

CHAPTER-4

PROFIT AND LOSS

I. **Cost price :** The price at which an article is purchased is called its Cost Price and denoted by CP.

or

For any person, Cost Price is an amount or quantity which firstly releases from the pocket of that person.

II. **Selling Price :** The price at which an article is sold, is called its selling price, denoted by SP.

or

For any person, Selling Price is, an amount or quantity which come to the pocket of that person.

III. **Profit or Gain :** If S.P. is greater than CP, then Seller is said to have a profit or gain.

IV. **Loss :** If S.P. is less than C.P. the seller is said to have a loss.

V. Profit and loss are always counted on C.P.

VI. CP is always 100% in the case of profit and loss.

VII. For any transaction there are two persons involved one is called buyer and second one is called seller.

VIII. **Marked Price :** MRP of an article is known as Marked Price or labelled price or listed price and denoted by MP.

IX. Discount always carried on MP (MRP)

X. MP is always 100% in the case of discount.

Observation:

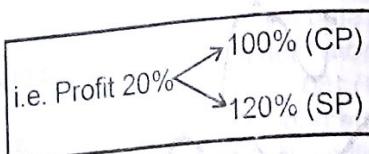
In the case of profit or loss, the relation is generated between CP and SP.

If 20% profit accrued on an article its mean

→ 100% represent cost price (CP)

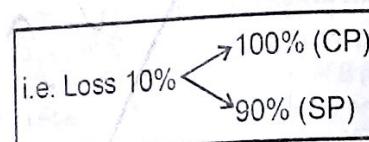
→ 120% represent selling price (S.P.)

→ 20% represent profit



If 10% loss accrued on an article, its means :

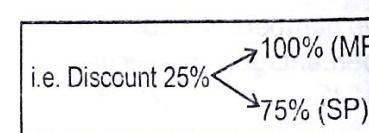
- 100% → represent cost price (CP)
- 90% → represent selling price (S.P.)
- 10% → represent loss i.e.,



In the case of discount, the relation is generated between SP/MP

If 25% discount accrued on an article its means :

- 100% → represent marked price (MP)
- 75% → represent selling price (SP)
- 25% → discount.



Note : A purchases an article at 40 Rs and sells it to B at Rs. 50 and B sells it to C at Rs. 30

A Profit= Rs. 10 B Loss= Rs. 20 C

— CP of A = Rs. 40

— SP of A = Rs. 50

— CP of B = Rs. 50

— SP of B = Rs. 30

— CP of C = Rs. 30

For A, Profit = 50-40 = 10

For B, Loss = 50 -30 = 20

$$\text{For A, } P = SP - CP$$

$$\text{For B, } L = CP - SP$$

$$\text{For A, Percent profit} = \frac{\text{Profit of A}}{\text{CP of A}} \times 100$$

$$\text{For B, Percent loss} = \frac{\text{Loss of B}}{\text{CP of B}} \times 100$$

$$\text{For A, } = \frac{10}{40} \times 100 = 25\%$$

$$\text{For B, } = \frac{20}{50} \times 100 = 40\%$$

$$P\% = \frac{P}{CP} \times 100$$

$$L\% = \frac{L}{CP} \times 100$$

Ex-1. A person purchased an article for Rs. 80 and sold it for Rs. 100. Find his % profit.

CP of the article = Rs. 80

SP of the article = Rs. 100

Profit of the person = 100 - 80 = Rs. 20

$$\% \text{ profit of the person} = \frac{\text{Profit}}{\text{CP}} \times 100$$

$$\% P = \frac{20}{80} \times 100$$

$$\% P = 25\%$$

Trick :

$$\% P = \frac{20}{80} \times 100 = 25\%$$

Ex-2. A dishonest shopkeeper sells goods at his cost price but uses a weight of 900 gm for a kg. weight. Find his gain percent.

The CP of shopkeeper = 900 gm

The SP of shopkeeper

$$= 1000 \text{ gm (1 kg} = 1000 \text{ gm)}$$

The profit of shopkeeper

$$= 1000 - 900 = 100 \text{ gm}$$

% profit of shopkeeper

$$= \frac{\text{Profit of shopkeeper}}{\text{CP of shopkeeper}} \times 100$$

$$\therefore \% P = \frac{100}{900} \times 100 = 11\frac{1}{9}\%$$

Ex-3. A person got 5% loss by selling an article for Rs. 1045. At what price should the article be sold to earn 5% profit?

Let the new SP be Rs. x then

$$(100-\text{Loss \%}) : (\text{1st SP}) = (100+\text{gain \%}) : (\text{2nd SP})$$

$$\frac{100-5}{1045} = \frac{100+5}{x} \Rightarrow x = \frac{105 \times 1045}{95}$$

Trick :

$$\text{New SP} = \frac{1045}{95} \times 105 = 1155$$

Ex-4. A person sold an article at profit of 12%. If he had sold it Rs. 3.60 more, he would have gain 18%. What is the cost price?

Let the CP of an article be x Rs. then

$$112\% \text{ of } x + 3.60 = 118\% \text{ of } x$$

$$\Rightarrow 118\% \text{ of } x - 112\% \text{ of } x = 3.60$$

$$\Rightarrow 6\% \text{ of } x = 3.60$$

$$x = \frac{3.60}{6} \times 100 = \text{Rs. 60}$$

Trick :

$$CP = \frac{3.60}{6} \times 100 = \text{Rs. 60}$$

Ex-5. If the CP of 12 articles is equal to the SP of 9 articles. Find the gain or loss.

Let the C.P. of each article be Rs. 1.

Then CP of 9 articles = Rs. 9

SP of 9 articles = Rs. 12

$$\text{Gain \%} = \frac{3}{9} \times 100 = 33\frac{1}{3}\%$$

$$\text{Trick} = \text{Gain\%} = \frac{3}{9} \times 100 = 33\frac{1}{3}\%$$

Ex-6. A person bought articles at 30 for a rupee. How many for a rupee must he sell to gain 20%?

Sol. CP of 30 articles = Rs. 1, SP of 30 article = 120% of Rs. 1

$$\text{For Rs. } \frac{6}{5}, \text{ article sold} = 30$$

$$\text{For Rs. 1 article sold} = 30 \times \frac{5}{6} = 25$$

Trick

20% gain, mean

 $\therefore \text{Article sold in Rs. } 1 = 30 \times \frac{100}{120} = 25$

Ex-7. A vendor bought bananas at 5 for Rs. 4 and sold them at 4 for Rs. 5. Find his gain or loss percent.

Sol. Suppose, number of bananas bought = LCM of 5 & 4 = 20

$$\text{CP} = \text{Rs. } \left(\frac{4}{5} \times 20 \right) = 16; \text{SP} = \text{Rs. } \left(\frac{5}{4} \times 20 \right) = 25$$

$$\% \text{ Profit} = \frac{25 - 16}{16} \times 100 = \frac{9}{16} \times 100 = 56.25\%$$

Trick

5 Bananas → 4 Rs.
 4 Bananas → 5 Rs.
 $\frac{\% P = \frac{25-16}{16} \times 100}{\% P = \frac{9}{16} \times 100 = 56.25\%}$

Ex-8. Find the equivalent discount of 50% and 20%.

Sol. Let the MP be = Rs. 100

$$\text{Then, Net SP} = 100 \times \frac{50}{100} \times \frac{80}{100}$$

$$= \text{Rs. } 40$$

$$\text{Required discount} = (100 - 40)\%$$

$$= 60\%$$

If the marked price of an article is 20% more than its C.P. and a shopkeeper allows a discount of 10%. Find his profit percent?

Sol.

Let the CP be = Rs. x then

$$\text{MP} = x \times 120\% = \left(x \times \frac{6}{5} \right) \text{ Rs.}$$

$$\text{After 10\% discount SP} = \left(x \times \frac{6}{5} \right) \times 90\%$$

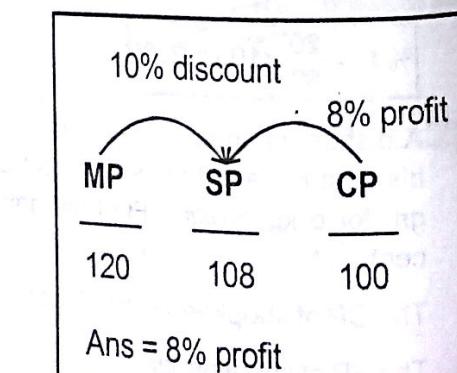
$$= \left(x \times \frac{6}{5} \times \frac{9}{10} \right) \text{ Rs.}$$

$$= \left(\frac{54}{50} x \right) \text{ Rs.}$$

$$\% P = \frac{\left(\frac{54}{50} x \right) - x}{x} \times 100 = \frac{54x - 50x}{50} \times 100$$

$$= \frac{4}{50} \times 100$$

$$= 8\%$$

Trick :**EXERCISE****PROFIT AND LOSS**

Q.1. If books bought at prices ranging from Rs. 200 to Rs. 325 are sold at prices ranging from Rs. 300 to Rs. 450, what is the greatest possible profit that might be made in selling eight books?
 (1) Rs. 400 (2) Rs. 600 (3) Cannot be determined
 (4) Rs. 2000 (5) None of these

Q.2. A person sold an article for Rs. 2090.42. Approximately, what will be the percentage profit if he sold that article for Rs. 2602.58?
 (1) 15% (2) 20% (3) 25% (4) Cannot be determined
 (5) None of these

Q.3. Ram purchases a Bike for Rs. 4700 and spends Rs. 800 on its repairs. If he sells the Bike for Rs. 5800, his gain percent is:
 (1) $1\frac{4}{7}\%$ (2) $5\frac{5}{11}\%$ (3) 10% (4) 12% (5) None of these

Q.4. A shopkeeper purchased 70 kg of potatoes for Rs. 420 and sold the whole at the rate of Rs. 6.50 per kg. What will be his gain percent?
 (1) $4\frac{1}{6}\%$ (2) $6\frac{1}{4}\%$ (3) $8\frac{1}{3}\%$ (4) 20% (5) None of these

Q.5. Saif purchased 20 dozens of toys at the rate of Rs. 375 per dozen. He sold each one at the rate of Rs. 33. What was his percentage profit?
 (1) 3.5% (2) .5% (3) 5.6% (4) 6.5% (5) None of these

Q.6. 100 oranges are bought at the rate of Rs. 350 and sold at the rate of Rs. 48 per dozen. The percentage of profit or loss is:
 (1) $14\frac{2}{7}\%$ gain (2) 15% gain (3) $14\frac{2}{7}\%$ loss (4) 15% loss (5) None of these

Q.7. A man buys a cycle for Rs. 1400 and sells it at a loss of 15%. What is the selling price of the cycle?
 (1) Rs. 1090 (2) Rs. 1160 (3) Rs. 1190 (4) Rs. 1202 (5) None of these

Q.8. A sells an article which costs him Rs. 500 to B at a profit of 20%. B then sells it to C, making a profit of 10% on the price he paid to A. How much does C pay B?
 (1) Rs. 472 (2) Rs. 476 (3) Rs. 528 (4) Rs. 532 (5) None of these

Q.9. Peter purchased a machine for Rs. 80,000 and spent Rs. 5000 on repair and Rs. 1000 on transport and sold it with 25% profit. At what price did he sell the machine?
 (1) Rs. 1,05,100 (2) Rs. 1,06,250 (3) Rs. 1,07,500
 (4) Rs. 1,17,500 (5) None of these

Q.10. By selling an article for Rs. 100, a man gains Rs. 30. Then, his gain% is:
 (1) 15% (2) $42\frac{6}{7}\%$ (3) $17\frac{11}{17}\%$

(4) $17\frac{1}{4}\%$ (5) None of these

Q.11. When an article is sold for Rs. 21.12, there is a loss of 4%. What is the cost price of the article?
 (1) Rs. 26.10 (2) Rs. 43 (3) Rs. 43.20 (4) Rs. 22 (5) None of these

Q.12. A shopkeeper expects a gain of $22\frac{1}{2}\%$ on his cost price. If in a week, his sale was of Rs. 392, what was his profit?
 (1) Rs. 18.20 (2) Rs. 70 (3) Rs. 72 (4) Rs. 88.25 (5) None of these

- Q.13.** When a plot is sold for Rs. 18,700, the owner loses 15%. At what price it must be sold in order to gain 15%?
 (1) Rs. 21,000 (2) Rs. 22,500
 (4) Rs. 25,800 (5) None of these
- Q.14.** A fruitseller sells mangoes at the rate of Rs. 8 per kg and thereby loses 25%. At what price per kg, he should have sold them to make a profit of 25%?
 (1) Rs. 11.81 (2) Rs. 12
 (4) Rs. 13.33 (5) None of these
- Q.15.** A property dealer sells a house for Rs. 9,00,000 and in the bargain makes 12.5%. Had he sold it for Rs. 6,00,000, then what percentage of loss or gain have made?
 (1) 25% loss (2) 10% loss (3) $12\frac{1}{2}\%$ gain (4) $16\frac{2}{3}\%$ gain (5) None of these
- Q.16.** A shopkeeper sells one transistor for Rs. 960 at a gain of 20% and another for Rs. 1152 at a loss of 4%. His total gain or loss percent is:
 (1) $5\frac{3}{5}\%$ loss (2) $5\frac{3}{5}\%$ gain (3) $6\frac{2}{3}\%$ gain (4) $6\frac{2}{3}\%$ loss (5) None of these
- Q.17.** If selling price of an article is $\frac{5}{4}$ of its cost price, the profit in that?
 (1) $16\frac{2}{3}\%$ (2) $20\frac{1}{2}\%$ (3) 25% (4) 30% (5) None of these
- Q.18.** The ratio of the cost price and the selling price is 4 : 5. The profit percent is-
 (1) 10% (2) 20% (3) 25% (4) 30% (5) None of these
- Q.19.** The ratio between the sale price and the cost price of an article is 7 : 5. What ratio between the profit and the cost price of that article?
 (1) 2 : 7 (2) 5 : 2 (3) 7 : 2
 (4) Data inadequate (5) None of these
- Q.20.** A man gains 20% by selling an article for a certain price. If he sells it at double the price, the percentage of profit will be:
 (1) 40% (2) 100% (3) 120% (4) 140% (5) None of these
- Q.21.** The profit earned by selling an article for Rs. 900 is double the loss incurred when the same article is sold for Rs. 450. At what price should the article be sold to make 25% profit?
 (1) Rs. 600 (2) Rs. 750 (3) Rs. 800
 (4) Data inadequate (5) None of these
- Q.22.** Profit earned by selling an article for Rs. 1060 is 20% more than the loss incurred by selling the article for Rs. 950. At what price should the article be sold to earn 20% profit?
 (1) Rs. 980 (2) Rs. 1080 (3) Rs. 1800
 (4) Rs. 1200 (5) None of these
- Q.23.** The cost price of 20 articles is the same as the selling price of x articles. If the profit is 25%, then the value of x is:
 (1) 15 (2) 16 (3) 18
 (4) 25 (5) None of these
- Q.24.** The cost price of 50 articles is equal to the selling price of 40 articles. Gain percent is:
 (1) $3\frac{9}{17}\%$ (2) $15\frac{15}{19}\%$ (3) $18\frac{3}{4}\%$ (4) 25% (5) None of these
- Q.25.** On an order of 5 dozen boxes of a consumer product, a retailer receives an extra dozen free. This is equivalent to allowing him a discount of:
 (1) 15% (2) $16\frac{1}{6}\%$ (3) $16\frac{2}{3}\%$ (4) 20% (5) None of these

CHAPTER-5

SIMPLE INTEREST & COMPOUND INTEREST

Definition: When we borrow some money from another person for a certain period then after some time we have to pay some extra money to him. This extra money is called the Interest. This interest is always same for same period. So it is known as simple interest denoted as S.I.

Formula :

$$S.I. = \frac{P \times R \times T}{100}$$

Where P → Principal

R → Rate percent per annum

T → Number of years

When S.I. is added to principal. It is changed into amount.

$$P + S.I. = A$$

$$S.I. = A - P$$

Case I : If S.I., R & T are known,

$$P = \frac{S.I. \times 100}{R \times T}$$

Case II : If S.I., P & T, are known,

$$R = \frac{S.I. \times 100}{P \times T}$$

Case III : When S.I. P, R are known

$$T = \frac{S.I. \times 100}{P \times R}$$

Solved Examples :

- Ex-1.** Find S.I. on Rs. 5000 at the rate of Interest 5 % p.a. for 5 years.

$$S.I. = \frac{PRT}{100} = \frac{5000 \times 5 \times 5}{100} = \text{Rs. } 1250$$

- Ex-2.** Find S.I. on Rs. 2000 at the rate of interest

4% for $2\frac{1}{2}$ years.

Sol. $S.I. = \frac{2000 \times 4 \times \frac{5}{2}}{100} = \text{Rs. } 2000$

- Ex-3.** Find the time taken when interest is paid Rs. 50 on Rs. 500 at the rate of interest 5%.

$$T = \frac{S.I. \times 100}{P \times R} = \frac{50 \times 100}{500 \times 5} = 2 \text{ years}$$

- Ex-4.** A certain sum of money doubles itself & number of years is equal to rate of interest. Find the rate of interest.

Sol. Let $P = x$, $A = 2x$
 $S.I. = A - P = 2x - x$
 By Formula,

$$S.I. = \frac{PRT}{100}$$

$$x = \frac{x \times R \times R}{100}$$

$$R^2 = 100 \Rightarrow R = 10\%$$

- Ex-5.** A sum of money doubles itself in 7 years. In how many years it will become 4 times?

Sol. $P = x$, $A = 2x$

$$S.I. = x$$

$$x = \frac{x \times R \times 7}{100}$$

$$R = \frac{100}{7} \quad \dots \dots \dots (1)$$

$$\text{Again } P = x, A = 4x$$

$$S.I. = 3x$$

$$3x = \frac{x \times R \times T}{100}$$

$$300 = R \times T \quad \dots \dots \dots (2)$$

From eq. (1) and (2)

$$T = 21 \text{ years}$$

Trick :

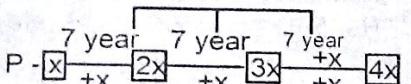
$$\frac{n_1 - 1}{t_1} = \frac{n_2 - 1}{t_2}$$

$$\frac{2-1}{7} = \frac{4-1}{t_2}$$

$$\frac{1}{7} = \frac{3}{t_2}$$

$$t_2 = 21 \text{ years}$$

By figure :



$$\text{Total years} = 7 + 7 + 7 = 21 \text{ year}$$

- Ex-6.** The S.I. is the $\frac{1}{9}$ of the principal & the number of years is equal to rate %. Find the rate %.

Sol. Let $P = x$

$$\text{S.I.} = \frac{PRT}{100}$$

$$\frac{1}{9}x = \frac{x \times R \times R}{100}$$

$$R^2 = \frac{100}{9} \Rightarrow R = \frac{10}{3} = 3\frac{1}{3}\%$$

- Ex-7.** The S.I. is the 40% of principal in 8 years. at certain rate of Interest. Find the rate %.

$$\text{S.I.} = \frac{P \times R \times T}{100}$$

$$40\% \text{ of } P = \frac{P \times R \times T}{100}$$

$$\frac{40}{100} \times P = \frac{P \times R \times 8}{100}$$

$$R = 5\%$$

- Ex-8.** At what rate of interest per annum will a sum double itself in 8 years ?

Sol. By formula

$$P = x, A = 2x$$

$$\text{S.I.} = A - P$$

$$= 2x - x = x$$

$$\text{S.I.} = \frac{PRT}{100}$$

$$x = \frac{x \times R \times 8}{100}$$

$$R = 12.5\%$$

By shortcut :

$$R = \left(\frac{N-1}{T} \right) \times 100$$

$$= \frac{2-1}{8} \times 100, \quad R = 12.5\%$$

COMPOUND INTEREST

As we discussed the S.I. is same for same time but in the case of compound interest this is not happened. In the case of C.I., The interest varies according to time. eg.

Suppose we take 100 Rs. at the rate of compound interest 10%, after one year we can not able to pay amount so, here C.I. is imposed on amount rate 1st year ie. 10% is imposed on 110 and so on.....

So. C.I. is equal to S.I. in first year but after 1 year C.I. > S.I.

Basic Formula :

$$A = P \left(1 + \frac{r}{100} \right)^n$$

$$\text{C.I.} = P \left[\left(1 + \frac{r}{100} \right)^n - 1 \right]$$

A → Amount

P → Principal

r → Rate of Interest

n → Number of years

SOLVED EXAMPLES :

- Ex-1.** Find C.I. on Rs. 16000 at the rate 5% p.c.p.a. for 2 years, compounded annually

By Formula

$$\text{C.I.} = P \left[\left(1 + \frac{r}{100} \right)^n - 1 \right]$$

$$= 16000 \left[\left(1 + \frac{5}{100} \right)^2 - 1 \right]$$

$$= 16000 \times \left[\frac{21 \times 21}{20 \times 20} - 1 \right]$$

$$= 16000 \times \left[\frac{441}{400} - 1 \right]$$

$$= 16000 \times \frac{41}{400} = 40 \times 41$$

$$= \text{Rs. } 1640$$

Trick :

$$P = 16000 \quad \begin{matrix} 5\% \\ \text{1st year} \end{matrix} \quad \begin{matrix} 800 \\ \text{for 1st year S.I.} = \text{C.I.} \end{matrix}$$

$$\begin{matrix} 5\% \\ \text{2nd year} \end{matrix} \quad \begin{matrix} 800 \\ + 40 \\ \text{5% rate of interest} \end{matrix}$$

$$\begin{matrix} 5\% \\ \text{C.I.} = 800 + 800 + 40 \\ + 40 \\ = \text{Rs. } 1640 \end{matrix}$$

- Ex-2.** Find C.I. on Rs. 10,000 at the rate of interest 6% for $1\frac{1}{2}$ years, compound annually.

$$\text{C.I.} = P \left[\left(1 + \frac{r}{100} \right)^n - 1 \right]$$

$$= 10,000 \left[\left(1 + \frac{6}{100} \right)^{3/2} - 1 \right]$$

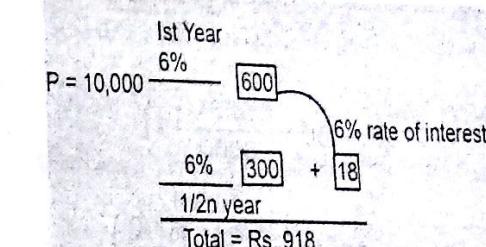
$$= 10,000 \times \left[\left(1 + \frac{6}{100} \right)^1 \left(1 + \frac{6}{100} \times \frac{1}{2} \right) - 1 \right]$$

$$= 10,000 \times \left[\frac{106}{100} \times \left(1 + \frac{3}{100} \right) - 1 \right]$$

$$= 10,000 \times \left[\frac{106}{100} \times \frac{103}{100} - 1 \right]$$

$$= 10,000 \times \left[\frac{10918 - 10,000}{10000} \right] = \text{Rs. } 918$$

Trick :



- Ex-3.** At what rate of percent a sum of Rs. 2000 amounts to Rs. 2662 at C.I. in 3 years ?

Sol. Using Basic formula:

$$A = P \left(1 + \frac{r}{100} \right)^n$$

$$2662 = 2000 \left(1 + \frac{r}{100} \right)^3$$

$$\frac{1331}{2000} = \left(1 + \frac{r}{100} \right)^3$$

$$\left(\frac{11}{10} \right)^3 = \left(1 + \frac{r}{100} \right)^3$$

$$\frac{11}{10} = 1 + \frac{r}{100}$$

$$\frac{r}{100} = \frac{1}{10}$$

- Ex-4.** Find the C.I. on Rs. 6000 at the rate of interest 5% for 3 years, compounded yearly.

$$\text{C.I.} = P \left[\left(1 + \frac{R}{100} \right)^n - 1 \right]$$

$$= 6000 \left[\left(1 + \frac{5}{100} \right)^3 - 1 \right]$$

$$= 6000 \left(\frac{105}{100} \times \frac{105}{100} \times \frac{105}{100} - 1 \right)$$

Ind method :

$$\left[n_2 = (n_1)^{\frac{r}{100}} \right] \quad n_2, n_1 \text{ --- number of times}$$

$$t_1, t_2 \text{ --- number of years.}$$

$$8 = (2)^{\frac{t_2}{15}}$$

$$2^3 = (2)^{\frac{t_2}{15}}$$

$$\frac{t_2}{15} = \frac{3}{1}$$

$$t_2 = 45 \text{ years}$$

Ex-9. A certain sum of money becomes amount at the certain rate of interest of C.I. to Rs. 7350 in 2 years & to Rs. 8575 in 3 years. Find the sum of money & rate of interest.

For single year
Sol. S.I. on Rs. 7350 for 1 year $S.I. = C.I.$
 $= 8575 - 7350 = \text{Rs. } 1225$

$$\text{Rate} = \left(\frac{100 \times S.I.}{P \times T} \right) \% = \frac{100 \times 1225}{7350 \times 1}$$

$$= 16 \frac{2}{3} \%$$

Let the sum be Rs. x then for two years.

$$A = P \left(1 + \frac{r}{100} \right)^n$$

$$2P = P \left(1 + \frac{r}{100} \right)^{15}$$

$$2 = \left(1 + \frac{r}{100} \right)^{15} \quad \dots \dots \dots (1)$$

$$7350 = x \times \left(1 + \frac{50}{3 \times 100} \right)^2$$

$$7350 = x \times \frac{7}{6} \times \frac{7}{6}$$

$$\text{Sum } (x) = 7350 \times \frac{36}{49} = \text{Rs. } 5400$$

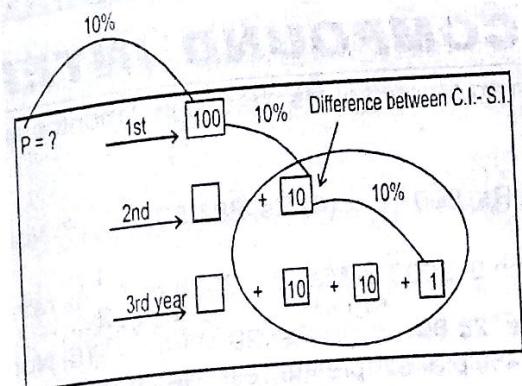
Ex-10. The difference between C.I. & S.I. on a certain sum at 10% per annum for 2 years is Rs. 631. Find the sum.

$$\text{Sol. } C.I. - S.I. = P \left(\frac{r}{100} \right)^2$$

$$631 = P \left(\frac{10}{100} \right)^2$$

$$631 = P \times \frac{10 \times 10}{100 \times 100}$$

$$P = \text{Rs. } 63100.$$

Trick :

In IIIrd year $10\% = 1$
In IInd year $100\% = 10$
or $10\% = 10$
In 1st year $100\% = 100$

$T = h = 1$

Ex-8. A sum of money doubles itself at compound interest in 15 years. In how many years will it become eight times.

$$A = P \left(1 + \frac{r}{100} \right)^n$$

$$2P = P \left(1 + \frac{r}{100} \right)^{15}$$

$$2 = \left(1 + \frac{r}{100} \right)^{15} \quad \dots \dots \dots (1)$$

again

$$8P = P \left(1 + \frac{r}{100} \right)^n$$

$$8 = \left(1 + \frac{r}{100} \right)^n \quad \dots \dots \dots (II)$$

using (I) and (II)

$$\left(1 + \frac{r}{100} \right)^n = 8 = 2^3 = \left\{ \left(1 + \frac{r}{100} \right)^{15} \right\}^3$$

$$\left(1 + \frac{r}{100} \right)^n = \left(1 + \frac{r}{100} \right)^{45}$$

$$x = 45 \text{ years}$$

Ex-5.

If the difference between C.I. & S.I. on a Rs. 1960 is Rs. 19.60 for 2 years, at certain rate of interest. Find the rate of interest.

Sol.

$$C.I. - S.I. = P \left(\frac{r}{100} \right)^2$$

$$\frac{1960}{100} = 1960 \times \frac{r^2}{100 \times 100}$$

$$r^2 = 100$$

$$r = 10\%$$

Ex-6. If the C.I. & S.I. on a certain sum of money for 2 years are Rs. 65 & Rs. 60 respectively at certain rate of interest. Find the sum of money & rate of interest.

Sol. By Formula

$$C.I. = P \left[\left(1 + \frac{r}{100} \right)^n - 1 \right]$$

$$= 6000 \times \left[\frac{21 \times 21 \times 21}{20 \times 20 \times 20} - 1 \right]$$

$$= 6000 \times \left(\frac{9261}{8000} - 1 \right)$$

$$= 6000 \times \left(\frac{9261 - 8000}{8000} \right)$$

$$= \frac{6 \times 1261}{8} = \frac{7566}{8}$$

$$= \text{Rs. } 945.75$$

Note : - If difference between C.I. & S.I. is to find out.

Let the principal = P

Time = T

Rate % p.a. = R

(1) When time is 2 years

$$C.I. - S.I. = P \left(\frac{R}{100} \right)^2$$

(2) When time is 3 years

$$C.I. - S.I. = P \left(\frac{R}{100} \right)^2 \times \left(\frac{300+R}{100} \right)$$

*Shortcut formula
only for 2 years*

Ex-7.

The difference between S.I. & C.I. on a certain sum of money for 3 years at 10% is Rs. 31. Find the sum of money.

Sol.

From formula for 3 years.

$$C.I. - S.I. = P \left(\frac{r}{100} \right)^2 \left(\frac{300+r}{100} \right)$$

$$31 = P \left(\frac{10}{100} \right)^2 \times \frac{310}{100}$$

$$31 = P \frac{100}{100 \times 100} \times \frac{310}{100}$$

$$P = \text{Rs. } 1000$$

EXERCISE

SIMPLE INTEREST & COMPOUND INTEREST

- Q.1.** What will be the simple interest earned on an amount of Rs. 16,800 in 9 months at the rate of $\frac{1}{4}\%$ p.a. ?
 (1) Rs. 787.50 (2) Rs. 812.50 (3) Rs. 860 (4) Rs. 887.50 (5) None of these
- Q.2.** The simple interest on Rs. 1820 from March 9, 2003 to May 21, 2003 at $7\frac{1}{2}\%$ rate will be :
 (1) Rs. 22.50 (2) Rs. 27.30 (3) Rs. 28.80 (4) Rs. 29 (5) None of these
- Q.3.** A person borrows Rs. 5000 for 2 years at 4% p.a. simple interest. He immediately lends it to another person at $6\frac{1}{4}\%$ p.a. for 2 years. Find his gain in the transaction per year.
 (1) Rs. 112.50 (2) Rs. 125 (3) Rs. 150 (4) Rs. 167.50 (5) None of these
- Q.4.** How much time will it take for an amount of Rs. 450 to yield Rs. 81 as interest at 4.5% per annum of simple interest ?
 (1) 3.5 years (2) 4 years (3) 4.5 years (4) 5 years (5) None of these
- Q.5.** A sum of Rs. 1600 gives a simple interest of Rs. 252 in 2 years and 4 months. The rate of interest per annum is :
 (1) 6% (2) $6\frac{1}{4}\%$ (3) $6\frac{1}{2}\%$ (4) $6\frac{3}{4}\%$ (5) None of these
- Q.6.** Reena took a loan of Rs. 1200 with simple interest for as many years as the rate of interest. If she paid Rs. 432 as interest at the end of the loan period, what was the rate of interest ?
 (1) 3.6% (2) 6% (3) 18%
 (4) Cannot be determined (5) None of these
- Q.7.** A sum fetched a total simple interest of Rs. 4016.25 at the rate of 9 p.c.p.a. in 5 years. What is the sum ?
 (1) Rs. 4462.50 (2) Rs. 8032.50 (3) Rs. 8900 (4) Rs. 8925 (5) None of these
- Q.8.** The simple interest at $x\%$ for x years will be Rs. x on a sum of :
 (1) Rs. x (2) Rs. $\left(\frac{100}{x}\right)$ (3) Rs. $100x$ (4) Rs. $\frac{100}{x^2}$ (5) None of these
- Q.9.** Rs. 800 becomes Rs. 956 in 3 years at a certain rate of simple interest. If the rate of interest is increased by 4%, what amount will Rs. 800 become in 3 years ?
 (1) Rs. 1020.80 (2) Rs. 1025 (3) Rs. 1052 (4) Data inadequate (5) None of these
- Q.10.** A certain amount earns simple interest of Rs. 1750 after 7 years. Had the interest been 2% more, how much more interest would it have earned ?
 (1) Rs. 35 (2) Rs. 245 (3) Rs. 350
 (4) Cannot be determined (5) None of these
- Q.11.** The simple interest on a certain sum of money at the rate of 5% p.a. for 8 years is Rs. 840. At what rate of interest the same amount of interest can be received on the same sum after 5 years?
 (1) 6% (2) 8% (3) 9% (4) 10% (5) None of these
- Q.12.** The interest on a certain deposit at 4.5% p.a. is Rs. 202.50 in one year. How much will the additional interest in one year be on the same deposit at 5% p.a. ?
 (1) Rs. 20.25 (2) Rs. 22.50 (3) Rs. 25 (4) Rs. 42.75 (5) None of these
- Q.13.** A sum invested at 5% simple interest per annum increase to Rs. 504 in 4 years. The same amount at 10% simple interest per annum in $2\frac{1}{2}$ years will grow to:-
 (1) Rs. 420 (2) Rs. 450 (3) Rs. 525 (4) Rs. 550 (5) None of these

- Q.14.** What will be the ratio of simple interest earned by certain amount at the same rate of interest for 6 years and that for 9 years ?
 (1) 1 : 3 (2) 1 : 4 (3) 2 : 3 (4) Data inadequate (5) None of these
- Q.15.** The simple interest on a sum of money will be Rs. 600 after 10 years. If the principal is tripled after 5 years, what will be the total interest at the end of the tenth year ?
 (1) Rs. 600 (2) Rs. 900 (3) Rs. 1200 (4) Rs. 1500 (5) Data inadequate
- Q.16.** What will be the compound interest on a sum of Rs. 25,000 after 3 years at the rate of 12 p.c.p.a.?
 (1) Rs. 9000.30 (2) Rs. 9720 (3) Rs. 9830 (4) Rs. 10483.20 (5) None of these
- The compound interest on Rs. 20,480 at $6\frac{1}{4}\%$ per annum for 2 years 73 days is :
 (1) Rs. 2929 (2) Rs. 3000 (3) Rs. 3131 (4) Rs. 363 (5) None of these
- Q.17.** Sam invested Rs. 15,000 @ 10% per annum for one year. If the interest is compounded half-yearly, then the amount received by Sam at the end of the year will be :
 (1) Rs. 16,500 (2) Rs. 16,525.50 (3) Rs. 16,537.5 (4) Rs. 18,150 (5) None of these
- Q.18.** What is the difference between the compound interests on Rs. 5000 for $1\frac{1}{2}$ years at 4% per annum compounded yearly and half-yearly ?
 (1) Rs. 2.04 (2) Rs. 3.06 (3) Rs. 4.80 (4) Rs. 8.30 (5) None of these
- Q.19.** Find the compound interest on Rs. 15,625 for 9 months at 16% per annum compounded quarterly.
 (1) Rs. 1851 (2) Rs. 1941 (3) Rs. 1951 (4) Rs. 1961 (5) None of these
- Q.20.** In how many years will a sum of Rs. 800 at 10% per annum compounded half yearly become RS. 926.10 ?
 (1) $1\frac{1}{3}$ (2) $1\frac{1}{2}$ (3) $2\frac{1}{3}$ (4) $2\frac{1}{2}$ (5) None of these
- Q.21.** If the compound interest on a sum for 2 years at $12\frac{1}{2}\%$ per annum is Rs. 510, the simple interest on the same sum at the same rate for the same period of time is :
 (1) Rs. 400 (2) Rs. 450 (3) Rs. 460 (4) Rs. 480 (5) None of these
- Q.22.** The compound interest on a certain sum for 2 years at 10% per annum is Rs. 525. The simple interest on the same sum for double the time at half the rate percent per annum is :
 (1) Rs. 400 (2) Rs. 500 (3) Rs. 600 (4) Rs. 800 (5) None of these
- Q.23.** The simple interest on a certain sum of money for 3 years at 8% per annum is half the compound interest on Rs. 4000 for 2 years at 10% per annum. The sum placed on simple interest is:
 (1) Rs. 1550 (2) Rs. 1650 (3) Rs. 1750 (4) Rs. 2000 (5) None of these
- Q.24.** There is 60% increase in an amount in 6 years at the rate of simple interest. What will be the compound interest of Rs. 12,000 after 3 years at the same rate ?
 (1) Rs. 2160 (2) Rs. 3120 (3) Rs. 3972 (4) Rs. 6240 (5) None of these
- Q.25.** Sum of money invested at compound interest amounts to Rs. 4624 in 2 years and Rs. 4913 in 3 years. The sum of money is-
 (1) Rs. 4086 (2) Rs. 4260 (3) Rs. 4335 (4) Rs. 4360 (5) None of these
- Q.26.** A sum of money placed at compound interest doubles itself in 5 years. In how many years it will becomes eight times itself at the same rate of interest in :
 (1) 7 years (2) 10 years (3) 15 years (4) 20 years (5) None of these
- Q.27.** Durgesh borrowed an amount of Rs. 15,000 at the simple interest rate of 12 p.c.p.a. and another amount at the simple interest rate of 15 p.c.p.a. for a period of two years each. He paid amount of Rs. 9000 as total interest. What is the total amount borrowed ?
 (1) Rs. 18,000 (2) Rs. 32000 (3) Rs. 35000 (4) Rs. 33000 (5) None of these
- Q.28.** Rs. 2100 is divided into two parts such that the simple interest on the one part at 4.5% for 3.5 years be the same as that on the other at 5.25% for 4 years. Find out the second part ?
 (1) Rs. 800 (2) Rs. 1400 (3) Rs. 1200 (4) Rs. 1500 (5) None of these
- Q.29.** The S.I. occurred on a sum of money at the rate of interest 5% per annum for two years. Is 410 Rs. . The compound interest is the same as S.I. as occurred on other sum of money at the same rate of interest and the same time. Find the difference between the two sum of money (principle) ?
 (1) Rs. 80 (2) Rs. 90 (3) Rs. 150 (4) Rs. 120 (5) None of these
- Q.30.** VOL-1/QUANTITATIVE APTITUDE

CHAPTER-6

AVERAGE

The Concept of Average is equal distribution of the overall value among all the things or persons present there. So the formula for finding the average is as follows :

$$\text{Average} = \left(\frac{\text{Sum of observations}}{\text{Number of observations}} \right)$$

Average Speed:

Suppose a man covers a certain distance at x kmph and an equal distance at y kmph.

Then, the average speed during the whole

$$\text{journey is } \left(\frac{2xy}{x+y} \right) \text{ kmph.}$$

How to solve Algebra Word Problems? Many students find solving algebra word problems difficult. The best way to approach word problems is to "divide and conquer". Break the problem down into smaller bits and solve each bit at a time.

Solving word problems can be divided into two main parts. For each part you would need some tools and techniques to help you "divide and conquer".

Examples:

Ex-1. There are two sections A and B of a class, consisting of 36 and 44 students respectively. If the average weight of sections A is 40 kg and that of section B is 35 kg. Find the average weight of the whole class (in kg).

Solution :

Total weight of (36+44) Students

$$= (36 \times 40 + 44 \times 35) \text{ Kg} = 2980 \text{ Kg.}$$

Average weight of the whole class

$$= (2980 / 80) = 37.25 \text{ kg}$$

Ex-2. A batsman makes a score of 87 runs in the 17th inning and thus increases his averages by 3. Find his average after 17th inning.

Solution :

Let the average after 17th innings = x .

Then,

Average after 16th innings = $(x - 3)$

Average

$$= 16(x-3) + 87$$

$$17x = 16(x-3) + 87$$

$$x = 39$$

Ex-3.

A student was asked to find the arithmetic mean of the numbers 3, 11, 7, 9, 15, 13, 8, 19, 17, 21, 14 and x . He found the mean to be 12. What should be the number in place of x ?

Solution :

$$12 = (3+11+7+9+15+13+8+19+17+21+14+x)/12$$

Number in place of x is

$$137+x=144$$

$$x = 144-137$$

$$x=7.$$

Ex-4.

Dev obtained 76, 65, 82, 67 and 85 marks (out of 100) in English, Mathematics, Physics, Chemistry and Biology. What are his average marks?

Solution :

Average

$$= (76+65+82+67+85) / 5$$

$$= (375 / 5)$$

$$= 75.$$

Ex-5.

The average of 20 numbers is zero. Of them, at the most, how many may be greater than zero?

Solution :

Average of 20 numbers = 0

Sum of 20 numbers = $(0 \times 20) = 0$.

It is quite possible that 19 of these numbers may be positive and if their sum is A , then 20th number is $(-A)$.

Ex-6. Distance between two stations A and

B is 778 km. A train covers the journey from A to B at 84 km per hour and returns back B to A with a uniform speed of 56 km per hour. Find the average speed of the train during the whole journey.

Solution :
Required average speed

$$\begin{aligned} &= (2xy / x+y) \text{ km/hr} \\ &= 2 \times 84 \times 56 / (84 + 56) \\ &= (2 \times 84 \times 56 / 140) \\ &= 67.2 \text{ km/hr.} \end{aligned}$$

Ex-7.

The average age of a husband and his wife was 23 years at the time of their marriage. After five years they have a one year old child. The average age of the family now is

Solution

Sum of the present ages of husband, wife and child

$$= (23 \times 2 + 5 \times 2) + 1$$

$$= 57 \text{ years}$$

Required average

$$= (57 / 3)$$

$$= 19 \text{ years.}$$

Ex-8.

The average age of 36 students in a group is 14 years, when teacher's age is included to it, the average increases by one. What is the teacher's age in years?

Solution :

Age of the teacher

$$= (37 \times 15 - 36 \times 14) \text{ years}$$

$$= 51 \text{ years.}$$

Ex-9.

The average of five numbers is 27. If one number is excluded the average becomes 25. The excluded number is

Solution :

Excluded number

$$= (27 \times 5) - (25 \times 4)$$

$$= 135 - 100$$

$$= 35.$$

Ex-10.

The batting average for 40 innings of a cricket player is 50 runs. His highest score exceeds his lowest score by 172 runs. If these two innings are excluded, the average of the remaining 38 innings is 48 runs. The highest score of the player is

Solution :

Let the highest score be x . Then,
lowest score = $(x-172)$

$$\begin{aligned} 50 \times 40 - [x + (x - 172)] &= 38 \times 48 \\ 2x &= 2000 + 172 - 1824 \\ x &= 174. \end{aligned}$$

Ex-11.

The average score of a cricketer for ten matches is 38.9 runs. If the average for the first six matches is 42. Then find the average for the last four matches.

Solution :

$$\begin{aligned} \text{Required average} &= (38.9 \times 10) - (42 \times 6) / 4 \\ &= 137 / 4 \\ &= 34.25 \end{aligned}$$

Ex-12.

A library has an average of 510 visitors on Sundays and 240 on other days. Then the average number of visitors per day in a month of 30 days beginning with a Sunday is

Solution :

Since the month begins with a Sunday, so there will be five Sundays in the month.

Required Average

$$\begin{aligned} &= (510 \times 5 + 240 \times 25) / 30 \\ &= (8550 / 30) \\ &= 285 \end{aligned}$$

Ex-13.

The average of six numbers is x and the average of three of these is y . If the average of the remaining three is z then, what is the relation between x, y and z ?

Solution :

Clearly, we have

$$x = (3y + 3z) / 6$$

or

$$2x = y + z$$

Ex-14.

A motorist travel to a place 150 km away at an average speed of 50 km/hr and returns at 30 km/hr. His average speed for the whole journey (in km/hr) is

Solution :

$$\begin{aligned} \text{Average Speed} &= (2xy / x+y) \text{ km/hr} \\ &= (2 \times 50 \times 30 / 50 + 30) \\ &= 37.5 \text{ km/hr.} \end{aligned}$$

EXERCISE

AVERAGE

- Q.1.** The average of first five multiples of 3 is :
 (1) 9 (2) 27 (3) 18 (4) 81 (5) None of these
- Q.2.** A library has an average of 510 visitors on Sundays and 240 on other days. The average number of visitors per day in month of 30 days beginning with a Sunday is :
 (1) 250 (2) 276 (3) 280 (4) 285 (5) None of these
- Q.3.** The average of 50 numbers is 30. If two numbers are, 35 and 40 then the average of the remaining numbers is :
 (1) 28.32 (2) 29.68 (3) 28.78 (4) 29.27 (5) None of these
- Q.4.** The average score of a cricketer for ten matches is 38.9 runs. If the average for the first six matches is 42, then find the average for the last four matches.
 (1) 33.25 (2) 33.5 (3) 34.25 (4) 35 (5) None of these
- Q.5.** Average of ten positive numbers is \bar{x} . If each number is increased by 10%, Then \bar{x} :
 (1) Remains unchanged (2) May decrease (3) May increase
 (4) Is increased by 10% (5) None of these
- Q.6.** A class has two sections, in one of which there are 40 students with an average of 14.5 years and the average of the class is 14.2 years. If there be 32 students in the other section, its average age is :
 (1) 11.32 years (2) 13.285 years (3) 14.23 years (4) 9.21 years (5) None of these
- Q.7.** The average of 50 numbers is 38. If two numbers, are 45 and 55 the average of the remaining numbers is :
 (1) 37.5 (2) 23.22 (3) 11.22 (4) 44.32 (5) None of these
- Q.8.** The mean of 100 observations was calculated as 40. It was found later on that one of the observations was misread as 83 instead of 53. The correct mean is :
 (1) 39.7 (2) 112.2 (3) 21.32 (4) 44.32 (5) None of these
- Q.9.** The average of six numbers is 30. If the average of first four is 25 and that of last three is 35, the fourth number is :
 (1) 25 (2) 33 (3) 28 (4) 44 (5) None of these
- Q.10.** The average of 25 results is 18. The average of first twelve of them is 14 and that of last twelve is 17, the thirteenth result is :
 (1) 78 (2) 48 (3) 55 (4) 75 (5) None of these
- Q.11.** Out of four numbers, the average of first three is 16 and that of the last three is 15. If, the last number is 18, the first number is :
 (1) 34 (2) 22 (3) 21 (4) 112 (5) None of these
- Q.12.** Mukesh has twice as much money as Sohan and Sohan has 50% more money than what Pankaj has. If the average money with them is Rs.110, then Mukesh has:
 (1) ₹ 123 (2) ₹ 134 (3) ₹ 167 (4) ₹ 180 (5) None of these
- Q.13.** The average of 30 students is 9 years. If the age of their teacher is included, it becomes 10 years. The age of the teacher (in years) is:
 (1) 48 (2) 40 (3) 37 (4) 56 (5) None of these
- Q.14.** The average weight of 50 balls is 2 lbs. If the weight of the container be included, the average weight will increase by 0.05 lbs. The weight of the container is:
 (1) 7.34 lbs (2) 4.55 lbs (3) 3.22 lbs (4) 6.34 lbs (5) None of these

- Q.15.** The average salary per month of 30 employees in a company is Rs. 4000. If the manager's salary is added, the average salary increases to Rs. 4300. What is the salary of the manager?
 (1) 77700 (2) 45000 (3) 13300 (4) 63000 (5) None of these
- Q.16.** The average weight of 8 men is increased by 1.5 kg when one of the men whose weight 65 kg is replaced by a new man. The weight of the new man is :
 (1) 88 kg. (2) 77 kg. (3) 63 kg. (4) 54 kg. (5) None of these
- Q.17.** The average of five consecutive odd numbers is 61. What is the difference between the highest and lowest numbers ?
 (1) 4 (2) 6 (3) 9 (4) 8 (5) None of these
- Q.18.** The average marks obtained by 22 candidates in an examination are 45. The average of the first ten is 55 while that of the last eleven is 40. The marks obtained by the 11th candidate are?
 (1) 0 (2) 3 (3) 4 (4) 10 (5) None of these
- Q.19.** The average weight of 8 persons is increased by 2.5 Kg. When one of them, whose weight is 56 kg is replaced by a new man. The weight of the new man is-
 (1) 64 Kg (2) 76 Kg (3) 80 kg (4) 110 kg (5) None of these
- Q.20-21.** Each of the questions given below consists of a question followed by three statements. You have to study the question and the statements and decide which of the statement(s) is/are necessary to answer the question.
- Q.20.** How many marks did Tarun secure in English?
- I. The average marks obtained by Tarun in four subjects including English is 60.
 - II. The total marks obtained by him in English and Mathematics together are 170.
 - III. The total marks obtained by him in Mathematics and Science together are 180.
- (1) I and II only (2) II and III only (3) I and III only (4) All I, II and III (5) None of these
- Q.21.** In a cricket team, the average age of eleven players is 28 years. What is the age of the captain?
- I. The captain is eleven years older than the youngest player.
 - II. The average age of 10 players, other than the captain is 27.3 years.
 - III. Leaving aside the captain and the youngest player, the average ages of three groups of three players each are 25 years, 28 years and 30 years respectively.
- (1) Any two of the three (2) All I, II and III (3) II only or I and III only
 (4) II and III only (5) None of these
- Q.22.** The average of a husband and his wife was 23 years at the time of their marriage. After five years they have a one-year old child. The average age of the family now is -
- (1) 19 years (2) 23 years (3) 28.5 years (4) 29.3 years (5) None of these
- Q.23.** The average marks of a student in 10 papers are 80. If the highest and the lowest score are not considered the average is 81. If his highest score is 92. Find the lowest score.
- (1) 55 (2) 60 (3) 62
 (4) Can not be determined (5) None of these
- Q.24.** Three maths classes X, Y and Z, take an algebra test. The average score of class X is 83. The average score of class Y is 76. The average score of class Z is 85. The average score of class X & Y is 79 and average score of class Y and Z is 81. What is the average score of classes X, Y and Z?
- (1) 81.5 (2) 80.5 (3) 83 (4) 78 (5) None of these
- Q.25.** In a school with 600 students, the average age of the boys is 12 years and that of the girls is 11 years. If the average age of the school is 11 years 9 months, then the number of girls in the school is-
- (1) 150 (2) 250 (3) 350 (4) 450 (5) None of these

CHAPTER-7

RATIO & PROPORTION

Ratio : Ratio is the comparison of two quantities by division. The ratio of a to b is written as

$$a : b = \frac{a}{b} = a \div b$$

Proportion : A proportion is an expression which states that two ratios are equal.

$$\text{eg. } \frac{3}{12} = \frac{1}{4} \text{ is a proportion}$$

It can also be expressed as

$$3 : 12 = 1 : 4 \text{ or } 3 : 12 :: 1 : 4$$

Each quantity in proportion is called a term proportional. The first & the last terms are called the extremes whereas the second & the third terms are called middle term.

Properties of Ratio :

In a ratio, two quantities are compared, so the quantities must be of the same kind.

2. The ratio of two quantities determines how many times of quantity is contained by the other.

Comparison of Ratios

Let $a : b$ and $c : d$ be two ratios, then
 $a : b > c : d$ if $ad > bc$

$$\text{ie. } \frac{a}{b} > \frac{c}{d} \text{ if } ad > bc$$

Similarly

$$a : b < c : d \text{ if } ad < bc$$

$$a : b = c : d \text{ if } ad = bc$$

Two Important Results

$$\text{If } \frac{a}{b} > 1, \text{ it is implied that } a > b$$

1st term > 2nd term

$$\text{and } \frac{a}{b} < 1 \Rightarrow a < b$$

Useful Results on Proportion:

If four quantities a, b, c and d are said to be proportion if and only if

$$\begin{array}{c} \downarrow \\ a : b = c : d \\ \uparrow \\ a \times d = b \times c \end{array}$$

\Rightarrow product of extremes = product of middles

Continued Proportion :

Three quantities a, b, c of same kind are said to be in continued proportion, when $a : b = b : c$

* The middle number b is said to be a mean proportional to two extreme numbers a & c

So, in such case of continued proportion.

$$b^2 = ac$$

$$(\text{middle number})^2 = \text{First number} \times \text{Last number}$$

Relation Among the Quantities More than two

$$\text{Given } a : b = x : y$$

$$b : c = m : n$$

the these three quantites are related as,

$$\begin{array}{c} a : b = x : y \\ b : c = m : n \\ \hline a : b : c = xm : my : yn \end{array}$$

$$a : c = xm : yn$$

Ex-1. Divide Rs. 3200 among P, Q, R, in the ratio 5 : 2 : 9. Find the amount received by Q.

Amount received by Q

$$= \frac{\text{Its related ratio term}}{\text{Sum of ratio terms}} \times \text{Total amount}$$

$$= \frac{2}{5+2+9} \times 3200$$

$$= \text{Rs. } 400$$

Ex-2. Find the mean proportional between 9 and 16.

Required mean proportional

$$= \sqrt{9 \times 16} = 12$$

Ex-3. If 3, x, 27 are in continued proportion, then find the value of x.

Since 3, x, 27 are in continued proportion.

$$x^2 = 3 \times 27$$

$$x^2 = \sqrt{81}$$

$$x = 9$$

Ex-4. The ratio between two numbers is 12 : 13. If each number is reduced by 20; the ratio becomes 2 : 3. Find the number.

Sol. Let no.be $12x$ and $13x$

$$\frac{12x-20}{13x-20} = \frac{2}{3} \Rightarrow x = 2$$

$$\text{Numbers are } 24, 26$$

Ex-5. A person distributes his pens among four friends A, B, C and D in the ratio

$\frac{1}{3} : \frac{1}{4} : \frac{1}{5} : \frac{1}{6}$. What is the minimum number of pens that the person should have ?

Sol. LCM of 3, 4, 5 and 6 is 60.

Pens are distributed in Ratio

$$A : B : C : D$$

$$\frac{1}{3} \times 60 : \frac{1}{4} \times 60 : \frac{1}{5} \times 60 : \frac{1}{6} \times 60$$

$$\text{i.e. } 20 : 15 : 12 : 10$$

$$\text{Total number of pens} = 20x + 15x + 12x + 10x = 57x$$

For minimum number of pens $x = 1$

The person should have atleast 57 pens.

Ex-6. An amount of money is to be divided between P, Q and R in the ratio of 2 : 5 : 7 respectively. If the total of P's and R's share is Rs. 800 more than Q's share. What will be P's share in it?

$$\frac{2x}{14} + \frac{7x}{14} - \frac{5x}{14} = 800$$

$$\frac{4}{14}x = 800 \Rightarrow x = 2800$$

$$P's \text{ share is } = 2800 \times \frac{2}{14} = \text{Rs } 400$$

Ex-7. The ratio between the length and the breadth of a rectangular field is 5 : 4. respectively. If the perimeter of that field is 360 metres. What is the breadth of that field in metres ?

$$\text{Perimeter} = 2(5+4) = 18$$

$$\text{Mean Value of } 18 = 360$$

$$\text{Breadth} = \frac{360}{18} \times 4 = 80 \text{ metres}$$

Ex-8. A bag contains 50 P, 25 P and 10P coins in the ratio 5 : 9 : 4. amounting to Rs. 206. Find the number of coins of each type.

Sol. Let the number of 50P, 25P and 10P coins be $5x$, $9x$ and $4x$ respectively.

$$\frac{5x}{2} + \frac{9x}{4} + \frac{4x}{10} = 206$$

$$50x + 45x + 8x = 4120$$

$$103x = 4120$$

$$x = 40$$

$$\text{No. of } 50\text{ P coins} = 5 \times 40 = 200$$

$$\text{No. of } 10\text{ P coins} = 4 \times 40 = 160$$

$$\text{No. of } 25\text{ P coins} = 9 \times 40 = 360$$

Ex-9. A mixture contains alcohol and water in the ratio of 4 : 3. If 5 litres of water is added to the mixture the ratio becomes 4 : 5. Find the quantities of alcohol in the given mixture.

Sol. Let the quantity of alcohol and water be $4x$ litres and $3x$ litres respectively.

$$\frac{4x}{3x+5} = \frac{4}{5} \Rightarrow 8x = 20$$

$$x = 2.5$$

$$\text{Quantity of alcohol} = 4 \times 2.5 = 10 \text{ litres}$$

Ex-10. A : B = 5 : 9 and B : C = 4 : 7 Find A : B : C.

$$\begin{array}{c} A : B = 5 : 9 \\ B : C = 4 : 7 \\ \hline A : B : C = 20 : 36 : 63 \end{array}$$

EXERCISE**RATIO & PROPORTION**

- Q.1.** If $A : B = 5 : 7$, $B : C = 6 : 11$ then $A : B : C$ is
 (1) 55 : 77 : 66 (2) 30 : 42 : 77 (3) 35 : 49 : 42 (4) 55 : 42 : 96 (5) None of these
- Q.2.** The ratio of $4^{3/5} : 2^5$ is same as
 (1) 2 : 1 (2) 4 : 1 (3) 7 : 5 (4) 7 : 10 (5) None of these
- Q.3.** If $\frac{a}{3} = \frac{b}{4} = \frac{c}{7}$ then $\frac{a+b+c}{c}$ is equal to
 (1) 7 (2) 2 (3) $\frac{1}{2}$ (4) $7\frac{1}{7}$ (5) None of these
- Q.4.** Which of the following ratios is the greatest ?
 (1) 7 : 15 (2) 15 : 23 (3) 17 : 25 (4) 21 : 29 (5) None of these
- Q.5.** If 15% of X = 20% of Y, then X : Y is
 (1) 3 : 4 (2) 4 : 3 (3) 17 : 16 (4) 16 : 17 (5) None of these
- Q.6.** The third proportional to 0.36 and 0.48 is-
 (1) 0.64 (2) 0.1728 (3) 0.42 (4) 0.99 (5) None of these
- Q.7.** A sum of money is to be distributed among A, B, C and D in the proportion of 5 : 2 : 4 : 3. If C gets Rs. 1000 more than D, what is B's share ?
 (1) Rs. 500 (2) Rs. 1500 (3) Rs. 2000 (4) Rs. 5000 (5) None of these
- Q.8.** The sum of the two numbers is 30 and their different is 12. Find the ratio of these two numbers.
 (1) 3 : 7 (2) 4 : 7 (3) 5 : 6 (4) 7 : 3 (5) None of these
- Q.9.** Ratio of the earnings of A and B is 4 : 7. If the earnings of A increased by 50% and those of B decreased by 25%, the new ratio of their earnings becomes 8 : 7. What are A's earning ?
 (1) Rs. 21,000 (2) Rs. 26,000 (3) Rs. 28,000 (4) Data inadequate (5) None of these
- Q.10.** What least number must be subtracted from each of the numbers 14, 17, 34 and 42 so that the remainders may be proportional ?
 (1) 0 (2) 1 (3) 2 (4) 7 (5) None of these
- Q.11.** In a mixture of 60 litres, the ratio of milk and water is 2 : 1. If this ratio is to be 1 : 2, then the quantity of water to be further added is :
 (1) 20 litres (2) 30 litres (3) 40 litres (4) 60 litres (5) None of these
- Q.12.** The ratio between two numbers is 3 : 4 and their L.C.M is 180. The first number is :
 (1) 60 (2) 45 (3) 20 (4) 15 (5) None of these
- Q.13.** An alloy is to contain copper and zinc in the ratio 9 : 4. If quantity of zinc is 24 kg., the quantity of copper is -
 (1) $10\frac{2}{3}$ kg (2) $10\frac{1}{3}$ kg (3) $9\frac{2}{3}$ kg (4) 9 kg (5) None of these
- Q.14.** 60 kg of alloy A is mixed with 100 kg of alloy B. If alloy A has lead and tin in the ratio 3 : 2 and alloy B has tin and copper in the ratio 1 : 4, then the amount of tin in new alloy is
 (1) 36 kg (2) 44 kg (3) 53 kg (4) 80 kg (5) None of these
- Q.15.** Gold is 19 times as heavy as water and copper is 9 times as heavy as water. In what ratio should these be mixed to get an alloy 15 times as heavy as water ?
 (1) 1 : 1 (2) 2 : 3 (3) 1 : 2 (4) 3 : 2 (5) None of these
- Q.16.** 15 litres of mixture contains 20% alcohol and the rest of water. If 3 litres of water be mixed with it, the percentage of alcohol in the new mixture would be :
 (5) None of these

- Q.17.** 20 litres of a mixture contains milk and water in the ratio 5 : 3. If 4 litres of this mixture be replaced by 4 litres of milk, the ratio of milk to water in the new mixture would be :
 (1) 2 : 1 (2) 7 : 3 (3) 8 : 3 (4) 4 : 3 (5) None of these
- Q.18.** The average age of three boys is 25 years and their ages are in the ratio 3 : 5 : 7. The age of the youngest boy is :
 (1) 21 years (2) 18 years (3) 15 years (4) 9 years (5) None of these
- Q.19.** The speeds of three cars are in the ratio 5 : 4 : 6. The ratio between the time taken by them to travel the same distance is :
 (1) 5 : 4 : 6 (2) 6 : 4 : 5 (3) 10 : 12 : 15 (4) 12 : 15 : 10 (5) None of these
- Q.20.** In a college, the ratio of the number of boys to girls is 8 : 5. If there are 160 girls. Find the total number of students in the college is :
 (1) 100 (2) 250 (3) 260 (4) 416 (5) None of these
- Q.21.** The sides of a triangle are in the ratio $\frac{1}{2} : \frac{1}{3} : \frac{1}{4}$ and its perimeter is 104 cm. The length of the longest side is :
 (1) 52 cm (2) 48 cm (3) 32 cm (4) 26 cm (5) None of these
- Q.22.** In a school, 10% of the boys are same in number as $\frac{1}{4}$ th of the girls. What is the ratio of boys to girls in that school ?
 (1) 3 : 2 (2) 5 : 2 (3) 2 : 1 (4) 4 : 3 (5) None of these
- Q.23.** Three containers have their volumes in the ratio 3 : 4 : 5. They are full of mixtures of milk and water. The mixtures contain milk and water in the ratio (4 : 1), (3 : 1) and (5 : 2) respectively. The contents of all these three containers are poured into fourth container. The ratio of milk and water in the fourth container is :
 (1) 4 : 1 (2) 151 : 48 (3) 157 : 53 (4) 5 : 2 (5) None of these
- Q.24.** If 10% of x = 20% of y, then x : y is equal to :
 (1) 1 : 2 (2) 2 : 1 (3) 5 : 1 (4) 10 : 1 (5) None of these
- Q.25.** The ratio of the incomes of A and B is 5 : 4 and the ratio of their expenditures is 3 : 2. If at the end of the year, each saves Rs. 1600, then the income of A is :
 (1) Rs. 3400 (2) Rs. 3600 (3) Rs. 4000 (4) Rs. 4400 (5) None of these
- Q.26.** A and B are two alloys of gold and copper prepared by mixing metals in the ratio 7 : 2 and 7 : 11 respectively. If equal quantities of the alloys are melted to form a third alloy C, the ratio of gold and copper in C will be :
 (1) 5 : 7 (2) 5 : 9 (3) 7 : 6 (4) 9 : 5 (5) None of these
- Q.27.** Which of the following ratio is the greatest ?
 (1) 7 : 15 (2) 15 : 23 (3) 17 : 25 (4) 21 : 29 (5) None of these
- Q.28.** A certain amount was divided between A and B in the ratio 4 : 3. If B's share was Rs. 4800, the total amount was :
 (1) Rs. 11,200 (2) Rs. 6400 (3) Rs. 19,200 (4) Rs. 39,200 (5) None of these
- Q.29.** A sum of Rs. 53 is divided among A, B, C in such a way that A gets Rs. 7 more than what B gets and B gets Rs. 8 more than what C gets. The ratio of their shares is :
 (1) 16 : 9 : 18 (2) 27 : 18 : 10 (3) 18 : 25 : 10 (4) 15 : 8 : 30 (5) None of these
- Q.30.** If $\frac{1}{5} : \frac{1}{x} = \frac{1}{x} : \frac{1}{1.25}$ then the value of x is
 (1) 1.5 (2) 2 (3) 2.5 (4) 3.5 (5) None of these

CHAPTER-8

PROBLEMS ON AGES

INTRODUCTION

Problems based on ages are generally asked in most of the competitive examinations. To solve these problems, the knowledge of linear equations is essential. In such problems, there may be three situations:

- (i) Age some years ago
- (ii) Present age
- (iii) Age some years hence

Some Important Solved examples :

Ex-1. The ratio of present age of A & B is 2 : 3. The present age of A is 20 years. Find the age of B after 5 years.

Sol. Let the age of A is $2x$ years and age of B is $3x$ years.

$$2x = 20$$

$$x = 10$$

then present age of B is

$$3 \times x = 3 \times 10 = 30 \text{ years}$$

After 5 years, Age of B = $30 + 5$

$$= 35 \text{ years}$$

Trick :

$$A^0 : B^0 = 2 : 3$$

$$A^0 = 20 \text{ year}$$

$$B^0 = \frac{20}{2} \times 3 = 30 \text{ years}$$

$$B^{+5} = 30 + 5 = 35 \text{ years}$$

Ex-2. The present ratio of age of A & B is 3 : 5. If the sum of present age of A & B is 48 years. Find the ages of A & B before 5 years.

Sol. Let the ages of A & B are $3x$ years and $5x$ years respectively.

$$3x + 5x = 48$$

$$8x = 48$$

$$x = 6 \text{ years}$$

Then the present age of A is

$$= 3 \times x = 3 \times 6 = 18 \text{ years}$$

Before 5 years the age of A

$$= 18 - 5 = 13 \text{ years}$$

The present age of B is

$$= 5 \times x = 5 \times 6 = 30 \text{ years}$$

Before 5 years the age of B.

$$= 30 - 5 = 25 \text{ years}$$

Trick :

$$A^0 : B^0 = 3 : 5$$

$$(A+B)^0 = 48 \text{ years}$$

$$A^{-5} = ?$$

$$B^{-5} = ?$$

$$A^0 = \frac{48}{8} \times 3 = 18 \text{ years}$$

$$A^{-5} = 18 - 5 = 13 \text{ years}$$

$$B^0 = \frac{48}{8} \times 5 = 30 \text{ years}$$

$$B^{-5} = 30 - 5 = 25 \text{ years}$$

Ex-3.

The ratio of ages of A & B before 5 years was 2 : 3. If the sum of ages of A & B at present is 45 years. Find the present ages of A & B.

Let the ages of A & B 5 years before are 2x years and 3x years respectively.

then,

$$(2x + 5) + (3x + 5) = 45 \text{ years}$$

$$5x + 10 = 45$$

$$5x = 35$$

$$x = 7$$

The age of A before 5 years

$$= 7 \times 2$$

$$= 14 \text{ years}$$

At present age of A

$$= 14 + 5 = 19 \text{ years}$$

The age of B before 5 years

$$= 7 \times 3 = 21 \text{ years}$$

At present age of B

$$= 21 + 5$$

$$= 26 \text{ years}$$

Trick :

$$A^{-5} : B^{-5} = 2 : 3$$

$$(A+B)^0 = 45 \text{ years}$$

$$(A+B)^{-5} = 45 - 10 = 35 \text{ years}$$

$$A^{-5} = \frac{35}{5} \times 2 = 14 \text{ years}$$

$$A^0 = 14 + 5 = 19 \text{ years}$$

$$B^{-5} = \frac{35}{5} \times 3 = 21 \text{ years}$$

$$B^0 = 21 + 5 = 26 \text{ years}$$

Ex-4.

The ratio of ages of A & B after 5 years will be 3 : 5. If the sum of ages of A & B at present is 38 years. Find the ages of A & B before 5 years.

Sol.

Let the ages of A & B are $3x$ years and $5x$ years respectively after 5 years.

then,

$$(3x - 5) + (5x - 5) = 38 \text{ years}$$

$$8x - 10 = 38 \text{ years}$$

$$8x = 48 \text{ years}$$

$$x = 6 \text{ years}$$

The age of A after 5 years

$$= 6 \times 3$$

$$= 18 \text{ years}$$

Then the age of B after 5 years

$$= 6 \times 5$$

$$= 30 \text{ years}$$

The age of A before 5 years

$$= 18 - 10$$

$$= 8 \text{ years}$$

The age of B before 5 years

$$= 30 - 10$$

$$= 20 \text{ years}$$

Trick :

$$A^{+5} - B^{+5} = 3 : 5$$

$$(A+B)^0 = 38 \text{ years}$$

$$(A+B)^{+5} = 38 + 10$$

$$= 48 \text{ years}$$

$$A^{+5} = \frac{48}{8} \times 3 = 18 \text{ years}$$

$$A^{-5} = 18 - 10 = 8 \text{ years}$$

$$B^{+5} = \frac{48}{8} \times 5 = 30 \text{ years}$$

$$B^{-5} = 30 - 10$$

$$= 20 \text{ years}$$

Ex-5.

The present ratio of ages of A & B is 6 : 7. After 5 years this ratio will be changed into 7 : 8. Find the present age of A & B.

Sol.

Let the present age of A is x years & B is y years.

$$\frac{x}{y} = \frac{6}{7} \dots\dots\dots(1)$$

$$\frac{x+5}{y+5} = \frac{7}{8} \dots\dots\dots(2)$$

Solving eq. (1) & (2)

We get, $x = 30$ years

$$y = 35 \text{ years}$$

Trick :

$$A^0 : B^0 = 6 : 7$$

$$A^{+5} : B^{+5} = 7 : 8$$

$$A^0 = \frac{5}{1} \times 6 = 30 \text{ years}$$

$$B^0 = \frac{5}{1} \times 7 = 35 \text{ years}$$

- Ex-6.** The ratio of ages of A & B is at present 5 : 6. 6 years before this ratio was 4 : 5. Find the present age of A & B.

- Sol.** Let present age of A is x and B is y years.
Then

$$\frac{x}{y} = \frac{5}{6} \dots\dots\dots(1)$$

Again

$$\frac{x-6}{y-6} = \frac{4}{5} \dots\dots\dots(2)$$

Solving eq. (1) & (2)

$$x = 30 \text{ years and } y = 36 \text{ years}$$

Trick :

$$A^0 : B^0 = 5 : 6$$

$$A^{-6} : B^{-6} = 4 : 5$$

$$A^0 = \frac{6}{1} \times 5 = 30 \text{ years}$$

$$B^0 = \frac{6}{1} \times 6 = 36 \text{ years}$$

- Ex-7.** The ratio of age of A & B at present is 6 : 5 & the sum of their ages is 54 years after 5 years. What will be the ratio of their ages after 8 years ?

$$A^0 : B^0 = 6 : 5$$

$$(A+B)^{+5} = 54$$

$$A^{+8} : B^{+8} = ?$$

$$(A+B)^0 = 44$$

$$A^0 = \frac{44}{11} \times 6 = 24$$

Mahendra's

$$A^{+8} = 32$$

$$B^0 = \frac{44}{11} \times 5 = 20$$

$$B^{+8} = 28$$

$$A^{+8} : B^{+8} = 32 : 28 = 8 : 7$$

- Ex-8.** If Sita's mother was 4 times as old as Sita 10 years ago. After ten years mother will be twice as old as Sita. How old is mother & Sita at present?

$$Sm^{-10} : S^{+10} = [4 : 1] \times 1 = 4 : 1$$

$$Sm^{+10} : S^{+10} = [2 : 1] \times 3 = 6 : 3$$

$$Sm^{+10} = \frac{20}{2} \times 6 = 60$$

$$Sm^0 = 50 \text{ years}$$

$$S^{+10} = \frac{20}{2} \times 3 = 30$$

$$S^0 = 20 \text{ years}$$

- Ex-9.** Jayesh is as more younger to Amit as Jayesh is older to Prashant. If the sum of the ages of Amit & Prashant is 48 years. What is the age of Jayesh in years ?

- Sol.** Let the age of Jayesh = x years

$$\text{Amit} = y \text{ years}$$

$$\text{Prashant} = z \text{ years}$$

$$y-x = x-z$$

$$2x = y+z$$

$$= 48$$

$$\text{age of Jayesh (x)} = 24 \text{ years}$$

- Ex-10.** Neeraj is as younger to Gopal as he is older to Deepak. If the sum of the ages of Gopal & Deepak is 58 years. What is Neeraj's age ?

$$G - N = N - D$$

$$G + D = 2N$$

$$58 = 2N$$

$$N = 29 \text{ years}$$

EXERCISE

PROBLEM ON AGES

- Q.1.** Sachin is younger than Rahul by 4 years. If their ages are in the respective ratio of 7 : 9, how old is Sachin ?

- (1) 16 years (2) 18 years (3) 28 years

- (4) Cannot be determined (5) None of these

- Q.2.** The ratio between the present ages of P and Q is 6 : 7. If Q is 4 years old than P, what will be the ratio of the ages of P and Q after 4 years ?

- (1) 3 : 4 (2) 3 : 5 (3) 4 : 3 (4) Data inadequate (5) None of these

- Q.3.** The ratio between the present ages of P and Q is 5 : 7 respectively. If the difference between Q's present age and P's age after 6 years is 2, what is the total of P's and Q's present ages ?

- (1) 48 years (2) 52 years (3) 56 years

- (4) Cannot be determined (5) None of these

- Q.4.** At present, the ratio between the ages of Arun and Deepak is 4 : 3. After 6 years, Arun's age will be 26 years. What is the age of Deepak at present ?

- (1) 12 years (2) 15 years (3) $19\frac{1}{2}$ years (4) 21 years (5) None of these

- Q.5.** Present ages of X and Y are in the ratio 5 : 6 respectively. Seven years hence this ratio will become 6 : 7 respectively. What is X's present age in years ?

- (1) 35 (2) 42 (3) 49

- (4) Cannot be determined (5) None of these

- Q.6.** The ratio between the school ages of Neelam and Shaan is 5 : 6 respectively. If the ratio between the one-third age of Neelam and half of Shaan's age is 5 : 9, then what is the school age of Shaan ?

- (1) 25 years (2) 30 years (3) 36 years

- (4) Cannot be determined (5) None of these

- Q.7.** The ratio between the present ages of A and B is 5 : 3 respectively. The ratio between A's age 4 years ago and B's age 4 years hence is 1 : 1. What is the ratio between A's, age 4 years hence and B's age 4 years ago ?

- (1) 1 : 3 (2) 2 : 1 (3) 3 : 1 (4) 4 : 1 (5) None of these

- Q.8.** A man is 24 years older than his son after two years, his age will be twice the age of his son. The present age of the son is :

- (1) 14 years (2) 18 years (3) 20 years (4) 22 years (5) None of these

- Q.9.** Eighteen years ago, a father was three times as old as his son. Now the father is only twice as old as his son. Then the sum of the present ages of the son and the father is

- (1) 54 years (2) 72 years (3) 105 years (4) 108 years (5) None of these

- Q.10.** A person's present age is two-fifth of the age of his mother. After 8 years, he will be one-half of the age of his mother. How old is the mother at present ?

- (1) 32 years (2) 36 years (3) 40 years (4) 48 years (5) None of these

- Q.11.** Tanya's grandfather was 8 times older to her 16 years ago. He would be 3 times of her age 8 years from now. Eight years ago, what was the ratio of Tanya's age to that of her grandfather ?

- (1) 1 : 2 (2) 1 : 5 (3) 3 : 8 (4) 2 : 5 (5) None of these

- Q.12.** The age of father 10 years ago was thrice the age of his son. Ten years hence, father's age will be twice that of his son. The ratio of their present ages is :

- (1) 5 : 2 (2) 7 : 3 (3) 9 : 2 (4) 13 : 4 (5) None of these

- Q.13.** One year ago, Promila was four times as old as her daughter Sakshi. Six years hence, Promila's age will exceed her daughter's age by 9 years. The ratio of the present ages of Promila and her daughter is :

- (1) 9 : 2 (2) 11 : 3 (3) 12 : 5 (4) 13 : 4 (5) None of these

- Q.14.** The sum of the present ages of father and his son is 60 years. Six years ago, father's age was five times the age of the son. After 6 years, son's age will be :

- (1) 12 years (2) 14 years (3) 18 years (4) 20 years (5) None of these

CHAPTER-9

PARTNERSHIP

- www.mahendrapublication.org
- Q.15. The total age of A and B is 12 years more than the total age of B and C. C is how many years younger than A ?
 (1) 12 (2) 24 (3) C is elder than A (4) Data inadequate (5) None of these
- Q.16. Q is as much younger than R as he is older than T. If the sum of the ages of R and T is 50 years, what is definitely the difference between R and Q's age ?
 (1) 1 year (2) 2 years (3) 25 years (4) Data inadequate (5) None of these
- Q.17. The age of a man is three times the sum of the ages of his two sons. Five years hence, his age will be double of the sum of the ages of his sons. The father's present age is :
 (1) 40 years (2) 45 years (3) 50 years (4) 55 years (5) None of these
- Q.18. The sum of the ages of a father and his son is 45 years. Five years ago, the product of their ages was 34. The ages of the son and the father are respectively : (in years)
 (1) 6 and 39 (2) 7 and 38 (3) 9 and 36 (4) 11 and 34 (5) None of these
- Q.19. The sum of the ages of 5 children born at the intervals of 3 years each is 50 years. What is the age of the youngest child ?
 (1) 4 years (2) 8 years (3) 10 years (4) 6 years (5) None of these
- Q.20. Father is aged three times more than his son Ronit. After 8 years, he would be two and a half times of Ronit's age. After further next 8 years, how many times would he be of Ronit's age ?
 (1) 2 times (2) $2\frac{1}{2}$ times (3) $2\frac{3}{4}$ times (4) 3 times (5) None of these
- Q.21. The difference between the ages of two persons is 10 years. Fifteen years ago, the elder one was twice as old as the younger one. The present age of the elder person is:
 (1) 25 years (2) 35 years (3) 45 years (4) 55 years (5) None of these
- Q.22. After 10 years, A will be twice as old as B was 10 years ago. If A is now 9 years older than B, the present age of B is :
 (1) 19 years (2) 29 years (3) 39 years (4) 49 years (5) None of these
- Q.23. Sneh's age is $\frac{1}{6}$ th of her father's age. Sneh's father's age will be twice of Vimal's age after 10 years. If Vimal's eighth birthday was celebrated two years before then what is Sneh's present age ?
 (1) $6\frac{2}{3}$ years (2) 24 years (3) 30 years (4) 5 years (5) None of these
- Q.24. If 6 years are subtracted from the present age of Gagan and the remainder is divided by 18, then the present age of his grandson Anoop is obtained. If Anup is 2 year younger to Madan whose age is 5 years, then what is Gagan's present age ?
 (1) 48 years (2) 60 years (3) 84 years (4) 96 years (5) None of these
- Q.25. My brother is 3 years elder to me. My father was 28 years of age when my sister was born while my mother was 26 years of age when I was born. If my sister was 4 years of age when my brother was born, then, what was the age of my father and mother respectively when my brother was born ?
 (1) 32 yrs, 23 yrs (2) 32 yrs, 29 yrs (3) 35 yrs, 29 yrs (4) 35 yrs, 33 yrs (5) None of these
- Q.26. The product of the ages of Priya and Aneeta is 240. If twice the age of Aneeta is more than Priya's age by 4 years. What is Aneeta's age ?
 (1) 11 years (2) 12 years (3) 13 years (4) 19 years (5) None of these
- Q.27. The ratio between the present age of Navin and Samir is 5 : 3. If the difference between their ages is 6 years. What will be Samir's age after 5 years ?
 (1) 23 Years (2) 20 Years (3) 28 Years (4) 24 Years (5) None of these
- Q.28. The average age of P, Q and R is 26 years. If the average age of P and R is 30 years. What is Q's age?
 (1) 24 years (2) 48 years (3) 36 years (4) data inadequate (5) None of these
- Q.29. The ratio between the ages of father and son is 5:2. If the difference between their ages is 27 years, what will be the father's age after 6 years?
 (1) 50 years (2) 49 years (3) 51 years (4) 52 years (5) None of these
- Q.30. The ratio of the ages of the husband and the wife five years ago was 11 : 9 where as at the same time the ratio of the ages of the husband and his son was 5 : 1. Five years hence the ratio of the three persons of the family ?
 (1) 128 years (2) 127 years (3) 126 years (4) Data inadequate (5) None of these

Partnership : When two or more than two persons run a business, jointly they are called partners and the deal is known as partnership.

Ratio of Division of Gains

(1) When investments of all the partners are for the same time, the gain or loss is distributed among the partners in the ratio of their investments.

(2) When investments are for different time period, then equivalent capitals are calculated for a unit of time by taking (Capital \times number of units of time) Now, gain or loss is divided in the ratio of their capital.

Working and sleeping partners : A partner who manages the business is known as a working partner and the one who simply invests the money is a sleeping partner.

Examples :

Ex-1. A, B and C started a business by investing Rs. 120000 Rs. 135000 and Rs. 150000 respectively. Find the share of each, out of an annual profit of Rs. 56,700.

Sol. Ratio of shares of A, B and C = Ratio of their investment

$$A : B : C = 120000 : 135000 : 150000 = 8 : 9 : 10$$

$$\text{A's share} = \text{Rs. } \left[56700 \times \frac{8}{27} \right] = \text{Rs. } 16800$$

$$\text{B's share} = \text{Rs. } \left[56700 \times \frac{9}{27} \right] = \text{Rs. } 18900$$

$$\text{C's share} = \text{Rs. } \left[56700 \times \frac{10}{27} \right] = \text{Rs. } 21000$$

Ex-2. A, B and C start a business each investing Rs. 20,000. After 5 months A withdraws Rs. 5000, B withdraws Rs. 4000 and C invests Rs. 6000 more. At the end of the year, a total profit of Rs. 69,900 was recorded. Find the share of each.

Ratio of the capitals of A, B and C.

$$\begin{aligned} &= (20,000 \times 5 + 15000 \times 7) : (20000 \times 5 + 16000 \times 7) : (20000 \times 5 + 26000 \times 7) \\ &= 20,5000 : 212000 : 282000 \\ &= 205 : 212 : 282 \end{aligned}$$

$$\text{A's share} = \left(69900 \times \frac{205}{699} \right) = \text{Rs. } 20500$$

$$\text{B's share} = \left(69900 \times \frac{212}{699} \right) = \text{Rs. } 21200$$

$$\text{C's share} = 69900 \times \frac{282}{699} = \text{Rs. } 28200$$

Ex-3. A invested Rs. 76000 in a business. After few months, B joined him with Rs. 57000. At the end of the year, the total profit was divided between them in the ratio 2 : 1. After how many months did B join ?

Suppose B joined after x months. Then B's money was invested for (12-x) months

$$\frac{76000 \times 12}{57000 \times (12-x)} = \frac{2}{1}$$

$$912000 = 114000(12-x)$$

$$114(12-x) = 912$$

$$x = 4$$

Hence, B joined after 4 months.

Ex-4. A and B together invested Rs. 12000 is a business. At the end of the year, out of a total profit of Rs. 1800. A's share was Rs. 750. Find the investment of A.

$$\frac{\text{A's investment}}{\text{B's investment}} = \frac{\text{Profit share of A}}{\text{Profit share of B}}$$

$$\frac{\text{A's investment}}{\text{B's investment}} = \frac{750}{1800 - 750} = \frac{750}{1050} = \frac{5}{7}$$

$$\text{Investment of A} = \frac{5}{(5+7)} \times 12000$$

$$= \text{Rs. } 5000$$

Ex-5. In a business A, B and C invested Rs. 380, Rs. 400, and 420 respectively. Divide a net profit of Rs. 180 among the partners.

CHAPTER-10

TIME AND WORK

- Q.10.** A and B started a partnership business investing some amount in the ratio of 3 : 5. C joined them after six months with an amount equal to that of B. In what proportion should the profit at the end of one year be distributed among A, B and C ?
 (1) 3 : 5 : 2 (2) 3 : 5 : 5 (3) 6 : 10 : 5
 (4) Data inadequate (5) None of these
- Q.11.** A, B and C enter into a partnership and their shares are in the ratio $\frac{1}{2} : \frac{1}{3} : \frac{1}{4}$. After 2 months, A withdraws half of his capital and after 10 months, a profit of Rs. 378 is divided among them. What is B's share ?
 (1) Rs. 129 (2) Rs. 144 (3) Rs. 156 (4) Rs. 168 (5) None of these
- Q.12.** A, B, C started a business with their investments in the ratio 1 : 3 : 5. After 4 months, A invested the same amount as before and B as well as C withdrew half of their investments. The ratio of their profits at the end of the year is :
 (1) 4 : 3 : 5 (2) 5 : 6 : 10 (3) 6 : 5 : 10 (4) 10 : 5 : 6 (5) None of these
- Q.13.** In a partnership, A invests $\frac{1}{6}$ of the capital for $\frac{1}{6}$ of the time, B invests $\frac{1}{3}$ of the capital for $\frac{1}{3}$ of the time and C, the rest of the capital for the whole time. Out of a profit of Rs. 4600, B's share is :
 (1) Rs. 650 (2) Rs. 800 (3) Rs. 960
 (4) Rs. 1000 (5) None of these
- Q.14.** A began a business with Rs. 85,000. He was joined afterwards by B with Rs. 42,500. For how much period does B join, if the profits at the end of the year are divided in the ratio of 3 : 1 ?
 (1) 4 months (2) 5 months (3) 6 months
 (4) 8 months (5) None of these
- Q.15.** A starts a business with Rs. 3500 and after 5 months, B joins with A as his partner. After a year, the profit is divided in the ratio 2 : 3. What is B's contribution in the capital ?
 (1) Rs. 7500 (2) Rs. 8000 (3) Rs. 8500
 (4) Rs. 9000 (5) None of these
- Q.16.** A and B start a business jointly. A invests Rs. 16,000 for 8 months and remains B in the business for 4 months. Out of total profit, B claims $\frac{2}{7}$ of the profit. How much money was contributed by B ?
 (1) Rs. 10,500 (2) Rs. 11,900 (3) Rs. 12,800 (4) Rs. 13,600 (5) None of these
- Q.17.** Two friends P and Q started a business investing in the ratio of 5 : 6. R joined them after six months investing an amount equal to that of Q's. At the end of the year, 20% profit was earned which was equal to Rs. 98,000. What was the amount invested by R ?
 (1) Rs. 1,05,000 (2) Rs. 1,75,000 (3) Rs. 2,10,000
 (4) Data inadequate (5) None of these
- Q.18.** A started a business investing Rs. 35,000. After six months B joined him with a capital of Rs. 60,000. At the end of the year the total profit was Rs. 26,000. What will be the difference between the share of profits of A and B ?
 (1) Rs. 4,000 (2) Rs. 2,000 (3) Rs. 1,500 (4) Rs. 3,000 (5) None of these
- Q.19.** Three persons Vikas, Rakesh and Sunil invested Rs. 2000, 3000 and 4000 respectively in a business. They had a profit of Rs. 2700 at the end of the year. Find the difference between shares of Vikas & Sunil ?
 (1) Rs. 1200 (2) Rs. 606 (3) Rs. 750 (4) Rs. 700 (5) None of these
- Q.20.** Praveen started a shop investing Rs. 18,000/- Six months later Naveen joined him investing Rs. 16,000/- If at the end of year they made a profit of Rs. 5,200/- What will be Naveen's share in it ?
 (1) Rs. 800/- (2) Rs. 1,200/- (3) Rs. 2000/- (4) Rs. 1600/- (5) None of these

In most of the problems on time and work, one of the following basic parameters is to be calculated :

(a) Time : Time needed by more than one person to complete a job or time for which a person(s) actually worked on the assigned job.

(b) Alone time : Time needed by single person to complete a job.

(c) Work : The amount of total work (assigned) or the part of total work actually done.

BASIC CONCEPTS :

Concept 1

Total amount of a complete job (or assigned job) = 1, always, unless specified.

Concept 2

If any person 'M' completes a job alone in t days, then alone time for 'M' = t

Concept 3

1 day's work by any person

$$= \left(\frac{1}{\text{alone time}} \right)^{\text{th}} \text{ part of total work}$$

Concept 4

The reciprocal of day's work gives the alone time i.e., alone time (or time to complete a job by a single person)

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

Concept 5

When more than one person working on the same piece of work, then their combined 1 day's work = sum of 1 day's work by each person. i.e., If A, B and C are three persons working on a job, then

$$(A+B+C)'s \text{ 1 day's work} = A's \text{ 1 day work} + B's \text{ 1 day work} + C's \text{ 1 day work.}$$

Concept 6

It is the application of concept (4) for more than one person.

The reciprocal of combined 1 day's work gives the time for completion by the person working together.

i.e., time for completion

$$= \frac{1}{\text{combined 1 day's work}}$$

It implies that.

If three persons, say, A, B and C are working together on a job, then

Time for completion by them

$$= \frac{1}{(A+B+C)'s \text{ 1 day's work}}$$

Concept 7

Part of work done at any time 't' by one or more persons = t (1 day's work)

Examples :

Ex-1.

If man A complete a work in 10 days & man B complete the same work in 15 days, In how many days the work is completed if they work together ?

Solution :

$$\begin{aligned} 3w/d \leftarrow A & \rightarrow 10 \text{ days} \\ 2w/d \leftarrow B & \rightarrow 15 \text{ days} \end{aligned} \Rightarrow L.C.M. = 30 \text{ work}$$

Total work /day = 5

$$A+B = \frac{30}{5} = 6 \text{ days}$$

Ex-2.

If man A completes a work in 10 days & the same work is completed by B & C in 15 days & 12 days respectively. In how many days the work is completed if they work together ?