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**QUANTITATIVE APTITUDE
FOR
CAMPUS RECRUITMENT TRAINING
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Ratio: A ratio is a comparison of two quantities by division.

If a and b are two numbers, then the ratio of a to b is $\frac{a}{b}$ or $a \div b$. It is denoted by $a : b$.

Note:

1. The two quantities in $a : b$ that is being compared is called terms.
2. The first term is called antecedent and the second term is called consequent.

Ex: The ratio 4:5 represents $\frac{4}{5}$ with antecedent 4 and consequent 5.

3. A ratio is a number, so to find the ratio of two quantities; they must be expressed in the same units.

4. A ratio does not change if both of its terms are multiplied or divided by the same number. Thus, $\frac{4}{5} = \frac{8}{10}$

$\frac{12}{15}$ etc.

TYPES OF RATIOS:

1. **Duplicate Ratio:** If $a : b$ is the given ratio then its duplicate ratio is $a^2 : b^2$.
2. **Triplicate Ratio:** If $a : b$ is the given ratio then its triplicate ratio is $a^3 : b^3$.
3. **Sub-duplicate Ratio:** If $a : b$ is the given ratio then its sub-duplicate ratio is $\sqrt{a} : \sqrt{b}$.
4. **Sub-triplicate Ratio:** If $a : b$ is the given ratio then its sub-triplicate ratio is $\sqrt[3]{a} : \sqrt[3]{b}$.
5. **Inverse Ratio or Reciprocal Ratio:** If $a : b$ is the given ratio, then its inverse or reciprocal ratio is $b : a$.
6. **Compound Ratio:** If $a : b$ and $c : d$ are two given ratios, then $ac : bd$ is the compound ratio of the given ratios.

Proportion: The equality of two ratios is called proportion.

Note:

1. If $\frac{a}{b} = \frac{c}{d}$, then a, b, c and d are said to be in proportion.

2. We write it as $a : b :: c : d$ and read as "a is to b as c is to d".

3. Each term of $\frac{a}{b}$ and $\frac{c}{d}$ is called a proportional.

4. In the $a : b :: c : d$ proportion, a, d are known as extremes and b, c are known as means.

5. If four quantities are in proportion, then

Product of Means = Product of Extremes

Ex: $\frac{3}{2} = \frac{6}{4}$, we write as $3:2 :: 6:4$ and say 3, 2, 6 and 4 are in proportion.

Here, 3 and 4 are extremes and their product = $3 \times 4 = 12$

2 and 6 are means and their product = $2 \times 6 = 12$

6. **Fourth Proportional:** If $a : b :: c : x$, then x is called the fourth proportional of a, b, c .

We have, $\frac{a}{b} = \frac{c}{x}$, or $x = \frac{b \times c}{a}$.

Thus, fourth proportional of a, b, c is $\frac{b \times c}{a}$.

7. **Third Proportional:** If $a : b :: b : x$, then x is called the third proportional of a, b .

8. **Mean Proportional:** If $a : b$ is the given ratio, then the mean proportional of a and b is \sqrt{ab} .

Formulae:

1. If $\frac{a}{b} = \frac{c}{d}$, then

a) **Componendo Rule:** $\frac{a+b}{b} = \frac{c+d}{d}$

b) **Dividendo Rule:** $\frac{a-b}{b} = \frac{c-d}{d}$

c) **Componendo and Dividendo Rule:** $\frac{a+b}{a-b} = \frac{c+d}{c-d}$

2. If two numbers are in the ratio of $a : b$ and the sum of these numbers is x , then these numbers will be

$\frac{ax}{a+b}$ and $\frac{bx}{a+b}$ respectively.

3. If in a mixture of x litres two liquids A and B are in the ratio of $a : b$, then the quantities of liquids A and

B in the mixture will be $\frac{ax}{a+b}$ litres and $\frac{bx}{a+b}$ litres respectively.

4. If three numbers are in the ratio $a : b : c$ and the sum of these numbers is x , then these numbers will

$\frac{ax}{a+b+c}$ $\frac{bx}{a+b+c}$ $\frac{cx}{a+b+c}$

be _____, _____ and _____ respectively.

5. If two numbers are in the ratio $a : b$ and the difference of these numbers is x , then these numbers will be

a) $\frac{ax}{a-b}$ and $\frac{bx}{a-b}$ respectively, (where $a > b$).

b) $\frac{ax}{b-a}$ and $\frac{bx}{b-a}$ respectively, (where $b > a$).

6. The ratio between two numbers is $a : b$. If x is added to each of these numbers, the ratio becomes $c : d$, then the two numbers are $\frac{ax(c-d)}{ad-bc}$ and $\frac{bx(c-d)}{ad-bc}$.

7. The ratio between two numbers is $a : b$. If x is subtracted from each of these numbers, the ratio becomes $c : d$, then the two numbers are $\frac{ax(d-c)}{ad-bc}$ and $\frac{bx(d-c)}{ad-bc}$.

8. If the ratio of two numbers is $a : b$, then the number that should be added to each of the numbers in order to make this ratio $c : d$ is given by $\frac{ad-bc}{c-d}$.

9. If the ratio of two numbers is $a : b$, then the number that should be subtracted from each of the numbers in order to make this ratio $c : d$ is given by $\frac{bc-ad}{c-d}$.

10. There are four numbers a, b, c and d . The number that should be subtracted from each of the numbers so that the remaining numbers may be proportional is given by $\frac{ad-bc}{(a+d)-(b+c)}$.

11. There are four numbers a, b, c and d . The number that should be added to each of the numbers so that the new numbers may be proportional is given by $\frac{bc-ad}{(a+d)-(b+c)}$.

12. The incomes of two persons are in the ratio of $a : b$ and their expenditures are in the ratio of $c : d$. If the savings of each person be Rs. X , then their

Incomes are Rs. $\frac{aX(d-c)}{ad-bc}$ and Rs. $\frac{bX(d-c)}{ad-bc}$ and their

Expenditures are Rs. $\frac{cX(b-a)}{ad-bc}$ and Rs. $\frac{dX(b-a)}{ad-bc}$.

13. If in a mixture of x litres of two liquids A and B , the ratio of liquids A and B is $a : b$, then the quantity of liquid B to be added in order to make this ratio $c : d$ is $\frac{x(ad-bc)}{c(a+b)}$.

- 14.** In a mixture of two liquids A and B , the ratio of liquids A and B is $a : b$. If on adding x litres of liquid B to the mixture, the ratio of A to B becomes $a : c$, then in the beginning the quantity of liquid A in the

mixture was $\frac{ax}{c}$ and that of liquid B was $\frac{bx}{c-b}$ litres.

15. When two ingredients A and B of quantities _____ and q_2 and cost price per unit c_1 and c_2 are mixed to get a mixture c having cost price per unit c_m , then

a) $\frac{q_1}{q_2} = \frac{c_2 - c_m}{c_m - c_1}$ and

b) $c_m = \frac{c_1 \times q_1 + c_2 \times q_2}{q_1 + q_2}$

16. If $a : b = n_1 : d_1$ and $b : c = n_2 : d_2$, then

$$a : b : c = (n_1 \times n_2) : (d_1 \times n_2) : (d_1 \times d_2)$$

17. If $a : b = n_1 : d_1$ and $b : c = n_2 : d_2$ and $c : d = n_3 : d_3$, then

$$a : b : c : d = (n_1 \times n_2 \times n_3) : (d_1 \times n_2 \times n_3) : (d_1 \times d_2 \times n_3) : (d_1 \times d_2 \times d_3)$$



18. If a mixture contains two ingredients A and B in the ratio $a : b$, then

a) Percentage of A in the mixture $= \frac{a}{a+b} \times 100\%$.

b) Percentage of B in the mixture $= \frac{b}{a+b} \times 100\%$.

19. If two mixtures M_1 and M_2 contain ingredients A and B in the ratios $a : b$ and $c : d$ respectively, then a third mixture M_3 obtained by mixing M_1 and M_2 in the ratio $x : y$ will contain:

a) $\left[\frac{\frac{ax}{a+b} + \frac{cy}{c+d}}{x+y} \times 100\% \right]$ ingredient A, and

b) $\left[\frac{\frac{bx}{a+b} + \frac{dy}{c+d}}{x+y} \times 100\% \right]$ ingredient B or

$\left[100 - \left\{ \frac{\frac{ax}{a+b} + \frac{cy}{c+d}}{x+y} \right\} \times 100\% \right]$ ingredient B

Solved Examples

1. The duplicate ratio of 4 : 5 is_____.

Sol: Duplicate ratio of 4 : 5 is $4^2 : 5^2 = 16 : 25$.

2. The triplicate ratio of 2 : 3 is_____.

Sol: Triplicate ratio of 2 : 3 is $2^3 : 3^3 = 8 : 27$.

3. The sub-duplicate ratio of 9 : 16 is_____.

Sol: Sub-duplicate ratio of 9 : 16 $= \sqrt{9} : \sqrt{16} = 3 : 4$.

4. The sub-triplicate ratio of 8 : 27 is_____.

Sol: Sub-triplicate ratio of 8 : 27 is $\sqrt[3]{8} : \sqrt[3]{27} = 2 : 3$.

5. The inverse ratio of 4 : 5 is_____.

Sol: Inverse ratio of 4 : 5 is 5 : 4.

6. The compound ratio of 3 : 4, 4 : 5 and 5 : 6 is_____.

Sol: Compound ratio of
 $3 : 4, 4 : 5$ and $5 : 6 = (3 \times 4 \times 5) : (4 \times 5 \times 6)$
 $= 60 : 120 = 1 : 2$.

7. Find a fourth proportional to 2, 5, 6.

Sol: Let x be the fourth proportional to 2, 5, 6.

$$\text{Then, } 2 : 5 :: 6 : x \text{ or } \frac{2}{3} = \frac{6}{x}$$

So, $x = 9$.

8. Find a fourth proportional to 5, 4.

Sol: Let x be the third proportional to 5, 4.

$$\text{Then } 5 : 4 :: 4 : x \text{ or } \frac{5}{4} = \frac{4}{x}$$

$$\Rightarrow x = \frac{16}{5} = 3.2$$

9. Find the mean proportional between 32 and 8.

Sol: The mean proportion between 32 and 8

$$= \sqrt{32 \times 8} = \sqrt{256} = 16.$$

10. Two numbers are in the ratio 3 : 4 and the sum of these numbers is 21. Find the two numbers.

Sol: Here, $a = 3$, $b = 4$ and $x = 21$

$$\text{The first number} = \frac{ax}{a+b} = \frac{3 \times 21}{3+4} = 9$$

$$\begin{aligned} \text{The second number} &= \frac{bx}{a+b} = \frac{4 \times 21}{3+4} = 12 \\ &\text{(or)} \\ &= 21 - 9 = 12. \end{aligned}$$

11. Two numbers are in the ratio 3 : 5 and the difference of these numbers is 36. Find the two numbers.

Sol: Here, $a = 3$, $b = 5$ and $x = 36$

$$\text{The first number} = \frac{ax}{b-a} = \frac{3 \times 36}{5-3} = 54$$

$$\begin{aligned} \text{The second number} &= \frac{bx}{b-a} = \frac{5 \times 36}{5-3} = 90 \\ &\text{(or)} \\ &= 54 + 36 = 90. \end{aligned}$$

12. If $a : b = 3 : 4$ and $b : c = 5 : 6$, find $a : b : c$.

Sol: Here $n_1 = 3, n_2 = 5, d_1 = 4, d_2 = 6$

$$\begin{aligned} a : b : c &= (n_1 \times n_2) : (d_1 \times n_2) : (d_1 \times d_2) \\ &= (3 \times 5) : (4 \times 5) : (4 \times 6) \\ &= 15 : 20 : 24 \end{aligned}$$

13. Given two numbers which are in the ratio of 2 : 3. If 6 is added to each of them, their ratio is changed to 4 : 5. Find the two numbers.

Sol: Here, $a : b = 2 : 3$ and $c : d = 4 : 5$ and $x = 6$

$$\text{The first number} = \frac{ax(c-d)}{ad-bc} = \frac{2(6)(4-5)}{2(5)-3(4)} = \frac{-12}{-2} = 6$$

$$\text{The second number} = \frac{bx(c-d)}{ad-bc} = \frac{3(6)(4-5)}{2(5)-3(4)} = \frac{-18}{-2} = 9$$

14. The ratio of two numbers is 5 : 9. If each number is decreased by 5, the ratio becomes 5 : 11. Find the numbers.

Sol: Here, $a : b = 5 : 9$ and $c : d = 5 : 11$ and $x = 5$



$$\text{The first number} = \frac{ax(d-c)}{ad-bc} = \frac{5(5)(11-5)}{5(11)-9(5)} = \frac{25 \times 6}{10} = 15$$

$$\text{The second number} = \frac{bx(d-c)}{ad-bc} = \frac{9(5)(11-5)}{5(11)-9(5)} = \frac{45 \times 6}{10} = 27$$

15. Find the number that must be subtracted from the terms of the ratio 5 : 6 to make it equal to 2 : 3.

Sol: Here, $a : b = 5 : 6$ and $c : d = 2 : 3$

$$\text{Required number} = \frac{bc-ad}{c-d} = \frac{6(2)-5(3)}{2-3} = 3.$$

16. Find the number that must be added from the terms of the ratio 11 : 29 to make it equal to 11 : 20.

Sol: Here, $a : b = 11 : 29$ and $c : d = 11 : 20$

$$\text{Required number} = \frac{ad-bc}{c-d} = \frac{11(20)-29(11)}{11-20} = 11.$$

17. Find the number subtracted from each of the numbers 54, 71, 75 and 99 leaves the remainders which are proportional.

Sol: Here, $a = 54, b = 71, c = 75$ and $d = 99$

$$\text{Required number} = \frac{ad-bc}{(a+d)-(b+c)} = \frac{54(99)-71(75)}{(54+99)-(71+75)} = 3$$

18. Annual income of Shashi and Ravi is in the ratio of 4: 3 and the ratio of their annual expenses is 3: 2. If each of them saves Rs. 500 at the end of year, then find their annual income.

Sol: Here, $a : b = 4 : 3$ and $c : d = 3 : 2$ and $X = 500$

$$\begin{aligned} \text{So, Annual income of Shashi} &= \frac{aX(d-c)}{ad-bc} \\ &= \frac{4(500)(2-3)}{4(2)-3(3)} = \frac{-2000}{-1} \\ &= \text{Rs.2000} \end{aligned}$$

$$\begin{aligned} \text{Annual income of Ravi} &= \frac{bX(d-c)}{ad-bc} \\ &= \frac{3(500)(2-3)}{4(2)-3(3)} = \frac{-1500}{-1} \\ &= \text{Rs.1500.} \end{aligned}$$

19. The incomes of Madhav and Kiran are in the ratio 9: 4 and their expenditures are in the ratio 5: 2. If each saves Rs.1000, find their expenditures.

Sol: Here, $a : b = 9 : 4$ and $c : d = 5 : 2$ and $X = 1000$ So,

$$\begin{aligned} \text{the expenditure of Madhav} &= \frac{cX(b-a)}{ad-bc} \\ &= \frac{5(1000)(4-9)}{9(2)-4(5)} = \frac{-5000}{-2} \\ &= \text{Rs.2500} \end{aligned}$$

$$\begin{aligned} \text{Expenditure of Kiran} &= \frac{dX(b-a)}{ad-bc} \\ &= \frac{2(1000)(4-9)}{9(2)-4(5)} = \frac{-2000}{-2} \\ &= \text{Rs.1000.} \end{aligned}$$

20. 630 ml of a mixture contains milk and water in the ratio 7: 2. How much more water is to be added to get a new mixture containing milk and water in the ratio of 7: 3.

Sol: Here, $a : b = 7 : 2$ and $c : d = 7 : 3$ and $x = 630$

$$\begin{aligned} \text{Required quantity of water to be added} &= \frac{x(ad - bc)}{c(a + b)} \\ &= \frac{630(7(3) - 2(7))}{7(7 + 2)} \\ &= \frac{630(14)}{63} = 140 \text{ ml.} \end{aligned}$$

21. A mixture contains milk and water in the ratio 8 : 3. On adding 6 litres of water, the ratio of milk to water becomes 8 : 5. Find the quantity of water in the mixture.

Sol: Here, $a : b = 8 : 3$ and $a : c = 8 : 5$ and $x = 6$

$$\begin{aligned} \text{So, the quantity of water in the mixture} &= \frac{bx}{c - b} \\ &= \frac{3(6)}{5 - 3} = 9 \text{ litres.} \end{aligned}$$

22. In what ratio the two kinds of tea powder (Ex: general tea powder with lamsa) must be mixed together into one at Rs.10 per kg and another at Rs.15 per kg, so that the mixture may cost Rs.12.2 per kg?

Sol: Here, $c_1 = 10$, $c_2 = 15$, $c_m = 12.2$

$$\begin{aligned} \text{Required ratio, } \frac{q_1}{q_2} &= \frac{c_2 - c_m}{c_m - c_1} \\ &= \frac{15 - 12.2}{12.2 - 10} = \frac{2.8}{2.2} = 1.4 : 1.1 \end{aligned}$$

Thus, the two kinds of tea powder are mixed in the ratio 1.4 : 1.1.

23. In a mixture of two types of liquids L_1 and L_2 , the ratio $L_1 : L_2$ is 4 : 3. If the cost of liquid L_1 is Rs.5 per litre and that of L_2 is Rs.10 per litre, then find the cost per litre of the resulting mixture.

Sol: Here, $q_1 = 4$, $q_2 = 3$, $c_1 = 5$, $c_2 = 10$

$$\begin{aligned} \text{So, the cost of the resulting mixture, } c_m &= \frac{c_1 \times q_1 + c_2 \times q_2}{q_1 + q_2} \\ &= \frac{5 \times 4 + 10 \times 3}{4 + 3} = \frac{50}{7} \\ &= \text{Rs.7.14 (app).} \end{aligned}$$

24. If a mixture contains water and alcohol in the ratio 3 : 7, what is the percentage quantity of alcohol in the mixture?

Sol: Water (a) : alcohol (b) = 3 : 7

$$\begin{aligned} \text{Percentage of alcohol in the mixture} &= \frac{b}{a + b} \times 100\% \\ &= \frac{7}{3 + 7} \times 100\% \\ &= 70\%. \end{aligned}$$

Note: Similarly you can find the percentage of water.

25. Two alloys contain gold and copper in the ratio 3 : 1 and 5 : 2. In what ratio the two alloys should be added together to get a new alloy having gold and copper in the ratio of 2 : 1.

Sol: Here, $a : b = 3 : 1$ and $c : d = 5 : 2$



9. If $a : b = 5 : 8$, find the ratio of $\frac{5b - 4a}{5b - 4a}$.
- 1) 9 : 20
2) 20 : 9
3) 21 : 20
4) None
10. Milk is available in two vessels. The ratio of milk to water in each of the vessels is 9 : 7 and 11 : 8 respectively. Which vessel contains more water?
- 1) 2nd Vessel
2) 3rd Vessel
3) 1st Vessel
4) None
11. Wine and water are in the ratio 7 : 3 in a 30 litre mixture. How much more water be added to make the ratio 3 : 7?
- 1) 40 litres
2) 60 litres
3) 30 litres
4) None
12. In a ratio 7 : 8 if the antecedent is 35, what is the consequent?
- 1) 60
2) 40
3) 80
4) None
13. What is the ratio compounded of the four fractions, 4 : 3, 9 : 13, 26 : 5, 2 : 15.
- 1) 16/25
2) 16/19
3) 19/16
4) None
14. Divide Rs.4300 between A, B and C such that A : B = 5 : 4 and B : C = 3 : 4.
- 1) 1500 : 1600 : 1200
2) 1500 : 1200 : 1600
3) 1600 : 1500 : 1200
4) None
15. A man had property worth Rs.26540. He gave Rs.9200 to his wife and distributed the remaining amount among his children in the ratio of 1 : 2 : 3. How much did the first child get?
- 1) 2890
2) 2600
3) 2280
4) None
16. The income of A, B and C are in the ratio 7 : 9 : 12 and their spending are in the ratio 8 : 9 : 15. If A saves $\frac{1}{4}$ th of the income then what is the ratio of the savings of A, B and C?
- 1) 56 : 69 : 99
2) 56 : 99 : 69
3) 69 : 56 : 99
4) None
17. If $\frac{5}{8}$ th property constitute Rs.30000 then how much $\frac{2}{3}$ rd will constitute?
- 1) 16200
2) 14000
3) 32000
4) None
18. The ratio between two numbers is 3 : 4. If their L.C.M. is 180, then find the numbers.
- 1) 45 and 60
2) 60 and 45
3) 60 and 20
4) None
19. A bag contains rupee coins fifty paise coins and twenty five paise coins in the proportion 5 : 6 : 8. If the total amount is Rs.210, find the number of coins of each kind.
- 1) 105, 126, 268
2) 126, 105, 268
3) 268, 105, 126
4) None
20. If A : B = 3 : 4, B : C = 5 : 9 and C : D = 16 : 15, find A : D.
- 1) 4 : 9
2) 9 : 4
3) 11 : 12
4) None
21. Two horse riders travel 135 km and 96 km in 9 hours and 6 hours respectively. Find the ratio of the average speeds of the riders.
- 1) 16 : 45
2) 15 : 16
3) 11 : 12
4) None
22. If 192 mangoes can be bought for Rs.15, how many can be bought for Rs.25?
- 1) 440
2) 320
3) 460
4) None
23. In a fort, ration for 2000 soldiers was sufficient for 54 days a few more soldiers came and the ration lasted for only 20 more days. What was the number of soldiers who came?
- 1) 1900
2) 2200
3) 1200
4) None



24. Find the mean proportion of 0.32 and 0.02.
 1) 0.8
 2) 11.02
 3) 0.08
 4) None
25. A's money : B's money = 4 : 5 and B's money : C's money = 2 : 3. If A has Rs.800, then what amount of money C has?
 1) 1600
 2) 2700
 3) 1500
 4) None

PARTNERSHIP

Partnership: Two or more persons carry on a business and share the profits of the business at an agreed proportion. This is called partnership.

Partners: Persons who have entered into partnership with one another are individually called partners. They are of two types.

- a) **Sleeping Partner:** A person who invests the capital in the business but does not actively participate in the conduct of business is called sleeping partner.
- b) **Working Partner:** A person who takes part in running the business besides investing the capital is called working partner. He gets salary for his work or some per cent of profit, in addition.

Firm name: The name under which the business is carried on is called firm name.

Note: The partnership may be simple or compound.

Simple Partnership: It is one in which the capital of each partner is in the business for same time.

Compound Partnership: It is one in which the capitals of partners are invested for different periods.

Formulae:

1. If capitals of two partners *A* and *B* be Rs. C_1 and Rs. C_2 respectively for the same period and the total profit be Rs. P , then:

$$\text{Profit of } A = \text{Rs.} \left[\frac{C_1 \times P}{C_1 + C_2} \right]$$

$$\text{Profit of } B = \text{Rs.} \left[\frac{C_2 \times P}{C_1 + C_2} \right]$$

2. If capitals of three partners *A*, *B* and *C* be Rs. C_1 , Rs. C_2 and Rs. C_3 respectively for the same period and the total profit be Rs. P , then:

$$\text{Profit of } A = \text{Rs.} \left[\frac{C_1 \times P}{C_1 + C_2 + C_3} \right]$$

$$\text{Profit of } B = \text{Rs.} \left[\frac{C_2 \times P}{C_1 + C_2 + C_3} \right]$$

$$\text{Profit of } C = \text{Rs.} \left[\frac{C_3 \times P}{C_1 + C_2 + C_3} \right]$$

3. If capitals of two partners *A* and *B* be Rs. C_1 and Rs. C_2 respectively for the periods t_1 and t_2 respectively and the total profit be Rs. P , then:

$$\text{Profit of } A = \text{Rs.} \left[\frac{C_1 t_1 \times P}{C_1 t_1 + C_2 t_2} \right]$$

$$\text{Profit of } B = \text{Rs.} \left[\frac{C_2 t_2 \times P}{C_1 t_1 + C_2 t_2} \right]$$

4. If capitals of three partners *A*, *B* and *C* be Rs. C_1 , Rs. C_2 and Rs. C_3 respectively for the periods t_1 , t_2 and t_3 respectively and the total profit be Rs. P , then:

$$\left[\frac{C_1 t_1 \times P}{C_1 t_1 + C_2 t_2 + C_3 t_3} \right]$$

Profit of $A = \text{Rs.}$

$$\text{Profit of } B = \text{Rs.} \left[\frac{C_2 t_2 \times P}{C_1 t_1 + C_2 t_2 + C_3 t_3} \right]$$

$$\text{Profit of } C = \text{Rs.} \left[\frac{C_3 t_3 \times P}{C_1 t_1 + C_2 t_2 + C_3 t_3} \right]$$

5. Three partners A, B and C invested their capitals in a business in the ratio of $C_1 : C_2 : C_3$ and their profits are in the ratio $P_1 : P_2 : P_3$, then the ratio of timing of their investments is $\frac{P_1}{C_1} : \frac{P_2}{C_2} : \frac{P_3}{C_3}$.

Three partners A, B and C invested their capitals in a business. If the timing of their investments is in the ratio $t_1 : t_2 : t_3$ and their profits are in the ratio $P_1 : P_2 : P_3$, then the ratio of their capitals invested is $\frac{P_1}{t_1} : \frac{P_2}{t_2} : \frac{P_3}{t_3}$.

Results:

- If capitals of two partners A and B be Rs. C_1 and Rs. C_2 respectively for the periods t_1 and t_2 respectively, then
Profit of $A : \text{Profit of } B = C_1 t_1 : C_2 t_2$
- If capitals of two partners A, B be C be Rs. C_1 and Rs. C_2 respectively for the periods t_1, t_2 and t_3 respectively, then
Profit of $A : \text{Profit of } B : \text{Profit of } C = C_1 t_1 : C_2 t_2 : C_3 t_3$
- If there is a loss in the business, then
Loss of $A : \text{Loss of } B : \text{Loss of } C = C_1 t_1 : C_2 t_2 : C_3 t_3$

Solved Examples

- Shashi, Ravi and Kiran invested Rs.2000, Rs.5000 and Rs.4000 respectively in a business. The net profit for the year was Rs.1210 which was divided in proportion to investments. Find the profit of each.

Sol: Here, $C_1 = 2000$, $C_2 = 5000$ and $C_3 = 4000$ and $P = 1210$

So,

$$\text{Profit of Shashi} = \left[\frac{C_1 \times P}{C_1 + C_2 + C_3} \right] = \left[\frac{2000 \times 1210}{2000 + 5000 + 4000} \right]$$

$$= \frac{2}{11} \times 1210 = \text{Rs.}220$$

$$\text{Profit of Ravi} = \left[\frac{C_2 \times P}{C_1 + C_2 + C_3} \right] = \left[\frac{5000 \times 1210}{2000 + 5000 + 4000} \right]$$

$$= \frac{5}{11} \times 1210 = \text{Rs.}550$$

$$\text{Profit of Kiran} = \left[\frac{C_3 \times P}{C_1 + C_2 + C_3} \right] = \left[\frac{4000 \times 1210}{2000 + 5000 + 4000} \right]$$

$$= \frac{4}{11} \times 1210 = \text{Rs.}440$$

Note: You can solve in this way also.



Profit of Kiran = Total Profit - (Profit of Shashi + Profit of Ravi)

2. *A* and *B* are two partners in a business. *A* contributes Rs. 1000 for 6 months and *B* Rs. 600 for 5 months. If total profit is Rs.700, find the profits of *A* and *B*.

Sol: Here, $C_1 = 1000$, $C_2 = 600$ and $t_1 = 6$, $t_2 = 5$ and $P = 600$

$$\text{Profit of } A = \left[\frac{C_1 t_1 \times P}{C_1 t_1 + C_2 t_2} \right] = \left[\frac{6000 \times 600}{6000 + 3000} \right]$$

$$= \frac{3600000}{9000} = \text{Rs.}400$$

$$\text{Profit of } B = \left[\frac{C_2 t_2 \times P}{C_1 t_1 + C_2 t_2} \right] = \left[\frac{3000 \times 600}{6000 + 3000} \right]$$

$$= \frac{1800000}{9000} = \text{Rs.}200$$

(or)

Profit of *B* = Total Profit - Profit of *A*

3. *A*, *B* and *C* are three partners in a business. *A* contributes Rs.1500 for 6 months and *B* Rs.1200 for 4 months and *C* Rs.2000 for 2 months. Find the ratio of their shares in the profit.

Sol: Here, $C_1 = 1500$, $C_2 = 1200$ and $C_3 = 2000$ and

$$t_1 = 6 \quad t_2 = 4 \quad \text{and} \quad t_3 = 2$$

$$\text{Profit of } A : \text{Profit of } B : \text{Profit of } C = C_1 t_1 : C_2 t_2 : C_3 t_3$$

$$= 1500(6) : 1200(4) : 2000(2)$$

$$= 9000 : 4800 : 4000$$

$$= 45 : 24 : 20.$$

4. Raju, Suman and Sunil invested capitals in the ratio of 6 : 4 : 7. At the end of the business term, their profits are in the ratio 1 : 3 : 5. Find the ratio of time for which they invested the capitals.

Sol: Here, $C_1 : C_2 : C_3 = 6 : 4 : 7$ and $P_1 : P_2 : P_3 = 1 : 3 : 5$

$$\text{Required ratio} = \frac{P_1}{C_1} : \frac{P_2}{C_2} : \frac{P_3}{C_3} = \frac{1}{6} : \frac{3}{4} : \frac{5}{7} = 28 : 63 : 60 .$$

5. Phani, Deepa and Bindu start a business. If the ratio of their periods of investments are 1 : 4 : 5 and their profits are in the ratio 4 : 8 : 10, find the ratio of their capitals.

Sol: $P_1 : P_2 : P_3 = 4 : 8 : 10$ and $t_1 : t_2 : t_3 = 1 : 4 : 5$

$$\text{Required ratio} = \frac{P_1}{t_1} : \frac{P_2}{t_2} : \frac{P_3}{t_3} = \frac{4}{1} : \frac{8}{4} : \frac{10}{5} = 4 : 2 : 2 = 2 : 1 : 1 .$$

Exercise - 6

- In a business A, B, C invested Rs.18000, Rs.21000 and Rs.24000 respectively. Find the share of A if the total profit is Rs.2,52,000.
 - Rs.7200
 - Rs.2700
 - Rs.6200
 - Rs.2400
- In a business A, B, C invested Rs.20000, Rs.28000 and Rs.32000 respectively. Find the difference between the share of A and C if the total profit is Rs.1,80,000.
 - Rs.72000
 - Rs.27000
 - Rs.2700
 - Rs.1,53,000
- Three persons A, B, C shared profits in the ratio of 3 : 6 : 5. If C gets Rs.18000 more than A then find the share of B.
 - Rs.50000
 - Rs.4000



- 3) Rs.54000
4) Rs.53000
4. Three persons A, B, C shared profits in the ratio of 10 : 15 : 20. If the share of B is Rs.3000 then find the total profit.
1) Rs.80000
2) Rs.70000
3) Rs.45000
4) Rs.90000
5. Three persons P, Q, R shared the profits in the ratio of 3 : 5 : 7. If the total profit is Rs.1,05,000 then find the difference between the share of P and R.
1) Rs.28000
2) Rs.24000
3) Rs.14000
4) Rs.12000
6. A, B, C enter into a partnership. A contributes Rs.32000 for 5 months. B contributes Rs.24000 for 6 months and C contributes Rs.45000 for 4 months. If the total profit be Rs.60,500 then find the share of A.
1) Rs.10000
2) Rs.20000
3) Rs.8000
4) Rs.12000
7. A, B, C enter into a partnership. A contributes Rs.80000 for 3 months. B contributes Rs.60000 for 4 months and C contributes Rs.50000 for 6 months. If C gets Rs.25000 more than A in the total profit then find the total profit.
1) Rs.2,12,000
2) Rs.12000
3) Rs.3,12,000
4) None
8. In a business the investments of A and B are in the ratio of 4 : 5 and the periods of their investments in the ratio of 5 : 3. In which ratio should be the profit is divided between them.
1) 2 : 3
2) 1 : 2
3) 3 : 4
4) 4 : 3
9. A, B and C hired a car for Rs.1200 and they used it for 8, 9 and 13 hours respectively. The charge paid by A was....
1) Rs.320
2) Rs.420
3) Rs.580
4) None
10. Three milk men A, B, C rented a pasture. A grazed his 6 cows for 8 months. B his 25 cows for 4 months and C his 20 cows for 5 months. If A's share of rent was Rs.960 then find the total rent.
1) Rs.4960
2) Rs.4860
3) Rs.4690
4) Rs.6490
11. Mohan started a business with a capital of Rs.16000. After 2 months Venu joined him with a capital of Rs.20000. At the end of the year they got Rs.4900 as a profit. Find the share of Mohan in this profit. 1) Rs.20000
2) Rs.24000
3) Rs.18000
4) None
12. Kiran started a business with Rs.25000. After certain months Madhav joined with Rs.40000. At the end of the year they shared the profits in the ratio of 3 : 4. After how many months Madhav joined?
1) 1 month
2) 2 months
3) 3 months
4) 4 months
13. Vimala and Kamala entered into a partnership with Rs.15000 and Rs.25000 respectively. After 4 months Vimala put in Rs.5000 more. Find the share of Kamala in the annual profit of Rs.26000.
1) Rs.15000
2) Rs.12000
3) Rs.18000
4) Rs.9000
14. A and B entered into a partnership with Rs.50000 and Rs.60000 respectively. After 4 months A invested Rs.25000 more while B withdrew Rs.20000. Find the share of B in the profit of Rs.1,70,000.
1) Rs.5000
2) Rs.10000
3) Rs.8000
4) None
15. A and B entered into a partnership with Rs.45000 and Rs.36000 respectively. After 4 months they invested Rs.10000 each. Find the difference between their shares in the annual profit of Rs.2,58,000.
1) Rs.27000
2) Rs.58000
3) Rs.54000
4) Rs.48000
16. A and B entered into a partnership with Rs.5 lakhs and Rs.6 lakhs respectively. After 6 months A invested Rs.1 lakh and after one more year B withdrew 2 lakhs. Find the share of A in the profit of Rs.26 lakhs at the end of the third year.
1) 2 lakhs
2) 4 lakhs
3) 7 lakhs
4) 14 lakhs
17. A and B entered into a partnership with Rs.24000 and Rs.35000 respectively. B was a sleeping partner. At the end of the year they received Rs.18200 each. Find the salary of A.
1) Rs.5720
2) Rs.2750



- 3) Rs.4720
4) None
18. P and Q entered into a partnership with Rs.75000 and Rs.1,25,000 respectively. Q was the sleeping partner. At the end of the year they shared the profit of Rs.2,40,000 in the ratio of 5 : 3. Find the salary drawn by P.
1) Rs.48000
2) Rs.96000
3) Rs.25000
4) None
19. A and B entered into a partnership with Rs.48000 and Rs.60000 respectively. B was the sleeping partner. A had to take 25% of total profit and the rest to be divided between them in proportion of their capitals. If A got Rs.21000 at the end of the year then find the total profit.
1) Rs.18000
2) Rs.9000
3) Rs.36000
4) None
20. A, B and C started a business. The capital of A is three fourth of as much as the capitals of B and C together and the capital of B is two third of as much as the capitals of C and A together. Find the share of C in the annual profit of Rs.1,75,000.
1) Rs.15000
2) Rs.30000
3) Rs.8000
4) None
21. Raja and Rana started a business of spare parts by investing Rs.1,00,000 and Rs.1,50,000 respectively. What will be the share of each out of a profit of Rs.24,000?
1) Rs.9600, Rs.14400
2) Rs.14400, Rs.9600
3) Rs.9600, Rs.15000
4) None
22. Chinna and Priya are partners in a business where Chinna invests Rs.1000 for 8 months and Priya Rs.1500 for 6 months. They gain Rs.340. What is Priya's share?
1) Rs.190
2) Rs.180
3) Rs.160
4) None
23. A, B and C are partners in a business. A puts in Rs.350, B Rs.450 and C Rs.550. What is the share of C in a profit of Rs.405 at the end of the year?
1) Rs.165
2) Rs.180
3) Rs.190
4) None
24. Three partners A, B and C invests Rs.5900 in all, A puts in Rs.500 more than B, and B Rs.300 more than C, what is the profit of A out of a profit of Rs.590?
1) Rs.260
2) Rs.240
3) Rs.190
4) None
25. A and B enter into a partnership, A contributed Rs.6000 for 4 months and B Rs.5000 for 8 months. What is the share of profit B out of Rs.6000?
1) Rs.3760
2) Rs.3750
3) Rs.4050
4) None

SIMPLE INTEREST

Read this please:

Raju borrowed Rs.1000 from Ramesh. After some days Raju paid back Rs.1200 to Ramesh. Means Raju paid Rs.200 excess than the amount he borrowed from Ramesh.

- ∑ This excess amount is called **interest**.
- ∑ The total amount of money borrowed by Raju from Ramesh is called the **Principal** or **Sum**.
- ∑ The money paid back to Ramesh, which is the combination of both Principal and interest is called the **Amount**.
- ∑ So, **Amount = Principal + Interest**

Rate of interest: The interest is usually charged according to a specified term, which is expressed as some per cent of the principal and is called the **rate of interest** for the fixed period of time.

- ∑ If the fixed period is a year, the rate of interest is charged annually.
- ∑ If the fixed period is six months, the rate of interest is charged semi-annually.
- ∑ If the fixed period is three months, the rate of interest is charged quarterly.
- ∑ If the fixed period is a month, the rate of interest is charged monthly.

Example: If the rate of interest is 10% per annum, then the interest payable on Rs.100 for one year is Rs.10.

Simple Interest: When the interest is payable on the principal only, it is called the simple interest. It is the interest calculated on the principal for the entire period it is borrowed. It is denoted by S.I.

Example: S.I. on Rs.100 at 10% per annum will be Rs.10 each year.
At the end of one year, the total amount will be Rs.100+10 = Rs.110.
At the end of second year, the total amount will be Rs.100+10+10 = Rs.120 and so on.

Formulae:

1. If P stands for Principal, R the rate per cent per annum, T the number of years, A the amount and S.I. the simple interest then

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

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

$$3. R = \frac{100 \times \text{S.I.}}{P \times T} \%$$

$$4. T = \frac{100 \times \text{S.I.}}{P \times R} \%$$

$$5. \text{Amount } A = P \left[1 + \frac{RT}{100} \right]$$

6. If a certain sum in T years at $R\%$ per annum amounts to Rs. A , then the sum will be $P = \frac{100 \times A}{100 + (R \times T)}$.

7. The annual payment that will discharge a debt of Rs. A due in T years at $R\%$ per annum

$$= \frac{100 \times A}{100T + \frac{RT(T-1)}{2}}$$

8. If a certain sum is invested in n types of investments in such a manner that equal amount is obtained on each investment where interest rates are R_1, R_2, \dots, R_n respectively and time periods and time periods are T_1, T_2, \dots, T_n respectively, then the ratio in which the amounts are invested is

$$\frac{1}{100 + R_1 T_1} : \frac{1}{100 + R_2 T_2} : \dots : \frac{1}{100 + R_n T_n}$$

9. If a certain sum of money becomes n times itself in T years at S.I., then the rate of interest per annum is,

$$R = \frac{100(n-1)}{T} \%$$

10. If a certain sum of money becomes n times itself at $R\%$ per annum S.I. in T years, then

$$T = \left[\frac{n-1}{R} \times 100 \right] \text{years}$$

11. If a certain sum of money becomes n times itself in T years at a simple interest, then the time T in which it

will become m times itself is given by $T' = \left[\frac{m-1}{n-1} \right] \times T \text{years}$.

12. If the rate of interest (R) changes from R_1 to R_2 and P, T are constant, then

$$\text{Change in S.I.} = \frac{PT}{100} \times (R_1 - R_2)$$

13. If Principal (P) changes from P_1 to P_2 and R, T are constant, then

$$\text{Change in S.I.} = \frac{RT}{100} \times (P_1 - P_2)$$

14. If Rate (R) Changes from R_1 to R_2 and time (T) changes from T_1 to T_2 but principal (P) is constant, then

$$\text{Change in S.I.} = \frac{P}{100} \times (R_1 T_1 - R_2 T_2)$$

15. If a debt of Rs. X is paid in n number of installments and if the value of each installment is a , then the

borrowed (debt) amount is given by $X = na + \frac{Ra}{100 \times b} \times \frac{n(n-1)}{2}$.

Where, R is the rate of interest per annum
 b is the no.of installments per year

Note:

- $b = 1$, when each installment is paid yearly.
- $b = 2$, when each installment is paid half-yearly.
- $b = 4$, when each installment is paid quarterly. b
- $= 12$, when each installment is paid monthly.

16. If a certain sum of money P lent out at S.I. amounts to A_1 in T_1 years and to A_2 in T_2 years,

$$\text{then } P = \frac{A_1 T_2 - A_2 T_1}{T_2 - T_1} \quad \text{and } R = \frac{A_1 - A_2}{A_1 T_2 - A_2 T_1} \times 100\%$$

17. If a certain sum of money P lent out for a certain time T amounts to A_1 at $R_1\%$ per annum and to A_2 at $R_2\%$ per annum, then

$$P = \frac{A_2 R_1 - A_1 R_2}{R_1 - R_2} \quad \text{and } T = \frac{A_1 - A_2}{A_2 R_1 - A_1 R_2} \times 100 \text{ years.}$$

18. If an amount P_1 lent at S.I. rate of interest $R_1\%$ p.a. and another amount P_2 at S.I. rate of $R_2\%$ p.a., then

$$\text{the rate of interest for the whole sum is } R = \left[\frac{P_1 R_1 + P_2 R_2}{P_1 + P_2} \right].$$

19. If a certain sum of money is lent out in n parts in such a manner that equal sum of money is obtained as S.I. on each part where interest rates are R_1, R_2, \dots, R_n respectively and time periods are T_1, T_2, \dots, T_n respectively, then the ratio in which the sum will be divided in n parts is given by

$$\frac{1}{R_1 T_1} : \frac{1}{R_2 T_2} : \dots : \frac{1}{R_n T_n}.$$

20. If there is a change in principal (P), rate of interest (R) and time (T), then the value of S.I also changes and is given by

$$\begin{aligned} \frac{S.I_1}{S.I_2} &= \frac{P_1 \times R_1 \times T_1}{P_2 \times R_2 \times T_2} \\ \Rightarrow \frac{A_1 - P_1}{A_2 - P_2} &= \frac{P_1 \times R_1 \times T_1}{P_2 \times R_2 \times T_2} \end{aligned}$$

21. Out of a certain sum P , $\frac{1}{x}$ part is invested at $R_1\%$, $\frac{1}{y}$ part is invested at $R_2\%$ and the remainder

$\left[1 - \frac{1}{x} - \frac{1}{y} \right]$ say, $\frac{1}{z}$ part at $R_3\%$. If the annual income from all these investments is Rs. A , the original sum is given by

$$P = \left[\frac{A \times 100}{\frac{R_1}{x} + \frac{R_2}{y} + \frac{R_3}{z}} \right].$$

Solved Examples

1. Find the S.I. on Rs.3500 for 3 years at 5% per annum.

Sol: Here, $P = \text{Rs.}3500$, $T = 3$ years and $R = 5\%$

$$\therefore \text{S.I.} = \frac{3500 \times 3 \times 5}{100} = \text{Rs.}525.$$

2. Find the Principal, if S.I. = 624 for 2 years at 3% per annum.

$$\text{Sol: } P = \frac{100 \times S.I.}{R \times T} = \frac{100 \times 624}{2 \times 3} = \text{Rs.}10400.$$

3. At what rate per annum will a sum of Rs.4000 amount to Rs. Rs.6000 in 5 years?

$$\text{Sol: S.I.} = 6000 - 4000 = 2000$$

$$R = \frac{100 \times S.I.}{P \times T} = \frac{100 \times 2000}{4000 \times 5} = 10\%.$$

4. In what time will Rs.1500 earn an interest of Rs.150 at 2% per annum?

$$\text{Sol: } T = \frac{100 \times S.I.}{P \times R} = \frac{100 \times 150}{1500 \times 2} = 5 \text{ years.}$$

5. Sunny borrowed Rs.2000 from his friend Praveen at 10% per annum for 5 years. Find the interest and money returned by Sunny to Praveen.

$$\text{Sol: } A = 2000 \left[1 + \frac{10 \times 5}{100} \right] = 2000 \times \frac{600}{100} = \text{Rs.}12000$$

$$S.I. = A - P = 12000 - 2000 = \text{Rs.}10000.$$

6. What sum will amount to Rs.420 at 2% per annum in $2\frac{1}{2}$ years?

$$\text{Sol: } P = \frac{100 \times A}{100 + (R \times T)} = \frac{100 \times 420}{100 + (2 \times 2\frac{1}{2})} = \frac{100 \times 420}{100 + (2 \times \frac{5}{2})} = \frac{100 \times 420}{105} = \text{Rs.}400$$

7. Find the annual installment that will discharge a debt of Rs.16200 in 5 years at 4% per annum.

$$\begin{aligned} \text{Sol: Annual installment} &= \frac{100 \times A}{100T + \frac{RT(T-1)}{2}} \\ &= \frac{100 \times 16200}{100(5) + \frac{4 \times 5 \times (5-1)}{2}} = \frac{100 \times 16200}{500 + \frac{80}{2}} = \frac{100 \times 16200}{540} = \text{Rs.}3000. \end{aligned}$$

8. A sum of Rs.3454 is divided among three such parts that amount obtained on these three parts of money after 3, 4 and 5 years, respectively at rate of 5% per annum remains equal. Find such three parts of the sum.

Sol: The three parts will be in the ratio

$$\begin{aligned} &\frac{1}{100 + R_1 T_1} : \frac{1}{100 + R_2 T_2} : \dots \dots \dots \frac{1}{100 + R_n T_n} \\ &= \frac{1}{100 + (5 \times 3)} : \frac{1}{100 + (5 \times 4)} : \frac{1}{100 + (5 \times 5)} = \frac{1}{115} : \frac{1}{120} : \frac{1}{125} \\ &= \frac{1 \times 69000}{115} : \frac{1 \times 69000}{120} : \frac{1 \times 69000}{125} = 600 : 575 : 552 \\ &\quad \text{[Since the L.C.M. of 115, 120 and 125 is 69000.]} \end{aligned}$$

$$\begin{aligned} \therefore \text{Ratio} &= 600 : 575 : 552 \\ \text{Sum of proportionals} &= 600 + 575 + 552 = 1727 \end{aligned}$$

$$\therefore \text{1st part} = \frac{600}{1727} \times 3454 = \text{Rs.}1200$$

$$\therefore \text{2nd part} = \frac{575}{1727} \times 3454 = \text{Rs.}1150$$

$$\therefore \text{3rd part} = \frac{552}{1727} \times 3454 = \text{Rs.}1104.$$

9. A certain sum of money quadruples itself in 6 years S.I. Find the rate percent per annum.

$$\text{Sol: } R = \frac{100(n-1)}{T} \% = \frac{100(4-1)}{6} = 50\%.$$

10. In what time a sum of money will double itself at a rate of S.I. of 5% per annum?

$$\text{Sol: } T = \left[\frac{n-1}{R} \times 100 \right] \text{ years} = \frac{(2-1)}{5} \times 100 = 16\frac{4}{5} = 16\frac{2}{3} \text{ years}$$

11. A sum of money put on S.I. doubles itself in 10 years. In how many years would it quadruple itself?

Sol: Required Time, $T' = \left[\frac{4-1}{2-1} \right] \times 10 = 40 \text{ years}$.

12. If simple interest on Rs.500 increases by Rs.20, when the rate % increases by 8% per annum, find the time.

Sol: Change in S.I. $= \frac{PT}{100} \times (R_1 - R_2)$
 $\Rightarrow 20 = \frac{500T}{100} \times 8 \Rightarrow 20 = 40T \Rightarrow T = \frac{1}{2} \text{ years}$.

13. If the S.I. on Rs.3500 be more than the interest on Rs.2000 by Rs.60 in 4 years, then find the rate per cent per annum.

Change in S.I. $= \frac{RT}{100} \times (P_1 - P_2)$
 $\Rightarrow 60 = \frac{4R}{100} \times (3500 - 2000) \Rightarrow 60 = \frac{4R}{100} \times 1500 \Rightarrow R = 1\%$.

14. If the S.I. on a certain sum at 3% per annum for 5 years is Rs.90 more than the interest on the same sum for 2 years at 6% per annum. Find the sum.

Sol: Change in S.I. $= \frac{P}{100} \times (R_1T_1 - R_2T_2)$
 $\Rightarrow 90 = \frac{P}{100} \times (3 \times 5 - 2 \times 6) \Rightarrow 90 = \frac{P}{100} \times 3 \Rightarrow P = \text{Rs.}3000$.

15. A sum of Rs.4 is lent to be paid back in 3 equal monthly installments of Re.1 each. Find the rate percent.

Sol: Here, $X = \text{Rs.}4$, $a = \text{Re.}1$, $n = 3$, $b = 12$, $R = ?$

Required formula, $X = na + \frac{Ra}{100 \times b} \times \frac{n(n-1)}{2}$

$$\begin{aligned} \Rightarrow 4 &= 3(1) + \frac{R \times 1}{100 \times 12} \times \frac{3(3-1)}{2} \\ \Rightarrow 4 &= 3 + \frac{R}{1200} \times 3 \\ \Rightarrow 4 &= \frac{1200 + R}{400} \\ \Rightarrow 1200 + R &= 1600 \\ \Rightarrow R &= 400\% \end{aligned}$$

16. Anitha deposits Rs.8000 in S.B.I at 2% per annum and Rs.6000 at 5% per annum in ICICI bank. Find the rate of interest for the whole sum.

Sol: Required rate, $R = \left[\frac{P_1R_1 + P_2R_2}{P_1 + P_2} \right]$
 $= \frac{8000 \times 2 + 6000 \times 5}{8000 + 6000}$
 $= \frac{19000}{14000} = 1 \frac{5}{14} \%$.

17. If a sum of Rs.3800 is divided into two such parts that the S.I. on the first part for $1 \frac{1}{2}$ years at the rate of 2% per annum, equals the S.I. on the second part for 4 years at the rate of 4% per annum, then find two such divisions of the sum.

Sol: Required Ratio $= \frac{1}{R_1T_1} : \frac{1}{R_2T_2}$

$$\therefore \text{1st part: 2nd part} = \frac{1}{2 \times 1 \frac{1}{2}} : \frac{1}{4 \times 4} = \frac{1}{3} : \frac{1}{16} = 16 : 3$$

Sum of proportionals = 16 + 3 = 19 So,

$$\text{1st part} = \frac{16}{19} \times 3800 = \text{Rs.} 3200$$

$$\text{part} = \frac{3}{19} \times 3800 = \text{Rs.} 600.$$

COMPOUND INTEREST

Compound Interest: In this method, the interest for each period is added to the principal before; interest is calculated for the next period. So, the principal grows as the interest is added to it. It is denoted by C.I.

Formulae:

1. If a principal P is given on C.I. at the rate of interest $R\%$ p.a., then the Amount A after t years is

$$A = P \left[1 + \frac{R}{100} \right]^t$$

2. C.I. = $A - P$

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

3. Rate of interest (R) = $100 \times \left[\left(\frac{A}{P} \right)^{\frac{1}{t}} - 1 \right] \% p.a.$

Note: S.I. and C.I. for 1 year at a given rate of interest per annum are always equal.

4. If the interest is compounded half-yearly, then

a) Amount, $A = P \left[1 + \frac{R}{100 \times 2} \right]^{2t}$

b) C.I. = $P \left[\left(1 + \frac{R}{100 \times 2} \right)^{2t} - 1 \right].$

c) Rate (R) = $2 \times 100 \times \left[\left(\frac{A}{P} \right)^{\frac{1}{t \times 2}} - 1 \right] \% p.a.$

5 If the interest is compounded quarterly, then

a) Amount, $A = P \left[1 + \frac{R}{100 \times 4} \right]^{4t}$

b) C.I. = $P \left[\left(1 + \frac{R}{100 \times 4} \right)^{4t} - 1 \right].$

c) Rate (R) = $4 \times 100 \times \left[\left(\frac{A}{P} \right)^{\frac{1}{t \times 4}} - 1 \right] \% p.a.$

6. If the interest is compounded n times a year, then

a) Amount, $A = P \left[1 + \frac{R}{100 \times n} \right]^t$

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

$$c) \text{ Rate } (R) = n \times 100 \times \left[\left(\frac{A}{P} \right)^{\frac{1}{n \times t}} - 1 \right] \% \text{ p.a.}$$

7. If the rate of interest is different for different years, say $R_1\%$, $R_2\%$, $R_3\%$ for first, second and third years respectively, then

$$\text{Amount } A = P \left(1 + \frac{R_1}{100} \right) \left(1 + \frac{R_2}{100} \right) \left(1 + \frac{R_3}{100} \right).$$

8. If the time is in the form of fraction, say $x \frac{y}{z}$ years, then

$$\text{Amount } A = P \left(1 + \frac{R}{100} \right)^x \times \left(1 + \frac{\frac{y}{z} R}{100} \right).$$

9. The difference between the C.I. and the S.I. on a certain sum of money for 2 years at $R\%$ p.a., is

$$a) \text{ C.I.} - \text{S.I.} = P \left(\frac{R}{100} \right)^2 \quad \text{if } P \text{ and } R \text{ are given}$$

$$b) \text{ C.I.} - \text{S.I.} = \frac{R \times \text{S.I.}}{2 \times 100} \quad \text{if S.I. and } R \text{ are given}$$

10. The difference between the C.I. and the S.I. on a certain sum of money for 3 years at $R\%$ p.a., is

$$a) \text{ C.I.} - \text{S.I.} = P \left[\left(\frac{R}{100} \right)^3 + 3 \left(\frac{R}{100} \right)^2 \right] \quad \text{if } P \text{ and } R \text{ are given}$$

$$b) \text{ C.I.} - \text{S.I.} = \frac{\text{S.I.}}{3} \left[\left(\frac{R}{100} \right)^2 + 3 \left(\frac{R}{100} \right) \right] \quad \text{if S.I. and } R \text{ are given}$$

11. If a certain sum becomes n times in t years at C.I.,

a) Then the same sum becomes n^m in mt years.

$$b) \text{ Rate of C.I., } R = 100 \left[(n)^{\frac{1}{t}} - 1 \right] \%.$$

12. If a certain sum of money at C.I. amounts to Rs. x in A years and to Rs. y in B years, then the rate of interest p.a. is

$$R = \left[\left(\frac{y}{x} \right)^{\frac{1}{B-A}} - 1 \right] \times 100 \%.$$

13. If a loan of Rs. P at $R\%$ C.I. p.a., is to be repaid in n equal yearly installments, then the value of each

$$\text{installment} = \text{Rs.} \frac{P}{\left(\frac{100}{100+R} \right) + \left(\frac{100}{100+R} \right)^2 + \dots + \left(\frac{100}{100+R} \right)^n}$$

Solved Examples

1. Ravi invested Rs.25000 at C.I. rate 4% p.a., for a period of 3 years. What amount will he receive at the end of 2 years?

Sol: $P = \text{Rs.}25000$, $R = 4\%$, $t = 3$ years, $A = ?$

$$A = P \left[1 + \frac{R}{100} \right]$$

$$= 25000 \left[1 + \frac{4}{100} \right]^3 = 25000 \times \frac{26}{25} \times \frac{26}{25} \times \frac{26}{25} = \text{Rs.}28,121.60.$$

2. Find the C.I. on Rs.2000 for 2 years at 5% p.a.

Sol: $P = \text{Rs.}2000$, $R = 5\%$, $t = 2$ years, C.I. = ?

$$\begin{aligned} \text{C.I.} &= P \left[\left(1 + \frac{R}{100} \right)^t - 1 \right] \\ &= 2000 \left[\left(1 + \frac{5}{100} \right)^2 - 1 \right] = 2000 \left[\left(\frac{21}{20} \right)^2 - 1 \right] \\ &= 2000(1.025 - 1) = 2000(0.1025) = \text{Rs.}205. \end{aligned}$$

3. Ram invested Rs.5548 for 3 years at C.I. and received an amount of Rs.6750 on maturity. What is rate percent?

Sol: $P = \text{Rs.}5548$, $A = \text{Rs.}6750$, $t = 3$ years, $R = ?$

$$\begin{aligned} \text{Rate of interest (R)} &= 100 \times \left[\left(\frac{A}{P} \right)^{\frac{1}{t}} - 1 \right] \% \text{ p.a.} \\ &= 100 \times \left[\left(\frac{6750}{5548} \right)^{\frac{1}{3}} - 1 \right] \% = 100 \left[\left(\frac{3375}{2774} \right)^{\frac{1}{3}} - 1 \right] \% \\ &= 100 \times \left[\left(\left(\frac{15}{14} \right)^3 \right)^{\frac{1}{3}} - 1 \right] \% = 100 \left[\frac{15}{14} - 1 \right] \% \\ &= \frac{100}{14} = \frac{50}{7} = 7\frac{1}{7} \% \text{ p.a.} \end{aligned}$$

4. Find the amount of Rs.16000 in $\frac{1}{2}$ years at 10% p.a., C.I. payable half-yearly.

Sol: $P = \text{Rs.}16000$, $R = 10\%$, $t = \frac{1}{2} = \frac{3}{2}$ years, $A = ?$

$$\begin{aligned} \text{Amount, } A &= P \left[1 + \frac{R}{100 \times 2} \right]^{2t} \\ &= 16000 \left[1 + \frac{10}{100 \times 2} \right]^{2 \times \frac{3}{2}} = 16000 \left(\frac{21}{20} \right)^3 \\ &= 16000 \times \frac{(21)^3}{8000} = 2 \times 9261 = \text{Rs.}18,522. \end{aligned}$$

5. Find the C.I. on Rs.8192 at 50% p.a., compounded quarterly for 1 year.

Sol: $P = \text{Rs.}8192$, $R = 50\%$, $t = 1$ year, C.I. = ?

$$\begin{aligned} \text{C.I.} &= P \left[\left(1 + \frac{R}{100 \times 4} \right)^{4t} - 1 \right] \\ &= 8192 \left[\left(1 + \frac{50}{100 \times 4} \right)^{4 \times 1} - 1 \right] = 8192 \left[\left(\frac{9}{8} \right)^4 - 1 \right] \\ &= 8192 \left(\frac{6561 - 4096}{4096} \right) = 8192 \times \frac{2465}{4096} = \text{Rs.}4930 \end{aligned}$$

6. Find the C.I. on Rs.2000 at 12% p.a. for 2 months compounded monthly.

7. Sol: $P = \text{Rs.}2000$, $R = 12\%$, $t = 2$ months = $\frac{2}{12} = \frac{1}{6}$ years, C.I. = ?

$$P \left[\left(1 + \frac{R}{100} \right)^{12 \times t} - 1 \right]$$

C.I. =

$$= 2000 \left[\left(1 + \frac{12}{100 \times 12} \right)^{12 \times \frac{1}{6}} - 1 \right] = 2000 \left[\left(\frac{101}{100} \right)^2 - 1 \right]$$

$$= 2000 [1.0201 - 1] = 2000 \times 0.0201 = \text{Rs. } 40.2$$

8. Lakshmi invests Rs.50000 in a mutual fund which gives interest at 2% p.a., during first year, 5% during the second year and 8% during the third year. How much does she get at the end of the third year?

Sol: $P = \text{Rs.}50000$, $R_1 = 2\%$, $R_2 = 5\%$, $R_3 = 8\%$

$$\text{Amount at the third year } A = P \left(1 + \frac{R_1}{100} \right) \left(1 + \frac{R_2}{100} \right) \left(1 + \frac{R_3}{100} \right)$$

$$= 50000 \left(1 + \frac{2}{100} \right) \left(1 + \frac{5}{100} \right) \left(1 + \frac{8}{100} \right)$$

$$= 50000 \left(\frac{51}{50} \right) \left(\frac{21}{20} \right) \left(\frac{27}{25} \right) = \frac{50000 \times 28917}{25000} = \text{Rs.}57834.$$

9. What will be the C.I. on Rs. 93750 for $2\frac{1}{2}$ years at 4% p.a.?

Sol: $P = \text{Rs.}93750$, $t = 2\frac{1}{2}$ years, $R = 4\%$.

$$\text{Required C.I.} = P \left[\left(1 + \frac{R}{100} \right)^x \times \left(1 + \frac{\frac{y}{z}R}{100} \right) - 1 \right]$$

$$= 93750 \times \left[\left(1 + \frac{4}{100} \right)^2 \times \left(1 + \frac{\frac{1}{2} \times 4}{100} \right) - 1 \right]$$

$$= 93750 \times \left[\frac{26}{25} \times \frac{26}{25} \times \frac{51}{50} - 1 \right]$$

$$= \frac{93750 \times 3226}{31250} = \text{Rs.}9678$$

10. Find the difference between C.I. and S.I. on a sum of Rs.6250 put for 2 years at 4% p.a. Sol: $P = \text{Rs.}6250$, $t = 2$ years, $R = 4\%$

$$\text{For 2 years, C.I. - S.I.} = P \left(\frac{R}{100} \right)^2 \quad \text{if } P \text{ and } R \text{ are given}$$

$$= 6250 \times \left(\frac{4}{100} \right)^2 = 6250 \times \frac{1}{25} \times \frac{1}{25} = \text{Rs.}10$$

11. The difference between C.I. and S.I. on a certain sum of money for 3 years, at 4% p.a. is Rs.76. Find the sum.

Sol: C.I. - S.I. = Rs.76, $R = 4\%$

$$\text{For 3 years, C.I. - S.I.} = P \left[\left(\frac{R}{100} \right)^3 + 3 \left(\frac{R}{100} \right)^2 \right] \quad \text{if } P \text{ and } R \text{ are given}$$

$$76 = P \left[\left(\frac{4}{100} \right)^3 + 3 \left(\frac{4}{100} \right)^2 \right]$$

$$76 = P \left[\left(\frac{1}{25} \right)^3 + 3 \left(\frac{1}{25} \right)^2 \right]$$

$$76 = P \left[\left(\frac{1}{25} \right)^3 + 3 \left(\frac{1}{25} \right)^2 \right]$$

$$76 = P \left[\frac{1 + (3 \times 25)}{25 \times 25 \times 25} \right]$$

$$76 = P \left[\frac{76}{15625} \right]$$

$$P = \text{Rs.} 15625.$$

12. Certain sum of money placed at C.I. doubles itself in 3 years. In how many years will it amount to eight times itself?

Sol: Here, $n = 2$, $t = 3$ years and $m = 3$

Then the same sum becomes n^m in mt years = $3 \times 3 = 9$ years.

13. At what percent C.I. does a sum of money become eight-fold in 3 years.

Sol: Required Rate percent is, $R = 100 \left[(n)^{\frac{1}{t}} - 1 \right] = 100 \left[(8)^{\frac{1}{3}} - 1 \right] = 100\%$.

14. A certain sum of money at C.I. amounts to Rs.800 in two years and to Rs.1152 in four years. Find the rate of interest per annum.

Sol: $x = \text{Rs.} 800$, $y = \text{Rs.} 1152$, $A = 2$ and $B = 4$

Required rate of interest, $R = \left[\left(\frac{y}{x} \right)^{\frac{1}{B-A}} - 1 \right] \times 100\%$

$$= \left[\left(\frac{1152}{800} \right)^{\frac{1}{4-2}} - 1 \right] \times 100\% = \left[\left(\frac{576}{400} \right)^{\frac{1}{2}} - 1 \right] \times 100\%$$

$$= \left[\left\{ \left(\frac{24}{20} \right)^2 \right\}^{\frac{1}{2}} - 1 \right] \times 100\% = \left[\frac{24-20}{20} \right] \times 100 = 20\%.$$

15. If a sum of Rs.18120 is to be paid back in two equal installments at $\frac{1}{3}\%$ per annum, what is the amount of each installment?

Sol: $P = \text{Rs.} 18120$, $R = 1\frac{1}{3}\% = \frac{4}{3}\%$

Each installment = $\text{Rs.} \frac{P}{\left(\frac{100}{100+R} \right) + \left(\frac{100}{100+R} \right)^2}$

$$= \frac{18120}{\left(\frac{100}{100 + \frac{4}{3}} \right) + \left(\frac{100}{100 + \frac{4}{3}} \right)^2} = \frac{18120}{\left(\frac{100}{\frac{304}{3}} \right) + \left(\frac{100}{\frac{304}{3}} \right)^2}$$

$$= \frac{18120}{\left(\frac{300}{3} \right) + \left(\frac{300}{3} \right)^2} = \frac{18120}{300 \left[1 + \frac{300}{3} \right]}$$

$$= \frac{18120}{\frac{300}{304} \times \frac{604}{304}} = \frac{18120 \times 304 \times 304}{300 \times 604} = \frac{304 \times 304}{10} = \text{Rs.}9241.60.$$

Exercise - 7

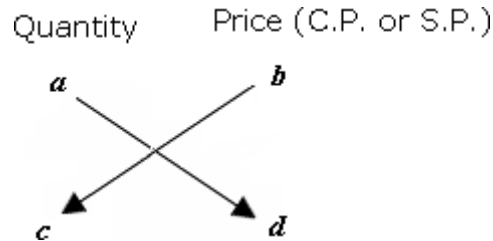
- Find the S.I. on Rs.1600 for 3 years at 3% per annum.
 - Rs.280
 - Rs.240
 - Rs.250
 - None of these
- On what sum of money the S.I. for 3 years at 5% p.a. is Rs.450?
 - Rs.3000
 - Rs.2500
 - Rs.2000
 - Rs.3500
- In what time will the S.I. on Rs.1600 at 4% is 256?
 - 3 Years
 - 4 Years
 - 5 Years
 - 6 Years
- At what rate per annum will the S.I. on Rs.8000 for 2 years is 960?
 - 5%
 - 4%
 - 6%
 - 8%
- Anand borrowed a sum of Rs.6000 at the rate of 6% p.a. Find the amount to be paid by him at the end of 6 years.
 - Rs.8016
 - Rs.8106
 - Rs.8601
 - Rs.8160
- Suresh borrowed certain sum from a financier at $0\frac{1}{2}\%$ p.a. At the end of 4 years he returned the sum along with the interest. He paid Rs.5680 in all. Find the sum borrowed by him initially.
 - Rs.4000
 - Rs.3500
 - Rs.4500
 - Rs.5000
- At what rate per annum a sum of money becomes double in 5 years?
 - 25%
 - 27%
 - 20%
 - 30%
- In how many years will a sum of money becomes triple at 10% p.a. at S.I.?
 - 25
 - 20
 - 30
 - 15
- A sum of money becomes triple itself in 16 years. In how many years will it become 5 times at the same rate?
 - 32
 - 15
 - 27
 - 30
- A certain sum amounts to Rs.4320 in 4 years and to Rs.4480 in 6 years. Find the sum.
 - Rs.4500
 - Rs.3500
 - Rs.4000
 - Rs.3000
- In what time will the S.I. on Rs.9000 at 5% p.a. be equal to the S.I. on Rs.5400 for 5 years at 10% p.a.?
 - 5
 - 4
 - 3
 - 6
- A part of the sum of Rs.3000 is invested at 5% and remaining at 6% p.a. The whole annual received was Rs.160. Find the money invested at 6%.
 - Rs.1500
 - Rs.1000
 - Rs.2500
 - Rs.2000
- A part of certain money is invested at 9% p.a. and the rest 5% p.a. If the S.I. earned in each case is same, then find the ratios of sum invested.
 - 9 : 5
 - 4 : 5
 - 5 : 9
 - 5 : 4
- A certain sum amounts to Rs.18000 in 3 years and Rs.22000 in 5 years. Find the rate%.
 - $6\frac{2}{3}\%$
 - 20%

$$\text{S.P.} = \left(\frac{100 - \text{Loss}\%}{100} \right) \times \text{C.P.}$$

7. If a man buys a items for Rs. b and sells c items for Rs. d , then the

$$\text{Gain or loss \%} = \left(\frac{ad}{bc} - 1 \right) \times 100\%$$

Remember in this way:



- Note: a) In case of gain percent, the result will be positive.
b) In case of loss percent, the result will be negative.

8. If the C.P. of x articles = S.P. of y articles, then

$$\text{Gain or loss \%} = \left(\frac{x - y}{y} \right) \times 100\%$$

- Note: a) If $x > y$, it is % gain.
b) If $x < y$, it is % loss.

9. The Cost Price of an article is C.P. If it is sold at S.P. $_1$, then gain% or loss% is x and if it is sold at a price S.P. $_2$, gain% or loss% is y then

$$\frac{\text{S.P.}_1}{100 + x} = \frac{\text{S.P.}_2}{100 + y} \quad (\text{Or}) \quad \frac{\text{C.P.}}{100} = \frac{\text{S.P.}_1 - \text{S.P.}_2}{x - y}$$

- Note: a) If x or y is negative it indicates a loss.
b) If x or y is positive it indicates a gain.

10. A sells an article to B at a gain or loss of $x\%$, and B sells it to C at a gain or loss of $y\%$. If C pays Rs. z for it to B , then

$$\text{C.P. for A} = \left[\frac{100^2 \times z}{(100 + x)(100 + y)} \right]$$

- Note: a) If x or y is negative it indicates a loss.
b) If x or y is positive it indicates a gain.

11. If A sells an article to B at a gain or loss of $x\%$, and B sells it to C at a gain or loss of $y\%$ then the

$$\text{Resultant Profit\% or Loss \%} = \left(x + y + \frac{xy}{100} \right)$$

- Note: a) If x or y is negative it indicates a loss.
b) If x or y is positive it indicates a gain.
c) This expression represents resultant profit% or loss% according as it is positive or negative.

12. If two different articles are sold at the same S.P., getting gain or loss of $x\%$ on the first transaction and gain or loss of $y\%$ on the second transaction, then the

$$\text{Overall \% gain or \% loss} = \left(\frac{100(x + y) + 2xy}{(100 + x) + (100 + y)} \right) \%$$

Note: This expression represents overall gain or loss according as its sign is positive or negative.]

13. If two different articles are sold at the same S.P., getting gain of $x\%$ on the first transaction and gain or loss of $x\%$ on the second transaction, then the

$$\left(\frac{x}{100} \right)^2 \%$$

Overall % loss =

Note: In this type of questions there is always a loss.

14. If a shopkeeper uses faulty measure and sells his goods at a gain or loss of $x\%$ then the

$$\text{Overall \% gain or \% loss is } \frac{100 + g}{100 + x} = \frac{\text{True measure}}{\text{Faulty measure}}$$

Note: If the merchant sells his goods at C.P., then $x = 0$.

15. If a merchant $y\%$ less weight or length and sells his goods at a gain or loss of $x\%$ then the

$$\text{Overall \% gain or loss} = \left[\left(\frac{y + x}{100 - y} \right) \times 100 \right] \%$$

16. If a person buys two items for Rs. A and sells one at a loss of $l\%$ and other at a gain of $g\%$ and if each item was sold at the same price, then

b) The C.P. of the item sold at loss = $\frac{A(100 + \text{gain}\%)}{(100 - \text{loss}\%) + (100 + \text{gain}\%)}$

c) The C.P. of the item sold at gain = $\frac{A(100 - \text{loss}\%)}{(100 - \text{loss}\%) + (100 + \text{gain}\%)}$

17. If two successive discounts on an article at $x\%$ and $y\%$ respectively, then the

$$\text{Overall Discount} = \left(x + y - \frac{xy}{100} \right) \%$$

18. If three successive discounts on an article at $x\%$, $y\%$ and $z\%$ respectively, then the

$$\text{Overall Discount} = \left(x + y + z - \frac{(xy + yz + zx)}{100} + \frac{xyz}{100^2} \right) \%$$

19. A shopkeeper sells an item at Rs. x after giving a discount of $d\%$ on labeled price. Had he not given the discount, he would have earned a profit of $p\%$ on the C.P. then the C.P. of each item is given by

$$\text{C.P.} = \left(\frac{100^2 x}{(100 - d)(100 + p)} \right)$$

Solved Examples

1. If C.P. = Rs.440, S.P. = Rs.480 then find the profit.

Sol: C.P. = Rs.440, S.P. = Rs.480
Profit = S.P. - C.P. = 480 - 440 = Rs.40.

2. If C.P. = Rs.135, S.P. = Rs.120 then find the loss.

Sol: C.P. = Rs.135, S.P. = Rs.120

$$\text{Loss} = \text{C.P.} - \text{S.P.} = 135 - 120 = \text{Rs.15.}$$

3. The cost price of a pen is Rs.400 and the selling price is Rs.460. Find the gain %.

Sol: C.P. = Rs.400, S.P. = Rs.460
Gain = S.P. - C.P. = 460 - 400 = Rs.60
Gain % = $\frac{\text{Gain} \times 100}{\text{C.P.}} = \frac{60}{400} \times 100 = 15\%$.

4. Rajani bought a jewel for Rs.825 and sold it for Rs.750. Find the loss%.

Sol: C.P. = Rs.825, S.P. = Rs.750
Loss = C.P. - S.P. = 825 - 750 = Rs.75
Loss % = $\frac{\text{Loss} \times 100}{\text{C.P.}} = \frac{75 \times 100}{825} = \frac{100}{11} = 9\frac{1}{11}\%$.

5. Shashi buys a T.V. set for Rs.9500. For how much should he sell in order to gain 4%?

Sol: C.P. = Rs.9500, gain% = 4%

$$S.P. = \left(\frac{100 + \text{Gain}\%}{100} \right) \times C.P. \quad , \text{ if C.P. and gain\% are given}$$

$$S.P. = \left(\frac{100 + 4}{100} \right) \times 9500 = 104 \times 95 = \text{Rs. } 9880 \quad .$$

6. Hari loses 8% by selling a Cooler for Rs.5520. Find the C.P. of the cooler.

Sol: S.P. = Rs.5520, loss% = 8%

$$C.P. = \left(\frac{100}{100 - \text{Loss}\%} \right) \times S.P. \quad , \text{ if S.P. and loss\% are given}$$

$$C.P. = \left(\frac{100}{100 - 8} \right) \times 5520 = \frac{100}{92} \times 5520 = \text{Rs. } 6000 \quad .$$

7. By selling a toy for Rs.422, Kiran gain $5\frac{1}{2}\%$. Find the C.P. of the toy.

Sol: S.P. = Rs.422, gain% = $5\frac{1}{2}\%$ = $\frac{11}{2}\%$.

$$C.P. = \left(\frac{100}{100 + \text{Gain}\%} \right) \times S.P. \quad , \text{ if S.P. and gain\% are given}$$

$$C.P. = \left(\frac{100}{100 + \frac{11}{2}} \right) \times 422 = \frac{200}{211} \times 422 = \text{Rs. } 400 \quad .$$

8. Venu buys oranges at the rate of Rs.10 per dozen and sells them at rate of 16 for Rs.11. Find his % gain or loss.

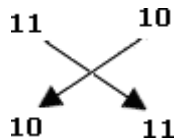
Sol: $a = 12, b = \text{Rs.}10, c = 16, d = \text{Rs.}11$

$$\begin{aligned} \text{Gain or loss\%} &= \left(\frac{ad}{bc} - 1 \right) \times 100\% = \left(\frac{132}{160} - 1 \right) \times 100\% \\ &= -\frac{28}{160} \times 100\% = -17.5\% \quad . \end{aligned}$$

Since, the result is negative; there is a loss of 17.5%.

9. 11 apples are bought at Rs.10 and sold at 10 for Rs.11. What is gain or loss%?

Sol: $a = 11, b = \text{Rs.}10, c = 10, d = \text{Rs.}11$



$$\begin{aligned} \text{Gain or loss\%} &= \left(\frac{ad}{bc} - 1 \right) \times 100\% = \left(\frac{121}{100} - 1 \right) \times 100\% \\ &= \frac{21}{100} \times 100\% = 21\% \quad . \end{aligned}$$

10. The selling price of 18 articles is equal to the cost price of 10 articles. What is the profit%?

Sol: $x = 18, y = 10$ Gain%

$$= \left(\frac{x - y}{y} \right) \times 100\% = \frac{18 - 10}{10} \times 100\% = 80\% \quad .$$

11. By selling a mobile for Rs.2400, Phani lost 10%. What percent shall he gain or lose by selling it for Rs.2800.

Sol: S.P₁. = Rs.2400, $x = -10\%$, S.P₂. = Rs.2800, $y = ?$

Here negative sign for x indicates loss.

$$\text{We have, } \frac{S.P_1}{100+x} = \frac{S.P_2}{100+y}$$

$$\frac{2400}{100-10} = \frac{2800}{100+y} \Rightarrow \frac{6}{90} = \frac{7}{100+y} \Rightarrow 600 + 6y = 630$$

$$6y = 30 \Rightarrow y = 5$$

Since the result is positive, Phani can have a gain of 5% by selling it for Rs.2800.

12. Avinash sells a bike to Shireesh at a gain of 15% and Shireesh again sells to Teju at a profit of 10%. If Teju pays Rs.37950 to Avinash then what is the cost price of the bike for Avinash?

Sol: Here, $x = 15$, $y = 10$ and $z = \text{Rs.}37950$

$$\text{C.P. for Avinash} = \left[\frac{100^2 \times z}{(100+x)(100+y)} \right]$$

$$= \left[\frac{100 \times 100 \times 37950}{(100+15)(100+10)} \right] = \frac{100 \times 100 \times 37950}{115 \times 110}$$

$$= \text{Rs.}30000.$$

13. Mounika sells an i-pod to Bindu at a gain of 12% and Bindu again sells it to swapna at a loss of 20%. If swapna pays Rs.2240 to Bindu then what is the cost price of i-pod to Mounika?

Sol: Here, $x = 12$, $y = -20$ and $z = \text{Rs.}2240$

$$\text{C.P. for Mounika} = \left[\frac{100^2 \times z}{(100+x)(100+y)} \right]$$

$$= \left[\frac{100 \times 100 \times 2240}{(100+12)(100-20)} \right] = \frac{100 \times 100 \times 2240}{112 \times 80}$$

$$= \frac{100 \times 100}{4} = \text{Rs.}2500.$$

14. Sachin sells a machine to Krishna at a profit of 3% and Krishna sells it to Dhruva at a profit of 5%. Find the resultant profit%.

Sol: Here, $x = 3$, $y = 5$

$$\text{Resultant Profit\%} = \left(x + y + \frac{xy}{100} \right)$$

$$= \left(3 + 5 + \frac{3(5)}{100} \right) = 8 + \frac{15}{100} = 8 \frac{3}{20} \%$$

15. Pratap sells a trouser to Rajesh at a profit of 10% and Rajesh sells it to Chandu at a loss of 8%. Find the resultant profit or loss%.

Sol: Here, $x = 10$, $y = -8$

$$\text{Resultant Profit or loss\%} = \left(x + y + \frac{xy}{100} \right)$$

$$= \left(10 + (-8) + \frac{10(-8)}{100} \right) = 2 - \frac{80}{100}$$

$$= \frac{120}{100} = 1 \frac{1}{5} \%$$

This represents profit as the sign is positive.

16. Manoj sold two laptops, each for Rs.30000. If he makes 15% profit on the first and 10% loss on the second, what is his gain or loss% on the whole transaction?

Sol: Here, $x = 15, y = -10$

$$\begin{aligned} \text{Overall \% gain or \% loss} &= \left(\frac{100(x+y) + 2xy}{(100+x) + (100+y)} \right) \% \\ &= \left(\frac{100(15-10) + 2(15)(-10)}{(100+15) + (100-10)} \right) \% \\ &= \left(\frac{500 - 300}{205} \right) \% = \frac{200}{205} \% = \frac{40}{41} \% \end{aligned}$$

This represents profit as the sign is positive.

17. Chary sold two bicycles for Rs.1000 each, gaining 20% on one and losing 20% on the other. Find his total gain or loss%.

Sol: Here, $x = 20$

$$\begin{aligned} \text{Overall \% loss} &= \left(\frac{x}{10} \right)^2 \% \\ &= \left(\frac{20}{10} \right)^2 \% = 2^2 \% = 4\% \end{aligned}$$

18. A dishonest shopkeeper professes to sell his goods at C.P. but uses a 950 g for kg weight. Find his gain%.

Sol: Here, True measure = 1000 g, False measure = 950 g, $x = 0$

Overall gain% is given by

$$\begin{aligned} \frac{100+g}{100+x} &= \frac{\text{True measure}}{\text{Faulty measure}} \\ \Rightarrow \frac{100+g}{100} &= \frac{1000}{950} \Rightarrow \frac{100+g}{100} = \frac{20}{19} \\ \Rightarrow 1900 + 19g &= 2000 \Rightarrow 19g = 100 \\ \Rightarrow g &= \frac{100}{19} = 5\frac{5}{19} \% \end{aligned}$$

19. A shopkeeper sells the goods at 22% loss on the C.P. but uses 10% less weight. What is his gain or loss%?

Sol: Here, $x = -22, y = 10$

$$\begin{aligned} \text{Overall gain or loss\%} &= \left[\left(\frac{10-22}{100-10} \right) \times 100 \right] \% \\ &= \left[\frac{-12}{90} \times 100 \right] \% = -\frac{40}{9} = -\frac{40}{9} \\ &= 13\frac{1}{3} \% \end{aligned}$$

This represents loss as the sign is negative.

20. Suresh buys two books for Rs. 615 and sells one at a loss of 10% and other at a gain of 15%. If both the books are sold at the same price, then find the cost price of two books.

Sol: The C.P. of the item sold at loss of 10%

$$\begin{aligned} &= \frac{A(100 + \text{gain}\%) }{(100 - \text{loss}\%) + (100 + \text{gain}\%)} \\ &= \frac{615 \times (100 + 15)}{(100 - 10) + (100 + 15)} = \frac{615 \times 115}{205} \\ &= 3 \times 115 = \text{Rs. } 345. \end{aligned}$$

The C.P. of the item sold at gain of 15%

$$\begin{aligned} &= \frac{A(100 - \text{loss}\%) }{(100 - \text{loss}\%) + (100 + \text{gain}\%)} \end{aligned}$$

=

$$\begin{aligned} &= \frac{615 \times (100 - 10)}{(100 - 10) + (100 + 15)} = \frac{615 \times 90}{205} \\ &= 3 \times 90 = \text{Rs. } 270. \end{aligned}$$

21. Find a single discount equivalent to two successive discounts of 20% and 30%.

Sol: Overall Discount = $\left(x + y - \frac{xy}{100}\right)\%$

$$= \left(20 + 30 - \frac{20(30)}{100}\right)\% = 44\%.$$

22. Find a single discount equivalent to two successive discounts of 20% and 30% and 40%.

Sol: Overall Discount

$$\begin{aligned} &= \left(x + y + z - \frac{(xy + yz + zx)}{100} + \frac{xyz}{100^2}\right)\% \\ &= \left(20 + 30 + 40 - \frac{(20)(30) + (30)(40) + (40)(20)}{100} + \frac{(20)(30)(40)}{100^2}\right)\% \\ &= \left(90 - \frac{600 + 1200 + 800}{100} + \frac{24000}{100 \times 100}\right)\% = \left(90 - \frac{2600}{100} + \frac{24000}{10000}\right)\% \\ &= (90 - 26 + 2.4)\% = 66.4\%. \end{aligned}$$

23. A shopkeeper sold the shirts at Rs.306 each after giving 15% discount on labelled price. If he had not given the discount, he would have earned a profit of 20% on the cost price. Find the C.P. of each shirt.

Sol: Here, labelled price $x = \text{Rs. } 306$, discount $d = 15\%$, profit $p = 20\%$

$$\begin{aligned} \text{Required C.P.} &= \left(\frac{100^2 x}{(100 - d)(100 + p)}\right) \\ &= \frac{100 \times 100 \times 306}{(100 - 15)(100 + 20)} = \frac{100 \times 100 \times 306}{85 \times 120} \\ &= \text{Rs. } 300. \end{aligned}$$

Exercise - 8

- Raju buys a watch for Rs.350 and sells it for Rs.392. Find his profit %.
 - 9%
 - 12%
 - 14%
 - None
- Kumar purchased an article for Rs.5200 and spent Rs.800 on its repair. He had to sell it for Rs.5500. Find his profit or loss%.
 - $8\frac{1}{3}\%$ loss
 - $7\frac{1}{2}\%$ profit
 - 9% loss
 - None
- A tooth paste marked Rs.80 is sold for Rs.68. Find the rate of discount.
 - 12%
 - 14%
 - 15%
 - None
- Mr. Sinha bought 200 dozen mangoes at Rs.10 per dozen. He spent Rs.500 on transportation. He sold them at Rs.1 each. Find the profit or loss%.
 - 4%
 - 6%
 - 5%
 - None
- Mr. Shekar sold his bike for Rs.10500 at a profit of 5%. Find the C.P. of the bike.
 - Rs.10300
 - Rs.10700
 - Rs.10000
 - None

and D_3 days respectively, then

a) Amount of work done by $A = \frac{D_1}{T_1}$

b) Amount of work done by $B = \frac{D_2}{T_2}$

c) Amount of work done by $C = \frac{D_3}{T_3}$

d) Amount of work done by A, B and C together $= \frac{D_1}{T_1} + \frac{D_2}{T_2} + \frac{D_3}{T_3}$.

6. If A can do a piece of work in X days and B can do the same work in Y days, then both of them working together will do the same work in $\frac{XY}{X+Y}$ days.

7. If A, B and C , while working alone, can complete a work in X, Y and Z days respectively, then they will together complete the work in $\frac{XYZ}{XY + YZ + ZX}$ days.

8. A and B working together can complete a piece of work in X days. If A working alone can complete the work in Y days, then B working alone will complete the work in $\frac{XY}{Y-X}$ days.

9. If A and B working together can complete a piece of work in X days, B and C in Y days, C and A in Z days, then

a) A, B and C working together will finish the job in $\frac{2XYZ}{XY + YZ + ZX}$ days.

b) A alone can finish the job in $\frac{2XYZ}{XY + YZ - ZX}$ days.

c) B alone can finish the job in $\frac{2XYZ}{YZ + ZX - XY}$ days.

d) C alone can finish the job in $\frac{2XYZ}{XY - YZ + ZX}$ days.

10. If A and B working together can complete a work in X days and B is k times efficient than A , then

a) The time taken by A working alone, to complete the work is $(k+1)X$.

b) The time taken by B working alone, to complete the work is $\left(\frac{k+1}{k}\right)X$.

c) The time taken by both A and B working together to complete the work is $\left(\frac{X}{1+k}\right)$.

11. If A working alone takes a days more than A and B working together. If B worked alone, he takes b hours more to complete the job than A and B working together then both A and B working together can finish the job in \sqrt{ab} days.

12. If A can complete $\frac{a}{b}$ part of a work in X days, then $\frac{c}{d}$ part of the work will be done in

$$\frac{b \times c \times X}{a \times d} \text{ days.}$$

13. If a men and b women can do a piece of work in n days, then c men and d women can do the work in

$$\left(\frac{nab}{bc + ad}\right) \text{ days.}$$

14. If A can complete a work in X days and B is k times efficient than A , then the time taken by both A and

B working together to complete the work is $\frac{X}{1+k}$.

15. If A is k times more efficient than B and hence able to finish the work in l days less than B , then

a) A working alone can finish the work in $\frac{l}{k-1}$ days.

b) B working alone can finish the work in $\frac{kl}{k-1}$ days.

c) A and B working together, can finish the work in $\frac{kl}{k^2-1}$ days.

16. There are two groups of people with same efficiency. In one M_1 persons can do W_1 works in D_1 time and in the other M_2 persons can do W_2 works in D_2 time. Then the relationship between the two groups is

$$M_1 D_1 W_2 = M_2 D_2 W_1$$

17. There are two groups of people with same efficiency. In one M_1 persons can do W_1 works in D_1 time

$$M_1 D_1 t_1 W_2 = M_2 D_2 t_2 W_1$$

working t_1 hours a day and in the other M_2 persons can do W_2 works in D_2 time working t_2 hours a day. Then the relationship between the two groups is

Solved Examples

1. A can complete a piece of work by working alone in 5 days and B while working alone can finish the same work in 10 days. If both of them work together, then in how many days, the work will be finished.

Sol: Here, $X = 5$, $Y = 10$

$$\begin{aligned} \text{Working together, } A \text{ and } B \text{ will finish the work in } & \frac{XY}{X+Y} \text{ days} \\ & = \frac{5(10)}{5+10} = \frac{10}{3} \text{ days.} \end{aligned}$$

2. A , B and C can complete a piece of work in 5, 10 and 13 days respectively. In how many days would all of them complete the same work working together?

Sol: Here, $X = 5$, $Y = 10$, $Z = 13$

$$\begin{aligned} \text{So, the work will be completed in } & \frac{XYZ}{XY + YZ + ZX} \text{ days} \\ & = \frac{5 \times 10 \times 13}{5(10) + 10(13) + 13(5)} = 2\frac{32}{49} \text{ days.} \end{aligned}$$

3. A and B working together take 10 days to complete a piece of work. If A alone can do this work in 15 days, how long would B take to complete the same work?

Sol: Here, $X = 10$, $Y = 15$

$$\text{So, } B \text{ alone will complete the work in } \frac{XY}{Y-X} \text{ days} = \frac{10(15)}{15-10} = 30 \text{ days.}$$

4. Madhu and Anil can do a piece of work in 12 days, Anil and Sunil in 15 days, Sunil and Madhu in 20 days. How long would each take separately to do the same work?

Sol: Here, $X = 12$, $Y = 15$ and $Z = 20$

$$\begin{aligned} \text{Madhu alone can do the work in } & \frac{2XYZ}{XY + YZ - ZX} \text{ days} \\ & = \frac{2 \times 12 \times 15 \times 20}{12(15) + 15(20) - 20(12)} = \frac{7200}{240} = 30 \text{ days.} \end{aligned}$$



Anil alone can do the work in $\frac{2XYZ}{YZ + ZX - XY}$ days

$$= \frac{2 \times 12 \times 15 \times 20}{15(20) + 20(12) - 12(15)} = \frac{7200}{360} = 20 \text{ days.}$$

Sunil alone can do the work in $\frac{2XYZ}{XY - YZ + ZX}$ days

$$= \frac{2 \times 12 \times 15 \times 20}{12(15) - 15(20) + 20(12)} = \frac{7200}{120} = 60 \text{ days.}$$

5. Mukesh can do a piece of work in 16 days. If Neeta works thrice as fast as Mukesh, how long would they take to finish the work by working together?

Sol: Here, $X = 16$ and $k = 3$

$$\begin{aligned} \text{Required time} &= \left(\frac{x}{1+k} \right) \text{ days} \\ &= \left(\frac{16}{1+3} \right) = 4 \text{ days.} \end{aligned}$$

A and B together can do a piece of work in 4 days. If A does twice as much work as B in a given time, how long A alone would take to do the work?

Sol: Here, $X = 4$ and $k = 2$

$$\text{Time taken by } A, \text{ working alone} = \left(\frac{k+1}{k} \right) x = \frac{2+1}{2} \times 4 = 6 \text{ days}$$

6. A alone would take 7 days more to complete the work than if both A and B worked together. If B worked alone, he took $1\frac{3}{4}$ days more to complete the job both worked together. What time would they take if both A and B worked together?

Sol: Here, $a = 7, b = 1\frac{3}{4} = \frac{7}{4}$

$$\text{Time taken by } A \text{ and } B \text{ working together} = \sqrt{ab} \text{ days} = \sqrt{7 \times \frac{7}{4}} = \frac{7}{2} \text{ days.}$$

7. A is four times as good a workman as B and takes 18 days less to do a piece of work than B takes. Find the time in which B alone can complete the work.

Sol: Here, $k = 4$ and $l = 12$

$$\text{Time taken by } B \text{ working alone} = \frac{kl}{k-1} \text{ days} = \frac{4 \times 12}{4-1} = 16 \text{ days.}$$

8. A can do $\frac{5}{4}$ of a work in 15 days. In how many days he can finish $\frac{1}{6}$ of the work?

Sol: Here, $a = 5, b = 4, c = 1, d = 6, X = 15$

$$\text{Required time} = \frac{b \times c \times X}{a \times d} = \frac{4 \times 1 \times 15}{5 \times 6} = 2 \text{ days.}$$

9. If 12 persons can complete $\frac{1}{5}$ th of a work in 4 days, then find the number of persons required to complete the remaining work in 16 days.

Sol: Here $M_1 = 12, D_1 = 4, W_1 = \frac{1}{5}$ and $M_2 = ?, D_2 = 16, W_2 = \frac{4}{5}$

$$\begin{aligned} \text{We have, } M_1 D_1 W_2 &= M_2 D_2 W_1 \\ 12 \times 4 \times \frac{4}{5} &= M_2 \times 16 \times \frac{1}{5} \end{aligned}$$

⇒ — —



⇒ $M_2 = 10$.

10. If 5 persons can cut 15 trees in 6 days working 10 hours a day. Then, in how many days can 12 persons cut 36 trees working 6 hours a day.

Sol: Here $M_1 = 5, D_1 = 6, W_1 = 15, t_1 = 10$
 $M_2 = 12, D_2 = ?, W_2 = 36, t_2 = 6$

We have, $M_1 D_1 t_1 W_2 = M_2 D_2 t_2 W_1$

$$\Rightarrow 5 \times 6 \times 10 \times 36 = 12 \times D_2 \times 6 \times 15$$

$$\Rightarrow D_2 = 10 \text{ days.}$$

11. 8 men or 12 women can do a work in 21 days. In how many days, 5 men and 3 women would complete the work?

Sol: Here, $a = 8, b = 12, c = 5, d = 3$ and $n = 21$

$$\text{Required no. of days} = \left(\frac{nab}{bc + ad} \right) = \frac{21 \times 8 \times 12}{12(5) + 8(3)} = \frac{21 \times 8 \times 12}{84} = 24 \text{ days.}$$