c) 25000 (d) 5.6%

Ans (C)

IV. The approximate difference between the compound interest and simple interest on a sum of Rs 2800 at 12% per annum after 3 years

- (a) 126 (b) 139 (c) 161 (d) 148

Ans (A)

Solution - I:

$$CI \text{ for 2 years} - S.I \text{ for 2 years} = \frac{P(R)^2}{(100)^2}$$

$$100 = \frac{P \times 10^2}{100^2} \Rightarrow P = 10000$$

Therefore, the principal amount was
Rs 10000

Solution - II:

$$CI \text{ for 2 years} - S.I \text{ for 2 years} = \frac{P(R)^2}{(100)^2}$$

$$25 = \frac{10000 \times R^2}{100^2}$$

$$\Rightarrow R = 5\%$$

Therefore, the Interest rate is 5%

Solution - III:

$$CI \text{ for 2 years} - S.I \text{ for 2 years} = \frac{P(R)^2}{(100)^2}$$

$$90 = \frac{P \times 6^2}{100^2} \Rightarrow P = 25000$$

Therefore, the principal amount was
Rs 25000

Solution - IV:

$$CI \text{ for 3 years} - S.I \text{ for 3 years} =$$

$$\frac{P(R) \times (300+R)}{(100)^3}$$

$$2800 = \frac{P \times 12 \times 12 \times (300+12)}{(100)^3}$$

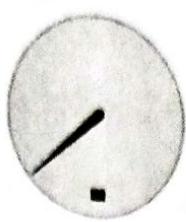
$$\Rightarrow P = 125.7$$

DECIMAL FRACTION

You can expect at least 1-2 questions from this chapter

Frequency of questions from this chapter is less

This chapter is very easy and won't take much time



TYPE-1

Let's first understand some basics before we move ahead.

e.g. $0.\overline{2}22222222 \dots \dots \dots$ can be written as $0.\bar{2}$ (The line above 0.2 is known as bar.)
Bar is placed over the numbers that are recurring

e.g. $0.234234234234 \dots \dots \dots$ can be written as $0.\overline{234}$

When bar is over all the digits, there is a simple way to convert it into $\frac{p}{q}$ form

$$\text{i) } 0.\overline{23} = \frac{23}{99} \quad \text{ii) } 0.\overline{254} = \frac{254}{999} \quad \text{iii) } 1.\overline{7} = \frac{17}{99}$$

e.g. $0.5\overline{9}999999999999 \dots \dots \dots$ can be written as $0.5\bar{9}$

When bar is only over a specific number, then there is a different way to convert it into $\frac{p}{q}$ form

$$\text{i) } 4.1\bar{2} = \frac{412-41}{90} \quad \text{ii) } 1.5\bar{4} = \frac{154-15}{90} \quad \text{iii) } 0.00\bar{7} = \frac{7-000}{900}$$

(we subtracted 41 in option (i) because it was the number just before bar and similarly we did it in other questions as well)

PRACTICE QUESTIONS



I. Write $17.\overline{83}$ into $\frac{p}{q}$ form.

(a) $\frac{1783}{99}$

ANS-(C)

(b) $\frac{1780}{99}$

(c) $\frac{1766}{99}$

(d) none

II. Write $1.1\bar{8}$ into $\frac{p}{q}$ form.

(a) $\frac{107}{90}$

ANS-(A)

(b) $\frac{107}{99}$

(c) $\frac{118}{90}$

(d) $\frac{118}{99}$

III. Write $1.\bar{8}$ into $\frac{p}{q}$ form.

(a) $\frac{17}{9}$

ANS-(A)

(b) $\frac{18}{9}$

(c) $\frac{18}{90}$

(d) $\frac{118}{99}$

IV. Write $0.2\overline{341}$ into $\frac{p}{q}$ form.

(a) $\frac{2339}{9999}$

ANS-(B)

(b) $\frac{2339}{9990}$

(c) $\frac{2341}{9999}$

(d) $\frac{2341}{9990}$

SOLUTION:

I.) $\frac{1783 - 17}{99}$

II.) $\frac{118 - 11}{90}$

III.) $\frac{18 - 1}{9}$

IV.) $\frac{2341 - 2}{9990}$

TYPE-II

POWER & ROOTS

(i) 2^3 begin with basic fundamentals
This is called power. (2 to the power 3).

This kind of expression signifies 2 multiplied 3 times. i.e $2 \times 2 \times 2 = 8$

$$2^4 = 2 \times 2 \times 2 \times 2 \quad \& \quad 2^5 = 2 \times 2 \times 2 \times 2 \times 2$$

(ii) $2^{3^2} = 2^{3 \times 2} = 2^6 = 2 \times 2 \times 2 \times 2 \times 2 \times 2$

(iii) $2^3 \times 2^4 = 2^7 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$

(iv) $2^3 \times 3^4$ → Here, we cannot add the powers as done above because the base is not the same

(v) $4^3 \times 2^2$ Base is not the same here as well. However, ($4 = 2^2$)

Therefore, it can be written as $2^{2^3} \times 2^2 = 2^{2 \times 3} \times 2^2 = 2^5 \times 2^2 = 2^{3+2} = 2^5$

(vi) $\frac{2^5}{2^3} = 2^{5-3} = 2^2 = 2 \times 2$

(vii) $\frac{2^5}{3^3}$ → Here we cannot write 2^2 as done above because the base is not the same

(viii) $\frac{2^8}{4^2}$ Base is not the same here as well. However, ($4 = 2^2$)

Therefore, it can be written as $\frac{2^8}{2^{2^2}} = \frac{2^8}{2^4} = 2^{8-4} = 2^4$

(ix) $\sqrt{4} = 2$ → ($\sqrt{4}$ can also be written as $4^{1/2}$)

(x) $\sqrt{9} = 3$ → ($\sqrt{9}$ can also be written as $9^{1/2}$)

(xi) $(\sqrt{16})^2 = 16$ → $(\sqrt{16})^2 = 16^{\frac{1}{2} \times 2} = 16$

(xii) $2^{-2} = \frac{1}{2^2} = \frac{1}{4}$

PRACTICE QUESTIONS



I. If $16 \times 8^{n+2} = 2^m$

- (a) $n+8$ (b) $2n+10$

ANS-(D)

(c) $3n+2$

(d) $3n+10$

II. If $196x^4 = x^6$, then x^3 is equal to which one of the following

- (a) $14x^{10}$ (b) $14x^4$ (c) $14x$ (d) $14x^2$

ANS-(D)

III. $3^{x+y} = 81$ and $81^{x-y} = 3$, then what is the value of x ?

- (a) $17/16$ (b) $17/8$ (c) $17/4$

ANS-(B)

(d) $15/4$

IV. If $2^m + 2^{1+m} = 24$, then what is the value of m

- (a) 0 (b) 2 (c) 3

ANS-(C)

(d) 6

V. If $\sqrt{10 + \sqrt[3]{x}} = 4$, then what is the value of x

- (a) 0 (b) 2 (c) 3

ANS-(C)

(d) 6

SOLUTION - I:

$$16 \times 8^{n+2} = 2^m$$

$$\Rightarrow (2^4) \times (2^{3n+6}) = 2^m$$

$$\Rightarrow (2^4) \times (2^{3n+6}) = 2^m$$

$$\Rightarrow 2^{4+3n+6} = 2^m$$

$$\Rightarrow \text{Therefore, } m = 10 + 3n$$

SOLUTION - III:

$$3^{x+y} = 81 \text{ and } 81^{x-y} = 3$$

$$\Rightarrow 3^{x+y} = 3^4 \text{ and } 3^{4(x-y)} = 3^1$$

$$\Rightarrow x+y=4 \text{ and } x-y=\frac{1}{4}$$

$$\text{On substituting, we get } x = \frac{17}{8}$$

SOLUTION - II:

$$196x^4 = x^6 \Rightarrow (14x^2)^2 = (x^3)^2$$

$$\Rightarrow (14x^2) = (x^3)$$

SOLUTION - IV:

$2^m + 2^{1+m} = 24$. If we substitute the value of m with option (c), it satisfies the equation.

SOLUTION - V:

$$\sqrt{10 + \sqrt[3]{x}} = 4$$

On squaring both the sides we get

$$\Rightarrow (\sqrt{10 + \sqrt[3]{x}})^2 = (4)^2$$

$$\Rightarrow 10 + \sqrt[3]{x} = 16$$

$$\Rightarrow \sqrt[3]{x} = 6$$

Cubing both the sides we get,

$$\Rightarrow x = 216$$

TYPE-III

Substitution types

Example:

When it is given $a^x = b, b^y = c, c^z = a$. Find xyz

(a) 1

(b) abc

(c) $1/abc$

(d) 0



TRICK

when it is given that $a^x = b, b^y = c, c^z = a$

$x \times y \times z$ will always be equal to 1 How? let us understand

$a^x = b$. Therefore $b^y = (a^x)^y$

\Rightarrow It is given that $b^y = c$, Therefore $c^z = (a^{xy})^z$

And it is given in the Question that $c^z = a \Rightarrow a^{xyz} = a \Rightarrow a^{xyz} = a^1$ Hence, $xyz=1$

Similarly the following trick can be used :

- When it is given that $a^x = b^y = c^z$ and $a \times b \times c = 1$ Then $xy + yz + zx = 0$
- When it is given that $a^x = b^y = M$ & $b^w = a^z = N$ Then $xw = zy$
- When it is given that $x^{\frac{1}{a}} = y^{\frac{1}{b}} = z^{\frac{1}{c}}$ and $x \times y \times z = 1$ Then $a+b+c=0$



PRACTICE QUESTIONS

I. If $a^x = b, b^y = c, xyz = 1$ then what is the value of c^z

- (a) b (b) 1 (c) 0 (d) a

ANS-(D)

II. If $a^x = b^y = c^z$ and $abc = 1$, then what is $xy+yz+zx$

- (a) xyz (b) abc (c) 1 (d) 0

ANS-(D)

- III. If $p^x = r^y = A$ & $r^w = p^z = B$, then
 (a) $xw = yz$ (b) $xz = yw$ (c) $x+y=w+z$ (d) $x+z=y+w$
 ANS-(A)

- IV. If $(x)^{\frac{1}{m}} = (y)^{\frac{1}{n}} = (z)^{\frac{1}{p}}$ and $xyz=1$, then what is the value of $m+n+p$
 (a) 0 (b) 2 (c) 1 (d) -1
 ANS-(A)

SOLUTION - I:

As stated in the trick above, when it is given that $a^x = b, b^y = c, c^z = a$
 $x \times y \times z$ will always be equal to 1. Since in the question $xyz = 1$ & $a^x = b, b^y = c$
 Therefore, $c^z = a$

SOLUTION - II:

As stated in the trick above, When it is given that $a^x = b^y = c^z$ and $a \times b \times c = 1$

$$\text{Then } xy + yz + zx = 0$$

SOLUTION - III:

As stated in the trick above, When it is given that $a^x = b^y = M$ & $b^w = a^z = N$

$$\text{Then } xw = zy$$

$$a^x = b^y = M \quad \& \quad b^w = a^z = N$$

SOLUTION - IV:

As stated in the trick above, When it is given that $x^{\frac{1}{a}} = y^{\frac{1}{b}} = z^{\frac{1}{c}}$ and $xyz = 1$

$$\text{Then } a + b + c = 0$$

$$= 4 + 2 + 4\sqrt{2}$$

TYPE-V

Recurring roots

These are some of the common formulae's

I. Value of

$$\sqrt{R + \sqrt{R + \sqrt{R + \dots \infty}}} = \frac{\sqrt{4R+1}+1}{2}$$

II. Value of

$$\sqrt{R - \sqrt{R - \sqrt{R - \dots \infty}}} = \frac{\sqrt{4R+1}-1}{2}$$

III. Value of

$$\sqrt{R\sqrt{R\sqrt{R \dots \infty}}} = R$$



PRACTICE QUESTIONS

I. What is the value of $\sqrt{6 + \sqrt{6 + \sqrt{6 + \dots}}}$?

- (a) 2 (b) 3 (c) 3.5 (d) 4

ANS-(B)

II. What is the value of $\sqrt{12 - \sqrt{12 - \sqrt{12 - \dots}}}$?

- (a) 2.5 (b) 3 (c) 4.5 (d) 7

ANS-(B)

III. What is the value of $\sqrt{7\sqrt{7\sqrt{7\dots\infty}}}$?

- (a) 2.5 (b) 3 (c) 4.5 (d) 7

ANS-(D)

SOLUTION - I:

Using the formulae
given above, we get

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

SOLUTION - II:

Using the formulae
given above, we get

$$\frac{\sqrt{4 \times 12 + 1} - 1}{2} = \frac{7 - 1}{2} = 3$$

SOLUTION - III:

Using the formulae
given above, we get
answer as 7